Power Shift
energy + sustainability

Teacher Guide
for grades 7–12

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Introduction

How to Use the Teacher Guide

This Teacher Guide consists of six stand-alone learning activities. The duration of the activities varies from one to three class periods of approximately 45 minutes each. We recognize that you have time constraints and invite you to adapt the activities to suit your classroom needs. You can begin with any activity, although we suggest screening the Power Shift video to initiate the unit. Several activities require access to the Web. Review each activity to determine the number of computers needed to serve your class.

The Power Shift learning activities are appropriate for many subject areas, including Earth and Environmental Science, Government/Civics, Economics, Geography, History, Language Arts, and Service Learning. The Teacher Guide provides correlations to the national content standards for grades 7-12 in the following disciplines: Science and Social Studies.

The Power Shift Video

The Power Shift video is designed to open a conversation about energy and sustainability. This 26-minute PBS special serves as an excellent thought-starter and discussion tool. Primary themes include solar and wind power, energy efficiency, green buildings, and global climate change. Power Shift provides vital context to the issues, guiding viewers from a global perspective to individual actions steps. A synopsis of the video can be found in Activity One.

Learning a New Language

Becoming an energy literate citizen means learning a new language. To participate in a public discourse about energy-related issues requires a basic understanding of core concepts and vocabulary. The Teacher Guide includes a Power Shift Glossary that defines terms from the video and learning activities. Maximize opportunities to introduce and clarify new terms. Check for understanding on a regular basis and encourage students to use the vocabulary in their speaking and writing.

— Randy Udall, Community Office for Resource Efficiency
Assessment

The Power Shift learning activities challenge students to engage with real-world issues. To evaluate student understanding, we suggest several assessments:

- **Performance assessments:** Authentic assessments include a real audience and result in a complex product that reveals new understandings. Activity Three (Green Buildings) and Activity Six (Green Power) feature small group presentations. Consider inviting experts and community representatives to join the audience.

- **Worksheets:** Most of the activities involve information gathering and data collection. Use these work products to assess understanding and provide feedback to your students.

- **Vocabulary:** Analyze the words and phrases that students use to ask questions, complete worksheets, and make presentations. The richness and clarity of language provides an important benchmark of student understanding.

- **Classroom participation:** Because many of the activities occur in dyads, triads, and small groups, use classroom participation and collaboration as one measure of student engagement.

- **Extensions:** Each activity suggests extensions that can be used to deepen the inquiry process and check for student understanding.

These assessments should reveal the understanding of each student. An effective assessment makes student thinking visible so that both students and teacher can see whether learning has been accomplished and where further review is necessary.

**Power Shift Website**

Several activities require students to visit the Power Shift website (www.powershiftnow.org/activities.html) as a jumping off point for WebQuests or other research activities. Encourage your students to conduct their own web searches, using key words learned during the activities.

—— Peter Meisen, Global Energy Network Institute

A power shift will come from each of us declaring that the present situation is no longer acceptable. Do we want to continue an era where pollution belches out of smokestacks and where we dump toxic wastes into our rivers? Do we want to live with the risk of global climate change? We need to shift direction.
BACKGROUND  The Power Shift video is designed to open a conversation about energy and sustainability. Primary themes include solar and wind power, energy efficiency, green buildings, and global climate change. Power Shift provides vital context to the issues, guiding viewers from a global perspective to individual actions steps. With engaging stories and beautiful visuals, the program illustrates the many ways that energy touches our daily lives.

ACTIVITY OVERVIEW
In this activity, students view and discuss the Power Shift video. The contemporary, magazine-style program explores the abundant possibilities of clean, renewable energy. Actress Cameron Diaz hosts and narrates the film. Power Shift features four distinct segments that range in length from 4-6 minutes.

LEARNING OUTCOMES
- Students understand the distinction between renewable and nonrenewable energy sources.
- Students understand the value of fuel efficiency and energy efficiency.
- Students make connections between human activity and global climate change.
- Students learn some of the components and processes of a “green building.”
- Students understand the electricity grid as a system.
- Students discover energy conscious actions they can take in their own lives.
PROCESS

1. Write the words KNOW, LEARNED, ACT in three columns (see below) on an overhead, blackboard, or large paper.

   KNOW
   - What do you already know about energy efficiency and renewable energy?

   LEARNED
   - What did you learn about energy efficiency and renewable energy from Power Shift?

   ACT
   - How can you “Be the Difference”?

2. Activate prior knowledge by asking students to share information that they already know about energy efficiency or renewable energy. Record this in the “Know” column. Introduce the following definitions as necessary:

   **Energy Efficiency**: A design strategy that does “more with less.” Energy efficient designs—applied to such things as light bulbs, refrigerators, computers, autos, and buildings—use less energy/electricity to perform the same function. Energy efficiency saves energy, saves money on utility bills, and helps protect the environment by reducing the amount of electricity that needs to be generated.

   **Renewable Energy**: Electricity supplied from renewable energy sources, such as wind and solar power, geothermal, hydropower, and various forms of biomass. These energy sources are considered renewable sources because they are continuously replenished on Earth.

3. Introduce and screen the Power Shift video.

4. After the video concludes, lead a class discussion.
   - What was something in the film that was new to you? What surprised you?
   - What was your favorite segment? Why?
   - What was something said by a young person in the video that you can relate to?
   - What images or lines of narration stick out in your mind?
   - What one idea from the film would you like to share with your family or friends?

   Ask students to reflect upon what they learned from the film. Take responses and list them in the “Learned” column.

5. Next, ask students to suggest ways that they can “Be the Difference.” Write these responses in the “Act” column.

6. Discuss specific action steps in more detail.
   - How many of you have at least one compact fluorescent light bulb (CFL) installed at home? (Show a CFL to the class if you have one.)
     - A CFL lasts up to 10 times longer than a standard incandescent light bulb and saves $30 a year in energy costs.
EXTENSIONS

1. Students choose a renewable energy source to research in depth.

2. Students write and produce their own video about an energy-related issue.

3. Students design a public service announcement (PSA), poster, or skit to communicate the opportunities of energy efficiency and renewable energy.

4. Students screen the Power Shift video for school or community groups and lead a discussion.

☐ Do you know how to locate a store that sells CFLs and other ENERGY STAR products?
   • Log on to the ENERGY STAR website at www.energystar.gov and use the “Find a Store” feature.

☐ Did you know your family has the option to purchase “green power,” electricity that comes from clean, renewable energy?
   • Request a green power pricing option from your local utility. If your utility does not currently offer this option, let them know that it’s a high priority for you.
   • Purchase Renewable Energy Certificates (RECs) through the Green-e website at www.green-e.org.

☐ What can we do in our school and community to ensure a sustainable energy future?

SYNOPSIS OF POWER SHIFT VIDEO

Power Shift features the following program segments:

1. Connections
   Travels the world to illuminate the many facets of energy and sustainability. By connecting seemingly unrelated people, places and things, the segment demonstrates the interdependence of our global community. Weaving together such themes as renewable energy, energy efficiency and climate change, Connections reminds us to think global and act local.

2. Cradle to Cradle
   Profiles architect and TIME “Hero for the Planet” William McDonough. Through his poetic speaking and graceful metaphors, McDonough shows how the intelligent design of buildings and industrial processes will revolutionize our work and lives.

3. Energy Path
   Answers the question: “When I turn on the light in my room, where does the electricity come from and how does it reach me?” Beginning with a wind farm in Palm Springs, California, we follow the route of electrical energy as it makes its way to our homes and communities.

4. Be the Difference
   Recaps our narrative journey and offers specific action steps that individuals can take. Examples range from driving a hybrid car to requesting green power from local utilities.

5. Speaking Out
   Appearing between the four primary segments, Speaking Out serves as a forum for youth opinion. Young people from diverse backgrounds voice their perspective on energy and sustainability.
Energy Literacy

**BACKGROUND** If American citizens are going to play an active role in shaping their energy future, energy literacy is the first step. An energy literate citizen asks questions and challenges assumptions. An energy literate citizen understands why and how our energy system must be transformed, and then works to ensure that the shift takes place. An energy literate citizen translates her/his knowledge into action.

**ACTIVITY OVERVIEW**
This activity opens a conversation about energy literacy and sustainable energy practices. In teams of three, students compete in an Energy IQ Game designed to stimulate thought and discussion. Students then define the characteristics of an energy literate citizen. The activity concludes with a survey of family energy practices.

**LEARNING OUTCOMES**
- Students explore what it means to be an energy literate citizen.
- Students develop a better understanding of their personal and family energy practices.

**Key Concepts**
- Energy literacy
- Energy consumption
- Sustainable energy practices

**Materials**
- Energy IQ Game handout
- Energy Practices handout

**Time**
1 class period
PROCESS

1 Divide the class into groups of three. Each group should designate someone as the recorder. Distribute one copy of the Energy IQ Game to each small group. Introduce the game as an opportunity for the groups to test their “Energy IQ.” A correct answer is worth ten points. The team with the highest score wins.

2 Provide five minutes for the triads to discuss the ten questions and select their answers. Next, share the answer key (below) and ask the groups to total their scores. You might request a show of hands after each answer to assess which questions were most difficult for the students.

   Note: If there is a tie among the teams, choose a word from the Power Shift glossary and have the run-off teams prepare a written definition of the term. Ask the other class members to judge the best definition.

   Energy IQ Game answer key:

   Acknowledge the winning team and lead a brief class discussion:
   □ What questions in the game were most difficult for your group?
   □ What answers surprised you?
   □ What energy topics do you want to learn more about?

3 Open a conversation about energy literacy.
   □ “What does it mean to be a literate person?” (Often, this term is used to describe someone who can read and write, although it also means a “well-informed, educated person.”)
   □ What comes to mind when I say "energy literate person"?

4 Ask each triad to create a profile of an “energy literate citizen.” Offer the following prompts:
   □ What knowledge does this person possess?
   □ What issues is this person familiar with?
   □ What energy choices does this person make?

   Provide five minutes for the groups to develop a profile.

5 Invite each group to share three or four of the most important characteristics of an energy literate citizen.
   □ Do we have an energy literate society? What is the cost of energy illiteracy?
   □ What is the relationship between energy literacy and energy practices (our personal choices and actions)?

   VOCABULARY
   compact fluorescent light bulb (CFL)
   electric utility
   ENERGY STAR
   fuel efficiency
   green power

“Americans are, in general, the least energy-conscious people on the planet. We are not only profoundly ignorant about what energy is, and the critical role it has played and continues to play in economics and politics, but most of us simply don’t care about energy.

— Paul Roberts, The End of Oil
Distribute copies of the Energy Practices handout to each student. Provide time for students to complete the information they already know for Section One and to answer the four questions in Section Two. Next, pair up students and provide two minutes per person to share their responses to the questions listed under My Energy Literacy in Section Two. Finally, conclude with a class discussion that links energy literacy with energy practices.

☐ How aware of your family’s energy practices are you?
☐ What questions do you have about energy-related issues?
☐ What do you want to learn more about?
☐ What actions can you and your family take to become more energy conscious?

Ask students to take the Energy Survey home to check their answers and collect any missing information. Encourage a conversation about energy literacy and energy practices with their family members.

Optional: During the next class period, provide time for a short discussion about what students found at home and conversations that took place. Use this as a jumping off point for extensions.

EXTENSIONS

1. Students interview an energy expert (online, by phone, or in person) about the questions and issues they are most passionate about.

2. Students research an energy issue they are most interested in and prepare a report or presentation.

3. Students design an Energy Literacy briefing to inform fellow students or community groups about energy-related issues and how each person can “be the difference.”

4. Students locate and complete an online energy audit or energy footprint to assess their personal and/or family energy practices (see Quick Bytes).

QUICK BYTES

For online calculator tools that assess energy consumption and related issues:

Home energy saver
http://hes.lbl.gov

Ecological footprint
http://www.myfootprint.org
**Energy IQ Game**

1. More than ______ people on Earth have no access to electricity.
   a. 200 million  b. 850 million  c. 2 billion  d. 4.5 billion

2. The Persian Gulf region accounts for about ______% of the world’s oil reserves.
   a. 15%  b. 33%  c. 50%  d. 65%

3. Which of the following countries is the “greenest”?
   a. Japan  b. Germany  c. Switzerland  d. United States

4. What is the fastest growing energy source in the world today?
   a. natural gas  b. solar  c. coal  d. wind

5. Renewable energy sources (excluding large hydropower) provide about what percentage of total US energy consumption?
   a. less than 5%  b. 5–9%  c. 10–20%  d. more than 20%

6. More than half of US electricity is produced by which energy source?
   a. hydropower  b. coal  c. uranium  d. natural gas

7. Which of the following accounts for 30% of US greenhouse gas emissions?
   a. automobiles  b. buildings  c. agriculture  d. air travel

8. The US consumes what percentage of the world’s oil supply each year?
   a. less than 5%  b. 15%  c. 25%  d. more than 40%

9. Which appliance uses the most electricity in your home?
   a. refrigerator  b. washing machine  c. television  d. microwave

10. A compact fluorescent light bulb (CFL) uses about ____% less energy and lasts up to ____ times longer than an incandescent light bulb.
    a. 25 / 20  b. 35 / 5  c. 50 / 15  d. 70 / 10
# Energy Practices

How well do you know your family’s energy practices? Check your knowledge by answering the questions below. When you go home, collect any missing information.

## SECTION ONE

1. Do any vehicles in your family average more than 25 miles per gallon?
   - ☐ Yes
   - ☐ No
   - ☐ I don’t know
   - ☐ We use public transportation

   If 30% of our nation’s cars were hybrid electric vehicles, the US could eliminate oil imports from the Persian Gulf.

<table>
<thead>
<tr>
<th>Home Energy Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ vehicle(s) average more than 25 mpg</td>
</tr>
</tbody>
</table>

2. Has your family installed any compact fluorescent light bulbs (CFLs)?
   - ☐ Yes
   - ☐ No
   - ☐ I don’t know

   A compact fluorescent light bulb uses 65-75% less energy and lasts up to 10 times longer than a traditional incandescent light bulb.

| ____ CFLs |

3. Does your family use any ENERGY STAR appliances? (An energy rating given to refrigerators, washing machines, clothes dryers, computers, and other appliances.)
   - ☐ Yes
   - ☐ No
   - ☐ I don’t know

   An ENERGY STAR refrigerator uses 10-50% less energy. If every home in the US bought an ENERGY STAR refrigerator, we could close 10 aging power plants.

| ____ ENERGY STAR appliances |

4. Has your family installed any low-flow showerheads?
   - ☐ Yes
   - ☐ No
   - ☐ I don’t know

   A family of four, each showering 5 minutes per day, uses 2,400 gallons of water per month. By installing low-flow showerheads, you can reduce home water consumption by 50%.

| ____ low flow showerheads |

5. Does your family participate in a green power pricing program, buy electricity from a green power provider, or purchase Renewable Energy Certificates?
   - ☐ Yes
   - ☐ No
   - ☐ I don’t know

   On average, every kilowatt-hour (kWh) of green power avoids the emission of more than one pound of carbon dioxide into the atmosphere.

   If yes, which program?

| ___________________________ |

6. What is the average cost of your family’s monthly utility bill?
   - ☐ More than $100
   - ☐ $100-$75
   - ☐ $75-50
   - ☐ Less than $50
   - ☐ I don’t know

   Energy efficient choices can save a family about one third on their energy bill with similar savings of greenhouse gas emissions.

| $____ per month |
SECTION TWO

You might say energy literacy begins with curiosity. As you learn more about energy-related issues, you become a more energy conscious citizen.

My Energy Literacy

1. What energy issues do I want to learn more about?

2. What questions do I have about these issues?

My Energy Practices

1. What energy conscious actions can my family take?

2. What energy conscious actions can I take in my own life?
BACKGROUND  More than any other human endeavor, the design of homes and buildings shapes our relationship with energy and the environment. In the United States, buildings use one-third of all the energy consumed, and roughly two-thirds of all electricity. Our buildings generate 30% of the nation’s greenhouse gas emissions and 30% of waste output. For a new generation of architects, the challenge is to design “green buildings.” This means buildings that maximize energy efficiency and renewable energy, minimize waste and pollution, and increase the health, safety, and comfort of the people who live and work in them.

ACTIVITY OVERVIEW
In this WebQuest, students work in small groups to conduct online research about exemplary green building designs. Acting as representatives of leading American architectural firms, students organize a presentation about their building for an awards competition. A panel of student judges evaluates the presentations based on criteria used by the US Green Building Council.

LEARNING OUTCOMES
☐ Students understand the components and processes that define a green building.
☐ Students understand a building as a whole system that interacts with the environment around it.
☐ Students understand how building design relates to energy and sustainability.
PROCESS

DAY ONE

1 Divide the class into small groups, with a minimum of five students per group. This activity accommodates up to six small groups: five architectural firms and one judging panel. Each architectural firm will research a different green building design. The judging panel will research the general topic of green buildings.

Designate which groups will act as an architectural firm and which group will serve as the judging panel. Ask the members of each group to count off as roles A, B, C, D, and E.

2 Distribute the student handouts. Each group designated as an architectural firm should receive one copy of the handout describing the specific firm they represent. The judging panel should receive one copy of the judging panel handout and two copies of the evaluation form. (The evaluation form contains three judging scorecards per page.)

Provide time for each group to review their handout and expert roles. Clarify terms as needed. As a class, review the five expert roles common to all groups: A) land use expert, B) water efficiency expert, C) energy use expert, D) materials expert, and E) indoor environment expert. Students with the same role within a group should collaborate in their research.

3 Preview the WebQuest process.
   a. Log on to powershiftnow.org/activities.html and choose the Green Buildings activity.
   b. Collect the information for your expert role using the web links provided and other websites as needed.
   c. Share your findings with other members of the group.
   d. Organize a presentation for the Green Building Design Awards.
   e. Present your building to the judging panel.

4 Provide the remaining class time for the students to go online and conduct web research. If needed, assign remaining research as homework.

DAY TWO

1 Check in with the groups to assess their progress and answer questions. During this class period, group members should brief one another on their research findings and organize a presentation for the Green Building Design Awards. Remind students to review the guidelines for presentations on their handouts.

VOCABULARY

energy and water efficiency
green buildings
LEED
Solar (photovoltaic) system

How sophisticated are human designers? Think about a tree. How many human designers can go out and put something in the ground that they’ve designed, that starts making oxygen, distills water, provides habitat for hundreds of species, builds soil, uses solar energy as fuel, and self-replicates?

— William McDonough, architect
EXTENSIONS

1 Invite a guest — architect, solar power advocate, renewable energy advocate, hydrologist, landscape architect — to speak to the class about green buildings.

2 Students research the topic of solar power, including history, technology, cost, and state and local policy measures.

3 Students create a green building design of the future, including such elements as a written narrative, sketches and illustrations, and scale model.

4 Students create a green school design for their building site or a school of the future.

For the class presentations, consider inviting guests from the community. This might include representatives from local architectural firms, building development companies, environmental organizations, business groups, renewable energy companies, and concerned citizens.

DAY THREE

1 Provide each group 6 minutes to present their green building design. Encourage questions from the judges, the audience, and any special guests.

2 After the presentations and judging are complete, lead a class discussion.
   □ What questions did this activity raise for you?
   □ What design features from the green buildings did you find most innovative?
   □ What are some career opportunities related to green buildings?
   □ How can we influence the design of buildings in our community?
   □ What things can you do in your own homes to make them more “green”?

Students research the topic of solar power, including history, technology, cost, and state and local policy measures.

Students create a green building design of the future, including such elements as a written narrative, sketches and illustrations, and scale model.

Students create a green school design for their building site or a school of the future.
**Krueck & Sexton Architects, Chicago, Illinois**
Green Building: Herman Miller Building C1    Location: Zeeland, Michigan

**BACKGROUND**
Your team represents Krueck & Sexton Architects, designers of the Herman Miller Building C1. This building has been nominated for a Green Building Design Award. Your team is competing with other leading architectural firms to determine the best example of a green building.

**TASKS**

1. **research**
   Log on to www.powershiftnow.org/activities.html and choose Green Buildings. Review your role description. Use the links provided for Krueck & Sexton Architects to research your building design.

2. **organize**
   Organize your research findings into the following five categories:
   a. **Land Use**
      How does your design protect the local environment and enhance the community?
   b. **Water Efficiency**
      How does your design reduce the amount of water used?
   c. **Energy Use**
      How does your design maximize energy efficiency and integrate renewable energy?
   d. **Materials**
      How does your design incorporate sustainable and recyclable materials?
   e. **Indoor Environment**
      How does your design enhance the experience of its occupants?

3. **present**
   After you gather information about your building, prepare a presentation for the competition. You will be provided 6 minutes to describe the design innovations of your building and how it meets the five categories above. To communicate the innovations of your building design to the judges, consider the following:
   - Draw sketches or illustrations of selected design features.
   - Prepare a poster that shows your building and its unique features.
   - Use quotations from people outside your firm that describe your design innovations.
Cesar Pelli & Associates Architects, New York, NY
Green Building: The Solaire | Location: New York, NY

BACKGROUND
Your team represents Cesar Pelli & Associates Architects, designers of the Solaire Building. This building has been nominated for a Green Building Design Award. Your team is competing with other leading architectural firms to determine the best example of a green building.

TASKS

1. research
   Log on to www.powershiftnow.org/activities.html and choose Green Buildings. Review your role description. Use the links provided for Cesar Pelli & Associates Architects to research your building design.

2. organize
   Organize your research findings into the following five categories:
   a. Land Use
      How does your design protect the local environment and enhance the community?
   b. Water Efficiency
      How does your design reduce the amount of water used?
   c. Energy Use
      How does your design maximize energy efficiency and integrate renewable energy?
   d. Materials
      How does your design incorporate sustainable and recyclable materials?
   e. Indoor Environment
      How does your design enhance the experience of its occupants?

3. present
   After you gather information about your building, prepare a presentation for the competition. You will be provided 6 minutes to describe the design innovations of your building and how it meets the five categories above. To communicate the innovations of your building design to the judges, consider the following:
   - Draw sketches or illustrations of selected design features.
   - Prepare a poster that shows your building and its unique features.
   - Use quotations from people outside your firm that describe your design innovations.
Robert A.M. Stern Architects, New York, NY
Green Building: The Plaza at PPL Center  Location: Allentown, Pennsylvania

BACKGROUND
Your team represents Robert A.M. Stern Architects, designers of the Plaza at PPL Center. This building has been nominated for a Green Building Design Award. Your team is competing with other leading architectural firms to determine the best example of a green building.

TASKS

1 research
   Log on to www.powershiftnow.org/activities.html and choose Green Buildings. Review your role description. Use the links provided for Robert A.M. Stern Architects to research your building design.

2 organize
   Organize your research findings into the following five categories:
   a. Land Use
      How does your design protect the local environment and enhance the community?
   b. Water Efficiency
      How does your design reduce the amount of water used?
   c. Energy Use
      How does your design maximize energy efficiency and integrate renewable energy?
   d. Materials
      How does your design incorporate sustainable and recyclable materials?
   e. Indoor Environment
      How does your design enhance the experience of its occupants?

3 present
   After you gather information about your building, prepare a presentation for the competition. You will be provided 6 minutes to describe the design innovations of your building and how it meets the five categories above.
   To communicate the innovations of your building design to the judges, consider the following:

   ➤ Draw sketches or illustrations of selected design features.
   ➤ Prepare a poster that shows your building and its unique features.
   ➤ Use quotations from people outside your firm that describe your design innovations.
EHDD Architects, San Francisco, California

Green Building: Audubon Center at Debs Park    Location: Los Angeles, California

BACKGROUND

Your team represents EHDD Architects, designers of the Audubon Center at Debs Park. This building has been nominated for a Green Building Design Award. Your team is competing with other leading architectural firms to determine the best example of a green building.

TASKS

1. **research**
   
   Log on to [www.powershiftnow.org/activities.html](http://www.powershiftnow.org/activities.html) and choose **Green Buildings**. Review your role description. Use the links provided for EHDD Architects to research your building design.

2. **organize**
   
   Organize your research findings into the following five categories:
   
   a. **Land Use**
   
   How does your design protect the local environment and enhance the community?
   
   b. **Water Efficiency**
   
   How does your design reduce the amount of water used?
   
   c. **Energy Use**
   
   How does your design maximize energy efficiency and integrate renewable energy?
   
   d. **Materials**
   
   How does your design incorporate sustainable and recyclable materials?
   
   e. **Indoor Environment**
   
   How does your design enhance the experience of its occupants?

3. **present**
   
   After you gather information about your building, prepare a presentation for the competition. You will be provided **6 minutes** to describe the design innovations of your building and how it meets the five categories above.
   
   To communicate the innovations of your building design to the judges, consider the following:
   
   - Draw sketches or illustrations of selected design features.
   - Prepare a poster that shows your building and its unique features.
   - Use quotations from people outside your firm that describe your design innovations.

EHDD Architects, San Francisco, California

Green Building: Audubon Center at Debs Park    Location: Los Angeles, California
William McDonough + Partners, Charlottesville, VA

Green Building: Woods Hole Research Center  Location: Falmouth, Massachusetts

BACKGROUND
Your team represents William McDonough + Partners, designers of Woods Hole Research Center. This building has been nominated for a Green Building Design Award. Your team is competing with other leading architectural firms to determine the best example of a green building.

TASKS

1. **research**
   - Log on to [www.powershiftnow.org/activities.html](http://www.powershiftnow.org/activities.html) and choose **Green Buildings**. Review your role description. Use the links provided for William McDonough + Partners to research your building design.

2. **organize**
   - Organize your research findings into the following five categories:
     a. **Land Use**
        - How does your design protect the local environment and enhance the community?
     b. **Water Efficiency**
        - How does your design reduce the amount of water used?
     c. **Energy Use**
        - How does your design maximize energy efficiency and integrate renewable energy?
     d. **Materials**
        - How does your design incorporate sustainable and recyclable materials?
     e. **Indoor Environment**
        - How does your design enhance the experience of its occupants?

3. **present**
   - After you gather information about your building, prepare a presentation for the competition. You will be provided **6 minutes** to describe the design innovations of your building and how it meets the five categories above.
   - To communicate the innovations of your building design to the judges, consider the following:
     - Draw sketches or illustrations of selected design features.
     - Prepare a poster that shows your building and its unique features.
     - Use quotations from people outside your firm that describe your design innovations.
Judging Panel

Your group is responsible for judging the Green Building Design Awards competition. Evaluate the competing teams using the following criteria:

1. **Land Use**  How does the design protect the local environment and enhance the community?
2. **Water Efficiency**  How does the design reduce the amount of water used?
3. **Energy**  How does the design maximize energy efficiency and integrate renewable energy?
4. **Materials**  How does the design incorporate sustainable and recyclable materials?
5. **Indoor Environment**  How does the design enhance the experience of its occupants?
6. **Overall quality of the presentation**  (such as clarity, supporting materials, depth of understanding)

**PREPARATION**

To prepare for your role as judges, research the topic of green buildings and the first five criteria above. Log on to [www.powershiftnow.org/activities.html](http://www.powershiftnow.org/activities.html) and choose **Green Buildings**. Use the links provided for the Judging Panel. After conducting your research, brainstorm additional questions to ask the teams.

**JUDGING PROCESS**

Each team will have 6 minutes to present their design. Use the Green Building Evaluation Form to score the presentations. You’ll need to cut the forms into individual scorecards. At the end of the presentations, total your individual scores to create a panel score. Then announce the sequence of awards as follows:

- Highest Score: **Redwood**
- Second Highest: **Oak**
- Third Highest: **Maple**
- Fourth Highest: **Elm**
- Fifth Highest: **Spruce**
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Score Range</th>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
<th>Team 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Land Use</td>
<td>0–5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Water Efficiency</td>
<td>0–5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Energy</td>
<td>0–5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Materials</td>
<td>0–5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Indoor Environment</td>
<td>0–5 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Overall quality of presentation</td>
<td>0–10 points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL POINTS</strong></td>
<td><strong>out of 35 points</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity 4: Energy Independence

**BACKGROUND** Today, about 60% of the oil that Americans use is imported. This level of dependence on imports is the highest in US history, and will increase as we use up domestic resources. The vast majority of the world’s oil reserves are concentrated in the Middle East (65% to 75%), and controlled by the members of the Organization of Petroleum Exporting Countries (OPEC). Currently, the US economy depends on oil to move people and goods. In fact, 95% of the energy for transportation in the United States comes from oil.

**ACTIVITY OVERVIEW**
In this activity, students first compete in an Oil Tribe Game that highlights US dependence on imported oil and opportunities for fuel efficiency. Next, students conduct a fuel efficiency audit of vehicles in their family and determine greenhouse gas emissions for these vehicles. Extensions further investigate the theme of energy independence.

**LEARNING OUTCOMES**
- Students understand our nation’s current reliance on imported oil.
- Students understand the relationship between fuel efficiency and reducing US reliance on imported oil.
- Students understand the economic and environmental benefits of fuel efficiency.
DAY ONE

1. Inform students that they will be participating in a game about America’s dependence on imported oil. Before the game begins, there is a one-page reading that will provide some background information useful for the game.

Hand out copies of the Energy Independence reader to each student. After students finish reading, lead a short discussion.

☐ What facts from this reading surprised you?
☐ How “energy independent” is the US at this time? Who controls the majority of the world’s oil reserves?
☐ What are the economic costs of oil dependence?

2. Divide the class into five teams and ask each team to choose a recorder. Introduce the Oil Tribe Game and review the rules.

☐ There are nine questions in the game. Each team will have exactly one minute per question to choose their best answer and write it on a piece of paper.
☐ The team that is closest to the correct answer (whether over or under) receives one point. In the event of a tie, each team with the winning answer receives a point.

Ask the questions listed on the Oil Tribe Game sheet. Use a watch or clock with a second hand to keep time. At the end of one minute (per question), ask each team to reveal their written answer. Award points to the correct team(s). Keep a running tally on the board.

3. After concluding the Oil Tribe Game, provide a few minutes to discuss the experience.

☐ What questions were most difficult? What answers surprised you the most? Why?
☐ How is our national security affected by our reliance on imported oil?

4. Distribute copies of the Fuel Efficiency Audit handout to each student. Review the information on the worksheet and clarify terms.

☐ What is fuel efficiency? (“A measure of the amount of fuel consumed with regard to the distance traveled in a vehicle. Also known as fuel economy and gas mileage.”)
☐ How is it typically measured? (Miles per gallon or MPG)
☐ Who knows the fuel efficiency of a vehicle(s) in your family?

Ask students to complete the audit at home in preparation for the next class. If a student’s family does not own a vehicle, invite him/her to research their “dream car.”

VOCABULARY

greenhouse gas
hybrid electric vehicle
oil imports
oil reserves
OPEC

Our energy future is choice, not fate. Oil dependence is a problem we no longer need to have. US oil dependence can be eliminated with proven technologies that create wealth, enhance choice, and strengthen common security.

— from Winning the Oil Endgame

QUICK BYTES

www.fueleconomy.gov
www.oilendgame.com
www.rmi.org
www.nesea.org/transportation
DAY TWO

1. Lead a class discussion about the Fuel Efficiency Audit.
   - What did you learn about the vehicles in your family? What was most surprising?
   - Survey the class on their findings:
     - How many of you have a car that averages more than 40 mpg?
     - How many of you have a car that averages between 30-39 mpg?
     - How many of you have a car that averages between 20-29 mpg?
     - How many of you have a car that averages less than 20 mpg?
   Optional: Conduct a quick (45 second) “energy line-up” where students self-organize into a line from lowest to highest fuel efficiency.
   - Collect a sampling of other data from students about vehicles in their family:
     - What was the total annual fuel cost?
     - What were the tons/year in greenhouse gas emissions? What was the EPA air pollution score?
   - What is one of the most fuel efficient vehicle on the market today? One of the least fuel-efficient?
   - What do the most fuel-efficient vehicles have in common? (They are hybrids.)
   - Ask students to share their responses to the question, “Why is fuel economy important to you?” (Item #6 on the worksheet)

2. Conclude with a discussion about the possibility of achieving energy independence.
   - If you were advising the US Congress, what recommendations would you make for achieving energy independence?
   - What are some of the obstacles to achieving energy independence?
   - What can you and your family do to improve the fuel efficiency of your vehicles and reduce the amount of fuel consumed each year?
   - How has this activity influenced your thinking about what kind of car you might buy in the future?

3. Collect the worksheets for assessment purposes. If time permits, tabulate some of the data from the audits. Create a spreadsheet or table with this data for further analysis and visualization by students.
1. How much of the oil consumed in the US comes from domestic sources?
   ➤ about 40%

2. How much of the world’s oil does the US consume each year?
   ➤ about 25%

3. How much of the world’s oil does the US own?
   ➤ about 2%

4. How many barrels of oil does the United States use each day?
   ➤ approximately 21 million barrels

5. Of the oil consumed by the US, what percentage is used for transportation?
   ➤ 66.6%

6. How many Americans pull into a gas station each week to fill up their gas tank?
   ➤ about 200 million

7. For every gallon of gasoline your vehicle burns, how many pounds of carbon dioxide are released into the air?
   ➤ 20 pounds. A gallon of gasoline weighs about 6 pounds, but produces 20 pounds of carbon dioxide gas.

8. Imagine two automobile owners, each driving their cars 15,000 miles per year. One driver averages 20 miles per gallon and the other averages 40 miles per gallon. If the average cost of a gallon of gas is $2, how much more money does the fuel-efficient driver save over five years?
   ➤ $3,750

9. By how much would the automotive industry need to raise the average fuel efficiency—in miles per gallon—of today’s passenger cars to eliminate the need for US oil imports from the Persian Gulf?
   ➤ 5.3 miles per gallon

Optional: As a tiebreaker or bonus question, ask the students to name the member nations of OPEC. (Answer: Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.)

Sources for data: Department of Energy; Rocky Mountain Institute
Energy Independence

Today, about 60% of the oil that Americans use is imported. This level of dependence on imports is the highest in U.S. history, and will increase as we use up domestic resources. The vast majority of the world’s oil reserves are concentrated in the Middle East (65% to 75%), and controlled by the members of the Organization of Petroleum Exporting Countries (OPEC).

The US depends on oil to move people and goods. Ninety-five percent of the energy for transportation in the United States comes from oil. Transportation accounts for two-thirds of total US petroleum use.

How do oil imports affect our economy and national security?

What are the economic costs of oil dependence? Oil price increases by OPEC from 1979 to 2000 cost the US economy about $7 trillion, almost as much as we spent on national defense over the same time period. Each major price shock of the past three decades was followed by an economic recession in the United States. With growing US imports and increasing world dependence on OPEC oil, future price shocks are possible and would be very costly to the US economy.

What can we do to reduce our dependence on imported oil? Among the solutions: 1) develop more fuel-efficient vehicles and 2) create clean, renewable energy sources that can replace petroleum. By taking an interest in fuel economy, you can help reduce US petroleum dependence today and create incentives for carmakers to produce cleaner, more energy efficient vehicles in the future.

Adapted from Oil Dependence and Energy Security, www.fueleconomy.gov
**FUEL EFFICIENCY AUDIT**

1. **Collect** the following information about vehicles (cars, vans, SUVs, trucks) in your family. If your family has more than two vehicles, pick just two to research.

<table>
<thead>
<tr>
<th>Vehicle 1</th>
<th>Vehicle 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>Year</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Manufacturer</td>
</tr>
<tr>
<td>Model Type</td>
<td>Model Type</td>
</tr>
<tr>
<td>Transmission</td>
<td>Transmission</td>
</tr>
</tbody>
</table>


3. **Use** the “Find a Car” tool to research the vehicles in your family. Record the following data:

<table>
<thead>
<tr>
<th>Vehicle 1</th>
<th>Vehicle 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles per gallon (MPG): City ____ Hwy ____</td>
<td>City ____ Hwy ____</td>
</tr>
</tbody>
</table>

   a. Annual fuel cost (15,000 mi.) $________ $________

   b. Average MPG (both vehicles) Ave. MPG (both vehicles)

   c. Greenhouse gas emissions _____ tons/year _____ tons/year

   d. EPA air pollution score (0-10) _______ _______

4. **Locate** the “Best and Worst MPG” link on the left side of the webpage. Pick one of the most fuel-efficient vehicles and one of the least fuel-efficient.

<table>
<thead>
<tr>
<th>Most fuel efficient vehicle:</th>
<th>MPG (city)</th>
<th>MPG (highway)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least fuel efficient vehicle:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Now find the “Why is Fuel Economy Important” link at the top of the webpage. Choose the “Save Money” link in this section. Use the “Fuel Cost Calculator” to compare the two vehicles above. Update the price for a gallon of gas to reflect current fuel prices in your community.

   How much money would the more fuel-efficient vehicle save over the less fuel-efficient vehicle:

   In one year? $________ After four years? $______
5 Locate the “Gas Mileage Tips” link at the top of the webpage. Choose four specific ways to improve gas mileage in your family.

<table>
<thead>
<tr>
<th>How to improve gas mileage</th>
<th>Benefit or Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td></td>
</tr>
</tbody>
</table>

6 The website lists four reasons why fuel economy is important: a) to protect the environment, b) to reduce oil imports, c) to conserve resources for future generations, and d) to save money.

Which of these reasons is most important to you, and why?
Energy Poll

**BACKGROUND** Public opinion polls provide an opportunity for the voice of the common man and woman to be heard. When conducted with scientific rigor, polls serve as valuable tools for journalists, advocacy groups, and policy makers. Polls “take the pulse” of citizens on important social and environmental issues, informing and influencing political debate. Polls are quantitative rather than qualitative — good at finding out what people think, but only suggestive of why.

**ACTIVITY OVERVIEW**
In this activity, students explore the concepts of energy literacy and public opinion. After conducting an Energy Poll in the classroom, students administer the poll with people outside of the class. Extensions allow students to practice data analysis and data visualization.

**LEARNING OUTCOMES**
- Students explore the relationship between public awareness and public opinion.
- Students understand what makes a poll “scientifically reliable.”
- Students develop skill at data collection, tabulation, analysis, and visualization.
PROCESS

DAY ONE

1. Activate prior knowledge by asking students to share information that they already know about public opinion polling.
   - What is a poll? What is a public opinion poll?
   - Who has participated in a poll? What was the topic or issue?
   - Do you trust the reliability of polls? Why or why not?

2. Ask students to select a partner and designate one person A and the other B. Distribute one copy of the Energy Poll to each student. This poll is designed to measure individual values and preferences related to energy issues.

Students will first poll their partner in class and then survey two additional people outside of class. Review the data to collect on the polling sheet:
   a. Participant Information: Age, Gender, and Zip Code.
   b. Responses to questions 1 through 7, recorded in the right hand columns.

*Note: The responses for question 1 (a–d) should be recorded as F (favor) or O (oppose). The other responses will indicate the letter (a, b, c, d, e) chosen.*

Provide time for both student A and B to ask all of the questions on the poll and record the answers on their handouts under the “Person 1” column.

3. Discuss the Energy Poll.
   - Did you detect any bias in the wording of statements or questions? If yes, describe the bias.
   - Do you think your opinions about energy match the country as a whole? Why or why not?
   - How do polls influence government and business leaders?

4. Assign the homework task. Students will poll two additional people outside of class. At least one person should be 30 years or older. The polling may be conducted in person or by telephone. The pollster (student) should ask the questions and record participant responses in the columns for Person 2 and 3 on the form.

   *Optional: If time permits, collect and tabulate the data from the in-class polls. Create a spreadsheet or table with this data for further analysis by students.*

VOCABULARY

**bias:** A value or preference that inhibits impartial judgment.

**margin of error:** The range of confidence in a poll’s results. Generally speaking, the larger the random sample, the smaller the margin of error.

**poll:** A survey of what people think or believe about a topic or question.

**public opinion poll:** A poll that assesses people’s views on important social issues.

**random sample:** A sample is random if each member of the population has an equal chance of being represented.

**sample size:** The number of people who were questioned.

*Pollsters have a joke: If you don’t believe in random sampling, next time you go to the doctor for a blood test, have him take it all. It only takes a tiny drop of blood, randomly drawn from the body, to test for cholesterol. And it doesn’t matter how big the donor is — a mouse, a man, Godzilla.*

— ABC News
EXTENSIONS

1. Students design and administer a random sample survey using the Energy Poll or other energy-related questions. After tabulating, analyzing, and visualizing the data, students submit their findings to members of the city council and representatives of the local electrical utility.

2. Students design and administer an opinion poll on another public issue of interest to them.

3. Invite a guest — professional pollster, political journalist, market researcher — to speak to the class about the art and science of polling.

DAY TWO

1. Conduct a Think, Pair, Share process using the following prompts: “What did you learn from the polling process? What were your findings?” Provide about two minutes for individual student reflection and writing. Then, pair up students and provide two minutes per person to share their reflections. Finally, take responses from the class as a whole.

   Invite students to share their experience of polling:
   - How did the people you polled react to the questions? Were people unfamiliar with any of the terms used? Which ones?
   - Were the people you polled well informed about energy issues?
   - What surprised you about the opinions of the people you polled?

2. Continue the discussion by exploring the question: “How do we determine the reliability of a poll?” Share the following criteria as needed.
   - Who originated the poll?
   - What questions were asked? Can we detect any bias in the questions?
   - How many people were interviewed?
   - How were these people chosen?
   - Were they randomly selected? (introduce the concept of random sampling)
   - What area (nation, state, or region) were these people chosen from?

3. If tabulated, share results from the Energy Poll taken in class.
   - How do you think our class compares to people outside of class?
   - Would our class be considered a scientific sample? Why or why not?

   Optional: Create a spreadsheet to tabulate data from the Energy Poll administered outside of class. Divide students into small groups to analyze and visualize the data for a class presentation.
   - What patterns do you find?
   - What similarities and differences do you find when comparing such variables as age, gender, and zip code?
   - How can you visualize the data to communicate your findings? (e.g. bar charts, pie charts, maps by zip code, etc.)

QUICK BYTES

To learn more about the field of polling, visit these web sites:

- American Association for Public Opinion Research
  - www.aapor.org
- National Council on Public Polls
  - www.ncpp.org
- Roper Center
  - www.ropercenter.uconn.edu
**Energy Poll**

**Instructions:** Before you poll someone, introduce yourself and the assignment. You might say something like “Hi my name is ___________ and my class is conducting a poll about energy-related issues. It should take about five minutes. Would you be willing to participate?”

1. Following are some specific energy-related proposals. For each one, please say whether you generally **favor** or **oppose** it.
   - a. Spending more government money on developing solar and wind power.
   - b. Opening up the Alaskan Arctic Wildlife Refuge for oil exploration.
   - c. Setting higher fuel efficiency standards for automobiles.
   - d. Giving tax breaks to companies that invest in drilling for more oil and gas in the US.

2. Which of the following programs should receive the highest priority for funding in the US Department of Energy’s research and development budget?
   - a. Fossil fuels such as oil, natural gas, and coal
   - b. Technologies to improve energy efficiency
   - c. Nuclear power
   - d. Renewable energy such as solar, wind, geothermal, and biomass

3. Some states now generate a small percentage of their electricity from renewable energy sources such as solar, wind, geothermal, biomass, and small hydroelectricity. By the year 2020, what do you think should be the minimum percentage of electricity generated from renewable energy that is required by our state?
   - a. 10%
   - b. 20%
   - c. 30%
   - d. 40%
   - e. No opinion

4. Increased efforts by local utilities to develop and purchase solar and wind power might lead to higher utility bills. Would you be willing to pay $10 more each month to ensure that more electricity came from renewable sources?
   - a. Yes
   - b. No
   - c. No opinion

5. To promote higher fuel efficiency, would you support a state program that gives rebates to people who purchase the most fuel efficient vehicles and charges fees to people who purchase the least fuel efficient vehicles?
   - a. Yes
   - b. No
   - c. No opinion

6. The ENERGY STAR logo on household appliances guarantees that the product meets strict energy efficiency guidelines. When you shop for electrical appliances, how much does the ENERGY STAR logo influence your purchase?
   - a. Not at all
   - b. Somewhat
   - c. A lot
   - d. No opinion

7. What do you think is the biggest obstacle we face in shifting away from using fossil fuels like coal, oil, and natural gas to clean, renewable energy sources like wind and solar?
   - a. Lack of public concern
   - b. Lack of government commitment
   - c. Entrenched corporate interests
   - d. No opinion

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<table>
<thead>
<tr>
<th>Participant Information</th>
<th>Person 1</th>
<th>Person 2</th>
<th>Person 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zip Code</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responses</th>
<th>Person 1</th>
<th>Person 2</th>
<th>Person 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Electricity generated from renewable energy sources is known as “green power.” Growing green power is a vital step in building a cleaner, sustainable energy system. Innovative programs around the country now make it possible for energy consumers to support renewable energy by participating in the green power market. The willingness to pay for the benefits of increasing our renewable energy supplies can be tapped by any electricity customer. Choosing green power makes a big difference for the environment because electricity generation is the largest industrial polluter in the country.

In this WebQuest, students work in small groups to conduct online research about renewable energy and green power. Acting as a task force for the City Council, students prepare a green power plan for their community.

- Students understand the distinction between fossil fuels and renewable energy sources.
- Students discover the current “fuel mix” for the nation, their state, and their region.
- Students develop a basic vocabulary to participate in a conversation about growing green power.
- Students understand specific strategies for growing green power in their state and community.
PROCESS

DAY ONE

1 Divide students into small groups, with a minimum of four students per group.

Frame the activity: “You are part of an expert task force organized by our City Council (or local government). Your job is to research the topic of green power and create a plan for growing green power in our community.” Ask the members of each group to count off as roles A, B, C, and D.

2 Distribute copies of the four role descriptions (A, B, C, D) to each group. Review the four expert roles: A) national renewable energy expert, B) state energy expert, C) local energy expert, and D) green power market expert. Students with the same role within a group should collaborate in their research.

3 Preview the WebQuest process.
   a Log on to powershiftnow.org/activities.html and choose the Green Power activity.
   b Collect the information on your role sheet using the web links provided and other websites as needed.
   c Share your findings with other members of the group.
   d Prepare a plan for growing green power in the community.
   e Present your plan to the class and special guests that may attend.

4 Provide the remaining class time for students to go online and conduct web research. If needed, assign remaining research as homework.

DAY TWO

1 Check in with the groups to assess their progress and answer questions. During this class period, group members should brief one another on their research findings and prepare a plan for growing green power in the community. Remind students to review the guidelines for presentations posted on the WebQuest site.

2 For the class presentations, consider inviting guests from the community. This might include representatives from a local utility, local government agency, environmental organization, business group, renewable energy company, and concerned citizens.

VOCABULARY

electric utility (power provider)
green power
green power pricing
green power marketers
net metering
renewable energy certificates (RECs)
renewable portfolio standard (RPS)

QUICK FACTS

Electricity generation worldwide produces more pollution than any other single activity.

— Guide to Purchasing Green Power
DAY THREE

Provide each group 6-8 minutes to present their plan. Encourage questions from the class or any special guests. After the presentations, facilitate a class discussion.

- What questions did this activity raise for you?
- How is our state doing right now in terms of growing green power? How is our community doing?
- What obstacles do you think your plans will encounter?
- How will you build public awareness and enthusiasm for your plan?
- What can we do — both as citizens and consumers of electricity — to grow green power?

Optional: Invite students to vote on the best plan or reach consensus about different elements that would comprise a single class plan.

EXTENSIONS

1. Students author a single class plan and submit the document to the mayor, city council, local utility, local newspaper(s), or other interested parties.

2. Students create a press release, public service announcement (PSA), poster, or skit to communicate their plan to the community.

3. Students draft a renewable portfolio standard (RPS) and net-metering policy for the community.

4. Students conduct “green power briefings” for parent groups, community organizations, and other interested parties.
A. National Renewable Energy Expert

You are responsible for briefing your group on the status of renewable energy and green power in the US.

1. Research the current energy sources used to generate electricity in the US. For each source, indicate its percentage of the total energy mix. Collect the following information for the most recent year available.

<table>
<thead>
<tr>
<th>TOP TWO FOSSIL FUEL SOURCES</th>
<th>TOP TWO RENEWABLE ENERGY SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Source: ____________________</td>
<td>Source: _________________________</td>
</tr>
<tr>
<td>b Source: ____________________</td>
<td>Source: _________________________</td>
</tr>
<tr>
<td>Year: _________________________</td>
<td>Year: _________________________</td>
</tr>
</tbody>
</table>

2. What are the dirtiest energy sources?

<table>
<thead>
<tr>
<th>SOURCE</th>
<th>EXAMPLE OF HARMFUL EMISSIONS OR WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>_________________________________</td>
</tr>
<tr>
<td>b</td>
<td>_________________________________</td>
</tr>
<tr>
<td>c</td>
<td>_________________________________</td>
</tr>
</tbody>
</table>

3. List four examples of renewable energy sources (excluding hydroelectric).

   | a | _________________________________ |
   | b | _________________________________ |
   | c | _________________________________ |
   | d | _________________________________ |

4. Electricity generated from renewable energy sources is known as “green power.” List three reasons for purchasing green power.

   | a | _________________________________ |
   | b | _________________________________ |
   | c | _________________________________ |

5. What is a Renewable Portfolio Standard (RPS)?

   | _________________________________ |

6. List three states that have developed an RPS and complete the following information.

<table>
<thead>
<tr>
<th>STATE</th>
<th>% RENEWABLES</th>
<th>BY WHAT DATE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>____________</td>
<td>______________</td>
</tr>
<tr>
<td>b</td>
<td>____________</td>
<td>______________</td>
</tr>
<tr>
<td>c</td>
<td>____________</td>
<td>______________</td>
</tr>
</tbody>
</table>
B. State Energy Expert

You are responsible for briefing your group on the status of renewable energy and green power in our state.

1. Research the current energy sources used to generate electricity in our state. For each source, indicate its percentage of the total energy mix. Collect the following information for the most recent year available.

<table>
<thead>
<tr>
<th>TOP TWO FOSSIL FUEL SOURCES</th>
<th>TOP TWO RENEWABLE ENERGY SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source:</td>
<td>Source:</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Year:</td>
<td>Year:</td>
</tr>
</tbody>
</table>

2. What percentage of our state’s electricity is generated from nuclear power? ................................................................. %

3. What is a Renewable Portfolio Standard (RPS)?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

Has our state adopted an RPS? YES NO

If YES, complete the following information

% RENEWABLES IN STANDARD BY WHAT YEAR?
........................................................................................................................................
........................................................................................................................................

4. What is net metering?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

5. What is our state’s net metering policy?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

6. Find two electric utilities that offer a green power pricing program, preferably in our own state. Collect the following information.

<table>
<thead>
<tr>
<th>UTILITY NAME</th>
<th>PROGRAM NAME</th>
<th>TYPE(S) OF RENEWABLES</th>
<th>EXTRA COST/MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
C. Local Energy Expert

You are responsible for briefing your group on the status of renewable energy and green power in our local area.

1. Use the EPA “Power Profiler” tool to collect the following information. Enter your zip code to display utilities in our area.

   Primary electric utility (or utilities) in our community: .................................................................

   TOP TWO REGIONAL FUEL SOURCES       TOP TWO NATIONAL ENERGY SOURCES
   a Source: ........................................... %   Source: ...................................................... %
   b Source: ........................................... %   Source: ...................................................... %

2. What percentage of our region’s fuel mix comes from renewable energy (excluding hydroelectric)? ........................%  

3. Compare emissions in our area with national averages.

   REGIONAL EMISSIONS RATE (LBS/MWH)       NATIONAL EMISSIONS RATE (LBS/MWH)
   a Nitrogen Oxide ........................................ .................................................................
   b Sulfur Dioxide ........................................ .................................................................
   c Carbon Dioxide ........................................ .................................................................

4. On the same webpage, locate the “Make a Difference” section and choose “Buy Green Power.” Then, select our state.

   a Does our local electric utility offer a green power pricing program?

      YES  NO  If YES, what is the name of the program? .................................................................

   b If our utility does not currently offer a green power pricing program, what other options do citizens have to purchase green
     power?

      .................................................................................................................................

5. Visit the website of our local electric utility or power provider. On a scale of 0-10 (10 being highest), how would you rate our utility’s
   commitment to offering green power pricing programs?

      LOWEST  0  1  2  3  4  5  6  7  8  9  10  HIGHEST
You are responsible for briefing your group on the status of the green power market in the US.

1. **Describe three options for growing green power and one advantage of each.**

<table>
<thead>
<tr>
<th>GREEN POWER OPTION</th>
<th>ADVANTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
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<td>b</td>
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<td>c</td>
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</tbody>
</table>

2. **Research three of the top ten green power pricing programs offered by electric utilities in the US. Collect the following information:**

<table>
<thead>
<tr>
<th>UTILITY NAME</th>
<th>PROGRAM NAME</th>
<th>TYPE(S) OF RENEWABLES</th>
<th>EXTRA COST/MONTH</th>
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</tbody>
</table>

3. **In your opinion, which of the three programs is the best fit for our community?**

   Program name: ..............................................................

   Why the best fit: .................................................................

4. **What are Renewable Energy Certificates (RECs)?**

   ..........................................................................................................................

   How do you purchase them? ...............................................................................

5. **In your opinion, what are the four best reasons for a person to buy green power?**

   a. ..................................................................................................................

   b. ..................................................................................................................

   c. ..................................................................................................................

   d. ..................................................................................................................
Correlation of National Standards to Power Shift Activities

### SCIENCE STANDARDS GRADES 5 - 8

#### B. PHYSICAL SCIENCE GRADES 5-8

3. Transfer of Energy
   a. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
   e. In most chemical and nuclear reactions, energy is transferred into or out of a system.
   f. The sun is a major source of energy for changes on the earth’s surface.

#### D. EARTH AND SPACE SCIENCE GRADES 5-8

3. Earth In The Solar System
   d. The sun is the major source of energy for phenomena on the earth’s surface, such as growth of plants, winds, ocean currents, and the water cycle.

#### F. SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES GRADES 5-8

1. Personal Health
   g. Natural environments may contain substances (for example, radon and lead) that are harmful to human beings. Maintaining environmental health involves establishing or monitoring quality standards related to use of soil, water, and air.

2. Populations, Resources, And Environments
   b. Causes of environmental degradation and resource depletion vary from region to region and from country to country.

3. Natural Hazards
   b. Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

5. Science And Technology In Society
   b. Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
   c. Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.
### C. LIFE SCIENCE  GRADES 9-12

#### 4. The Interdependence Of Organisms
   e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

#### 5. Matter, Energy, And Organization In Living Systems
   b. The energy for life primarily derives from the sun.
   e. The distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials.

### D. EARTH AND SPACE SCIENCE  GRADES 9-12

#### 1. Energy In The Earth System
   a. Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the earth's original formation.
   c. Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.

### D. SCIENCE AND TECHNOLOGY  GRADES 9-12

#### 2. Understandings About Science And Technology
   d. Science and technology are pursued for different purposes. Scientific inquiry is driven by the desire to understand the natural world, and technological design is driven by the need to meet human needs and solve human problems. Technology, by its nature, has a more direct effect on society than science because its purpose is to solve human problems, help humans adapt, and fulfill human aspirations. Technological solutions may create new problems. Sometimes scientific advances challenge people's beliefs and practical explanations concerning various aspects of the world.

### D. SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES  GRADES 9-12

#### 3. Natural Resources
   a. Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.
   b. The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
   c. Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.
### SCIENCE STANDARDS GRADES 9 - 12

#### D. SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES GRADES 9-12, CONT.

**4. Environmental Quality**
- a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.
- b. Materials from human societies affect both physical and chemical cycles of the earth.
- c. Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**5. Natural and Human-induced Hazards**
- b. Human activities can enhance potential for hazards. Acquisition of resources, urban growth, and waste disposal can accelerate rates of natural change.
- d. Natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society, as well as cause risks.

**6. Science and Technology in Local, National, and Global Challenges**
- a. Science and technology are essential social enterprises, but alone they can only indicate what can happen, not what should happen. The latter involves human decisions about the use of knowledge.
- b. Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.
- c. Progress in science and technology can be affected by social issues and challenges.
- d. Individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them.
- e. Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use—which decreases space available to other species—and pollution—which changes the chemical composition of air, soil, and water.

### G. HISTORY AND NATURE OF SCIENCE GRADES 9-12

#### 3. Historical Perspectives
- c. Occasionally, there are advances in science and technology that have important and long-lasting effects on science and society.
<table>
<thead>
<tr>
<th>SOCIAL STUDIES STANDARDS</th>
<th>MIDDLE GRADES</th>
</tr>
</thead>
</table>

### III. People, Places, and Environments

- k. propose, compare, and evaluate alternative uses of land and resources in communities, regions, nations, and the world.

### IV. Individual Development and Identity

- g. work independently and cooperatively to accomplish goals.

### V. Individuals, Groups, and Institutions

- e. identify and describe examples of tensions between belief systems and government policies and laws.
- f. describe the role of institutions in furthering both continuity and change.
- g. apply knowledge of how groups and institutions work to meet individual needs and promote the common good.

### VI. Power, Authority, and Governance

- c. analyze and explain ideas and governmental mechanisms to meet needs and wants of citizens, regulate territory, manage conflict, and establish order and security.
- g. describe and analyze the role of technology in communications, transportation, information-processing, weapons development, or other areas as it contributes to or helps resolve conflicts.
- h. explain and apply concepts such as power, role, status, justice, and influence to the examination of persistent issues and social problems.

### VII. Production, Distribution, and Consumption

- a. give and explain examples of ways that economic systems structure choices about how goods and services are to be produced and distributed.
- b. describe the role that supply and demand, prices, incentives, and profits play in determining what is produced and distributed in a competitive market system.
- f. explain and illustrate how values and beliefs influence different economic decisions.
- i. use economic concepts to help explain historical and current developments and issues in local, national, or global contexts.
- j. use economic reasoning to compare different proposals for dealing with a contemporary social issue such as unemployment, acid rain, or high quality education.

### VIII. Science, Technology, and Society

- b. show through specific examples how science and technology have changed people's perceptions of the social and natural world, such as in their relationship to the land, animal life, family life, and economic needs, wants, and security.
- c. describe examples in which values, beliefs, and attitudes have been influenced by new scientific and technological knowledge, such as the invention of the printing press, conceptions of the universe, applications of atomic energy, and genetic discoveries.
- d. explain the need for laws and policies to govern scientific and technological applications, such as in the safety and well-being of workers and consumers and the regulation of utilities, radio, and television.
- e. seek reasonable and ethical solutions to problems that arise when scientific advancements and social norms or values come into conflict.
IX. Global Connections

d. explore the causes, consequences, and possible solutions to persistent, contemporary, and emerging global issues, such as health, security, resource allocation, economic development, and environmental quality.

e. describe and explain the relationships and tensions between national sovereignty and global interests, in such matters as territory, natural resources, trade, use of technology, and welfare of people.

X. Civic Ideals and Practices

c. locate, access, analyze, organize, and apply information about selected public issues — recognizing and explaining multiple points of view.

d. practice forms of civic discussion and participation consistent with the ideals of citizens in a democratic republic.

e. explain and analyze various forms of citizen action that influence public policy decisions.

g. analyze the influence of diverse forms of public opinion on the development of public policy and decision making.

i. explain the relationship between policy statements and action plans used to address issues of public concern.

j. examine strategies designed to strengthen the “common good,” which consider a range of options for citizen action.
### SOCIAL STUDIES STANDARDS  HIGH SCHOOL

#### II. Time, Continuity, and Change
   - e. investigate, interpret, and analyze multiple historical and contemporary viewpoints within and across cultures related to important events, recurring dilemmas, and persistent issues, while employing empathy, skepticism, and critical judgment.

#### III. People, Places, and Environments
   - g. describe and compare how people create places that reflect culture, human needs, government policy, and current values and ideals as they design and build specialized buildings, neighborhoods, shopping centers, urban centers, industrial parks, and the like.
   - k. propose, compare, and evaluate alternative policies for the use of land and other resources in communities, regions, nations, and the world.

#### IV. Individual Development and Identity
   - h. work independently and cooperatively within groups and institutions to accomplish goals.

#### V. Individuals, Groups, and Institutions
   - e. describe and examine belief systems basic to specific traditions and laws in contemporary and historical movements.
   - f. evaluate the role of institutions in furthering both continuity and change.
   - g. analyze the extent to which groups and institutions meet individual needs and promote the common good in contemporary and historical settings.

#### VI. Power, Authority, and Governance
   - g. evaluate the role of technology in communications, transportation, information-processing, weapons development, or other areas as it contributes to or helps resolve conflicts.
   - h. explain and apply ideas, theories, and modes of inquiry drawn from political science to the examination of persistent issues and social problems.
   - j. prepare a public policy paper and present and defend it before an appropriate forum in school or community.

#### VII. Production, Distribution, and Consumption
   - a. explain how the scarcity of productive resources (human, capital, technological, and natural) requires the development of economic systems to make decisions about how goods and services are to be produced and distributed.
   - b. analyze the role that supply and demand, prices, incentives, and profits play in determining what is produced and distributed in a competitive market system.
   - h. apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues.
   - i. distinguish between the domestic and global economic systems, and explain how the two interact.
   - j. apply knowledge of production, distribution, and consumption in the analysis of a public issue such as the allocation of health care or the consumption of energy, and devise an economic plan for accomplishing a socially desirable outcome related to that issue.
### VIII. Science, Technology, and Society

- b. make judgements about how science and technology have transformed the physical world and human society and our understanding of time, space, place, and human-environment interactions.

- c. analyze how science and technology influence the core values, beliefs, and attitudes of society, and how core values, beliefs, and attitudes of society shape scientific and technological change.

- d. evaluate various policies that have been proposed as ways of dealing with social changes resulting from new technologies, such as genetically engineered plants and animals.

- f. formulate strategies and develop policies for influencing public discussions associated with technology-society issues, such as the greenhouse effect.

### IX. Global Connections

- d. analyze the causes, consequences, and possible solutions to persistent, contemporary, and emerging global issues, such as health, security, resource allocation, economic development, and environmental quality.

- e. analyze the relationships and tensions between national sovereignty and global interests, in such matters as territory, economic development, nuclear and other weapons, use of natural resources, and human rights concerns.

- h. illustrate how individual behaviors and decisions connect with global systems.

### X. Civic Ideals and Practices

- c. locate, access, analyze, organize, synthesize, evaluate, and apply information about selected public issues — identifying, describing, and evaluating multiple points of view.

- d. practice forms of civic discussion and participation consistent with the ideals of citizens in a democratic republic.

- e. analyze and evaluate the influence of various forms of citizen action on public policy.

- g. evaluate the effectiveness of public opinion in influencing and shaping public policy development and decision making.

- i. construct a policy statement and an action plan to achieve one or more goals related to an issue of public concern.
Power Shift Glossary

A

alternative fuel A popular term for a transportation fuel that provides significant environmental and energy security benefits. Examples include biodiesel, electricity, ethanol, and hydrogen.

alternative fuel vehicle A vehicle designed to operate on at least one alternative fuel.

annual electricity consumption The amount of electricity used by a consumer in one year and typically measured in kilowatt-hours (kWh).

biodiesel A biodegradable transportation fuel for use in diesel engines that is produced using organically derived oils or fats. (see alternative fuel)

biomass A renewable energy source that comes from organic materials such as wood, crops, municipal organic waste, food processing waste, and animal wastes. When burned, this biomass creates heat and/or steam that can be used to generate electricity.

CAFE standards An acronym for Corporate Average Fuel Economy. This government standard requires auto manufacturers to achieve an average fuel economy (in miles per gallon) for its fleet of passenger cars and light trucks sold in the US. Originated in 1975, CAFE standards can be an effective tool to encourage automotive innovation and improve fuel efficiency.

carbon dioxide Burning fossil fuels releases carbon that has been stored underground for millions of years into the atmosphere. During the combustion process, the carbon in these fossil fuels is transformed into carbon dioxide, a principal greenhouse gas.

crable to cradle design A design philosophy that seeks to model human industry on nature’s processes. In a cradle to cradle approach, materials are viewed as nutrients circulating in healthy, safe metabolisms (cycles). Industry’s job is to protect and enrich ecosystems — nature’s biological metabolism — while also maintaining safe, productive technical metabolism for the high-quality use and circulation of mineral, synthetic, and other materials.

distributed power generation Small, decentralized energy systems such as solar electric panels and hydrogen fuel cells located in or near the place where energy is used. Distributed generation may be connected to the electricity grid or reside completely “off the grid.”

compact fluorescent light bulb (CFL) A smaller version of standard fluorescent lamps that can directly replace standard incandescent lights. CFLs typically use about 65-75% less electricity and last up to ten times longer than an incandescent light bulb.

E

electric meter Equipment that measures and registers the amount and direction of electricity over a period of time. (see net metering)

electric utility A municipal or private business that provides electricity to the public and is subject to governmental regulation. Also known as a power provider.

electric vehicle A vehicle powered by electricity, generally provided by storage batteries, but may also be provided by photovoltaic cells or fuel cells. (see alternative fuel vehicle)
electrical energy  The energy of electrical charges, usually electrons in motion.

electricity grid  A network of electric power lines and related equipment used to transmit and distribute electricity over a geographic area. Also known as the “power grid,” this interconnected system consists of power plants, transmission lines, towers, substations, and transformers.

emissions trading  A proposed economic solution to air pollution. In such a plan, government agencies set limits or “caps” on each pollutant. Groups that intend to exceed the limits may buy emissions credits from entities that are likely not to exceed the limits.

energy conservation  Policies and practices that manage energy resources and energy use in order to prevent waste and to ensure future availability. Energy conservation typically requires a change of behavior, while energy efficiency uses less energy to do the same thing.

energy efficiency  A design strategy that does “more with less.” Energy efficient designs—applied to such things as light bulbs, refrigerators, computers, autos, and buildings—use less energy/electricity to perform the same function. Energy efficiency saves energy, saves money on utility bills, and helps protect the environment by reducing the amount of electricity that needs to be generated.

energy independence  Policies and practices intended to reduce US reliance on imported petroleum and natural gas. Strategies for achieving greater energy independence include 1) design more fuel efficient vehicles, 2) design more energy efficient buildings and electrical appliances, and 3) utilize clean, renewable energy sources that can replace fossil fuels.

energy literacy  The quality of being well informed on energy-related issues. An energy literate citizen understands the vital role of energy in our society and incorporates sustainable energy practices into her/his personal life.

energy policy  A plan or set of guidelines related to energy issues that reflects a particular set of values and influences specific actions and decisions. Energy policy is formed at international, national, regional, state, and local levels.

energy security  A policy orientation that considers the risks associated with dependence on fuel sources located in remote and unstable regions of the world and the benefits of fuel efficiency and diverse, domestic energy sources.

ENERGY STAR  A government program that helps businesses and individuals protect the environment through superior energy efficiency. The ENERGY STAR logo on household appliances guarantees that the product meets strict energy efficiency guidelines. Energy efficient choices typically save a family about a third on their energy bill with similar savings of greenhouse gas emissions.

ethanol  An alcohol fuel produced from the fermentation of various sugars from carbohydrates found in agricultural crops. (see alternative fuel)

feebate  An economic tool designed to encourage environmentally friendly practices. Feebates simultaneously use both fees and rebates. In this approach, fees fund rebates, canceling each other out. For example, a feebate program might charge fees on vehicles with low fuel efficiency, and provide rebates to those with high fuel efficiency.

fuel efficiency  A numeric measure used to describe the amount of fuel consumed with regard to the distance traveled in a vehicle. Also know as fuel economy and gas mileage.

fossil fuels  The nation’s principal source of electricity, fossil fuels come in three major forms—coal, oil, and natural gas. Because fossil fuels are a finite resource and cannot be replenished once they are extracted and burned, they are considered nonrenewable.

fuel cell  An electrochemical device that converts chemical energy directly into electricity. A fuel cell works like a battery but does not run down or need recharging. (see hydrogen fuel cell)

generator  A machine that converts mechanical energy into electrical energy.

geothermal energy  A renewable energy source that comes from the natural heat, hot water, and steam found within Earth. A geothermal power plant uses this heat or steam to drive turbine-generators that produce electricity.

global climate change  Short and long-term effects on Earth’s climate as a result of human activities such as burning fossil fuels and clearing forests. Possible effects include melting glaciers, rising sea levels, species migration, and the spread of disease.
green buildings Building designs that seek to maximize energy and water efficiency, minimize waste and pollution, incorporate sustainable materials and renewable energy, and enhance the health, safety and comfort of occupants. A green building protects and restores local flora and fauna and contributes to the vitality of the larger community. The practice of designing green buildings is also known as "sustainable architecture." (see LEED)

green power Electricity that is generated from renewable energy sources is referred to as "green power."

green power marketers Power providers offering consumers electricity from renewable energy sources are typically referred to as green power marketers. This term can also include utilities that offer green power options under what are typically referred to as green pricing programs.

green power pricing Offering customers the choice of paying additional fees on their utility bill in order to support the production of renewable energy.

greenhouse effect The trapping of heat energy from the sun in Earth’s atmosphere, notably by water vapor and greenhouse gases. The resulting heat energy warms the planet’s surface. (see global climate change)

greenhouse gas Any gas in the atmosphere that contributes to the greenhouse effect. This includes carbon dioxide, methane, and nitrous oxide.

ground source heat pump A type of heat pump that uses the ground, ground water, or ponds as both a heat source and heat sink, rather than outside air. Ground or water temperatures remain more constant than air temperatures; warmer in winter and cooler in summer.

hybrid electric vehicle A vehicle that is powered by two or more fuels, typically a battery and an internal combustion engine.

hydroelectric power (hydropower) The process of generating electricity by harnessing the power of moving water is called hydroelectricity. Hydroelectric power (hydropower) is generated by forcing water that is flowing downstream, often from behind a dam, through a hydraulic turbine that is connected to a generator. The water exits the turbine and is returned to the stream or riverbed. In the US, hydroelectricity contributes about 10 percent of the total electricity supply.

industrial revolution The shift to large-scale factory production brought about by the extensive use of machinery, often driven by steam engines. Generally thought to occur between the 1750s and late 1800s. The industrial revolution marks the beginning of a major increase in the use of fossil fuels.

interconnection A connection or link between power systems that enables them to draw on each other’s reserve capacity in time of need.

kilowatt-hour (kWh) A standard metric unit of measurement for electricity. The energy expended when 1,000 watts of electrical power are used for one hour.

Kyoto Protocol An amendment to the UN Framework Convention on Climate Change, an international treaty on global warming. Countries who sign this protocol commit to reduce their emissions of carbon dioxide and other greenhouse gases, or engage in emissions trading if they maintain or increase emissions of these gases. (see emissions trading)

LEED An acronym for Leadership in Energy and Environmental Design, a green building rating system developed by the US Green Building Council.

mechanical energy The energy of an object as represented by its movement, position, or both.

megawatt-hour (MWh) A megawatt-hour is equal to 1,000 kilowatt-hours or 1 million watt-hours.

methane gas An odorless, colorless, combustible gas that can be used as an energy source. The primary component of natural gas and a source for hydrogen gas.
natural gas A fossil fuel formed when layers of buried plants and animals decompose over a long period of time. The primary component of natural gas is methane, a potent greenhouse gas. Natural gas power plants provide about 14 percent of the electricity produced in the United States, ranking third behind coal and nuclear power. Our domestic supply of natural gas is expected to run out within several decades.

net energy producer (exporter) A facility or building that produces more electricity than it consumes, often the result of on-site power generation from renewable energy systems. For example, a family with solar panels on their home that generates more electricity than it consumes would be considered a net energy producer.

net metering A program offered by electric utilities and power providers that encourages grid-connected consumers to generate some or all of their own electricity, usually through solar or wind power. In many cases, this type of program allows the consumer’s meter to turn backwards when they are producing more power than they are using, and some utilities will pay the consumer for the excess power generated.

nonrenewable energy Energy sources that do not regenerate themselves in a useful amount of time, including fossil fuels and nuclear fuels.

nuclear energy Energy that comes from splitting atoms of radioactive materials, such as uranium, and which produces radioactive wastes. Nuclear power accounts for about 20 percent of the country’s electricity production. No nuclear power plants have been built in the US since 1996, mostly due to economic factors and environmental concerns.

oil A liquid fossil fuel that is formed from layers of buried plants and animals that have been subjected to geologic heat and pressure over a long period of time. In addition to carbon, oil contains elements such as nitrogen, sulfur, mercury, lead, and arsenic. Oil is a nonrenewable resource because it cannot be replenished on a human time frame.

oil (petroleum) reserves The amount of oil that has been discovered and remains unused.

OPEC An acronym for the Organization of Petroleum Exporting Countries, founded in 1960 to unify and coordinate petroleum policies of its member nations. Current members include Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

peak load The time(s) of day when consumers demand (use) the most electricity.

peak oil Refers to a singular event in history: the peak of the entire planet’s oil production. As first articulated by American geophysicist Marion King Hubbert in 1956, the rate of oil extraction follows a bell-shaped curve. Once the peak is passed, oil production begins to decline while the cost of oil rises. Although we cannot predict the exact date of peak oil, humanity may have already reached this historical turning point.

photovoltaic (PV) Refers to the ability to convert photons into electrical energy. Photons are used to dislodge electrons from atoms of silicon or other materials, causing them to migrate, producing an electric current.

photovoltaic (solar) array An arrangement of a large group of photovoltaic (solar) panels or mirrors.

photovoltaic (solar) cell Treated semiconductor material that converts sunlight into electricity.

photovoltaic (solar) system A complete solar power system composed of the photovoltaic array and other components needed to operate the system.

rebate The return of a percentage of the cost of an item as an incentive to purchase. Rebates might be offered to consumers who install solar panels or purchase a fuel-efficient vehicle.

renewable energy Electricity supplied from renewable energy sources, such as wind and solar power, geothermal, hydropower, and various forms of biomass. These energy sources are considered renewable sources because they are continuously replenished on Earth.

renewable energy certificates (RECs) An energy product that offers consumers a way of supporting renewable energy whether or not they have access to green power programs through their local utility or a competitive power provider. Also known as green certificates, green tags, and tradable renewable certificates.

renewable portfolio standard (RPS) A standard, typically adopted by a national, state or local government, designed to ensure that a certain percentage of renewable energy resources be included in the portfolio (assorted collection) of its power providers or sources. A RPS is often phased in during a multiyear period.
small hydro Like large hydro plants, small-scale hydroelectric systems capture the energy in flowing water and convert it to electricity. Although the potential for small hydroelectric systems depends on the availability of suitable water flow, these systems can provide cheap, clean, reliable electricity in some locations.

sedum A drought-tolerant type of plant known for its shallow roots and juicy leaves. When used as a “green roof” covering, sedum helps absorb water, improve insulation, protect roof materials, and provide a habitat.

solar energy A renewable energy source that converts sunlight into electricity. Photovoltaic (PV) cells are made primarily of silicon, the second most abundant element in Earth’s crust. When silicon is combined with other materials, it exhibits unique electrical properties in the presence of sunlight. Electrons are excited by sunlight and move through the silicon. This is known as the “photovoltaic effect” and results in direct current (DC) electricity.

turbine A bladed, wheel-like device caused to spin by the force of pressurized steam or gas, wind, or moving water. Turbines are used in electricity production to drive an electrical generator (see wind turbine).

wind energy A renewable energy source that converts moving air into electric power. As air flows past the rotors of a wind turbine, the rotor spins and drives the shaft of an electric generator. Large turbines, often clustered in wind farms, generate significant amounts of electricity. This wind power can be used locally or fed into a regional electricity grid.

transformer A device used to "step up" (increase) or "step down" (decrease) the voltage of electric current.

transmission lines Long distance wires through which high-voltage electricity travels. Also known as "power lines."

triple top line A design practice (and accounting perspective) that seeks to maximize economic, social, and ecological value.

wave energy A renewable energy source, ocean waves represent a form of solar energy. The unequal solar heating of Earth generates wind. This wind blows over water generating waves. There are a variety of wave energy systems under development, ranging from small-scale shoreline to large-scale, offshore systems.

wind turbine A wind energy conversion device that produces electricity; typically having one, two, or three blades.

zero emission vehicle Zero emission standards, usually met by electric vehicles, require zero vehicle emissions.
About WorldLink

WorldLink is a non-profit organization formed in 1989. WorldLink’s purpose is to inspire understanding about critical global and local issues through transformational learning experiences. WorldLink seeks to fill the gap between what we know and how we act. Our aim is to cultivate thinking, acting citizens with the capability to influence social change.

Our thematic interests include environmental education, sustainability, energy literacy, green buildings, youth leadership, intergenerational dialogue, intercultural understanding, and active citizenship.

WorldLink develops and administers programs in the following areas:

Public Media
Combines media programming and learning resources to stimulate thoughtful discourse on social and environmental issues.

Curriculum Design
Creates interdisciplinary learning experiences that equip students with the knowledge, values, and skills to effectively participate in the global and local community.

Professional Development
Invites educators to develop and practice their craft through workshops, conferences, and online learning.

Youth Leadership
Offers young people a forum to examine issues of common concern. WorldLink convenes global and local youth summits and provides opportunities for youth-adult dialogue.

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We welcome your feedback and suggestions.