This unit has been created as an exemplary model for teachers in (re)design of course curricula. An exemplary model unit has undergone a rigorous peer review and jurying process to ensure alignment to selected Delaware Content Standards.

Unit Title: Humans Interact with Earth Systems
Designed by: Maggie Legates
Delaware Geographic Alliance
Content Area: Geography
Grade Level: 6

Summary of Unit and Instructional Standards
This unit addresses Geography Standard Two: Human/Environmental interaction. Standard Two at the middle school level requires students to acquire a knowledge of the basic physical processes that shape our planet and, very importantly, a knowledge of the strategies humans use to interact with the natural environment. Inherent in this study is the idea that natural phenomena are not random and the effects are not randomly distributed. They result in patterns of climate, topography, and resource distribution that are of critical importance to the lives of humans. Geographic knowledge of the workings of physical systems is helpful in understanding developments in the past and may prove useful in predicting the effects of current human activities into the future. At the 4-5 level students learned that physical processes, for example erosion and mountain building, have effects for human society. This unit builds on basic concepts developed in social studies in the previous level. It reinforces and extends concepts learned in science instruction related to weather, soils, land and water, and ecosystems by emphasizing an understanding of humans and their interaction with physical Earth. The unit will complement future studies in science related to watersheds and weather.

This benchmark calls for a basic understanding of the physical systems that shape planet Earth:

1) mountain building and erosion;
2) the cycles of water above the surface and below and the movement of water in streams;
3) cycles in the atmosphere that result in climate patterns.

A key to understanding each of these is the idea of a cycle or system with component parts that functions within predictable parameters. A knowledge of cycles and systems and the patterns they produce will assist students in explaining environmental differences.

- **Lesson One** explores the concepts of cycles and systems using the hydrologic cycles and stream systems as the teaching example.
- **Lesson Two** looks at Natural Hazards faced by humans around the world, and the ways they react to them.

Armed with a basic understanding of the processes that shape Earth, students should be able to understand the consequences of human actions of the past and predict the likely result of projects and activities that affect the environment. They will appreciate that
physical processes may limit or constrain human activities, but are not the sole determining
factor. Students will be encouraged to identify intended and possible unintended
consequences of human projects.

- **Lesson Three** looks at farming and irrigation projects in several world regions to
  evaluate benefits and negative impacts.
- **Lesson Four** looks at the search for power sources around the world. Armed with this
  knowledge, students will be faced with the challenge of comparing and contrasting
  two world areas in terms of human-environmental interaction.

There are two reasons for the use of examples and case studies from several world regions
in this unit. First, it is important to establish the universal applicability of natural principles
and the possible wider reach of consequences from local actions. Secondly, cultural
differences in perception, decision-making and use of resources may result in different
approaches to similar environmental challenges. The benchmark implies an element of
historical awareness. Students should understand that cultural evaluations and alterations
of the environment have evolved over time.
Stage 1 – Desired Results
What students will know, do, and understand

Delaware Content Standards

- **Geography Standard Two 6-8a**: Students will apply a knowledge of the major processes shaping natural environments to understand how different peoples have changed and been affected by, physical environments in the world’s sub-regions.

**Big Ideas**

- Physical Cycles and Systems
- Human strategies of adaptation to physical conditions
- Human alteration of the Environment
- Intended and Unintended Consequences

**Unit Enduring Understanding**

- The human response to the characteristics of a physical environment comes with consequences for both the human culture and the physical environment.

**Unit Essential Questions**

- How do Earth’s physical processes shape the surface of earth?
- How do physical processes affect human activity?
- How can we use knowledge of cycles and systems to predict environmental hazards?
- How can geographic principles help us make decisions about projects and problems?

**Knowledge and Skills**

*Students will know...*

- Physical Processes: Erosion or Weathering/ Mountain Building, Water Cycles and Stream Patterns
- Landscape Patterns produced by physical processes
- Human Adaptations to Environmental Conditions
- Ways People Alter the Environment through their activities

*Students will be able to...*

- use **deductive reasoning** to determine how physical features impact human settlements.
- examine the **causes/effects** of specific physical features and how climate characteristics affect human activities and settlements.
- **justify** why specific human activities occur in various climate regions.
- **evaluate** locations in terms of suitability for activities
Stage 2 – Assessment Evidence
Evidence that will be collected to determine whether or not Desired Results are achieved

Transfer Task
This summative assessment is a transfer task that requires students to use knowledge and understandings to perform a task in a new setting or context. The assessment and scoring guide should be reviewed with students prior to any instruction. Students should complete the assessment after the lessons conclude.

Essential Question addressed by the transfer task:
- How do Earth’s physical processes shape the surface of earth in this sub-region?
- How do physical processes affect human activity in this sub-region?
- How can we use knowledge of cycles and systems to predict environmental hazards?
- How can geographic principles help us make decisions about projects and problems?

Prior Knowledge
You have learned about physical systems that shape our natural world. You have also looked at ways humans in many parts of the world have adapted to the environment or have altered the environment to meet their needs. You have looked at some of the intended and unintended consequences of human projects. Now you are ready to put your knowledge to work to evaluate human/ environmental interaction in one of earth’s sub-regions.

Problem/Role
World Eco-Tours is a non-profit agency that tries to raise awareness of the importance of our natural world and the interaction of humans with their natural home. The agency takes small groups of eco-tourists on Eco-Adventue trips. The ticket price includes a contribution to their work.

Perspective
As an intern at World Eco Tours you have been asked to help with a design for the new website. Eco-Tourists will visit this website to decide which tour they want to take. You will be asked to design one page for the website, focusing on one of the world’s interesting sub-regions. Your supervisor has provided you with a list of areas the group plans to visit this year. Each area is the site of a proposed project designed to improve life for the people of the region. Select one sub-region with its proposed project to profile.

Costa Rican Rainforest - Logging and fires have destroyed many acres of the tropical rainforest. Replanting with native trees will prevent soils from washing away.

Mali - In recent years, this region has become drier and is struggling to feed its people. The project will drill deep wells for drinking water and crop irrigation.
**Nunavut, Canada** - Remote and beautiful, this region can only be reached by dogsled and airplane. The project will build a road to connect to nearest hospital.

<table>
<thead>
<tr>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your supervisor on the website project has asked you to do a “mock-up” or model of the webpage for your world sub-region.</td>
</tr>
</tbody>
</table>

Include these sections in your summary:

1) Identify the sub-region you have chosen and include a map that shows its boundaries and relative location. Describe the physical landscape of the region.

2) Include one or two pictures to highlight the physical system or cycle you consider most important for the people living in the sub-region.

3) Tell about the people who have lived in this region for a long time. How did they adapt to conditions here? Include at least one picture of the traditional culture.

4) In a section labeled Natural Hazards, summarize any conditions in the area that present a problem for people who live there. What has been the response to this hazard in the past?

5) What projects or improvements are proposed for the region? What is the likely impact of these projects based on what you have learned?

Your prototype may be an electronic file or it can be a paper model.

<table>
<thead>
<tr>
<th>Criteria for an Exemplary Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be accepted for use on the website, your model will include accurate information about the sub-region including sections on the physical processes that shape the landscape, the adaptations of traditional cultures, ways people have altered the environment, and projects that are proposed.</td>
</tr>
<tr>
<td>Show that you can apply your knowledge of natural processes, human adaptation, and the consequences of human activity to analyze a sub-region.</td>
</tr>
<tr>
<td>Present information and analysis in an organized and interesting way.</td>
</tr>
<tr>
<td>Scoring Category</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>The webpage.....</td>
</tr>
<tr>
<td>Links existing physical conditions to appropriate physical processes, systems or cycles.</td>
</tr>
<tr>
<td>Tells how the traditional culture of the region adapted to existing conditions</td>
</tr>
<tr>
<td>Tells how people have altered the environment of this sub-region to meet their needs.</td>
</tr>
<tr>
<td>Evaluates the likely impact of proposed projects based on learning.</td>
</tr>
<tr>
<td>Uses content-appropriate vocabulary in order to demonstrate understanding</td>
</tr>
</tbody>
</table>

**Total Score:** _____

**Above the Standard:** 16-18  
**Meets the Standard:** 10-15  
**Below the Standard:** 6-9
Lesson One: Cycles, Systems and Patterns of Physical Earth

Essential Questions
- How do Earth’s physical processes shape the surface of earth?
- How do physical processes affect human activity?
- How can we use knowledge of cycles and systems to predict environmental hazards?

Instructional Strategies

Vocabulary and Concept Development: Cycles
Begin by asking a student to dribble a basketball as he/she walks across the classroom. Ask the students to explain the steps of dribbling. Where is the ball in relation to the player at each stage? What will happen if the steady, repetitive motion is interrupted?

On the board or projector display the graphic for cycles (Visual 1).

Ask the students what this graphic might be used to represent. List possibilities on the board (Examples: life cycles, steps in washing clothing, recycling aluminum cans). Lead the students in a discussion to elicit the understanding that cycles are steps in an ongoing process (the number of steps may vary), cycles are recursive and repetitive, and so can be predictable, interruptions in one stage of a cycle will lead to changes in other stages.

Extending and Refining: Applying the Cycles Concept to Natural Processes
Ask students if they can use or adapt the cycle diagram to explain why it rains. (This will review basic concepts learned in elementary science classes. The students should recall the stages of evaporation, condensation and precipitation.) Use the Cycles Diagram Visual 1 to explain and reinforce. Tell the students that this basic understanding must be expanded to understand where drinking water comes from.

Gathering and Processing Information
Have students research the hydrologic cycle, including groundwater as a source of water, through:
- reading a summary (Handout 1)¹
- viewing The Groundwater Cycle
- viewing Groundwater.

As students gather the information, they can process it by diagramming the stages of the underground water cycle. A blank cycles worksheet is provided (Handout 2), or the students might devise their own graphic. It is important that students understand that the process is

¹ This reading has a lexile level of 810, within the range for sixth grade according to the Common Core Standards.
ongoing. While an individual water droplet or molecule may be at one stage, all stages of the cycle are operational at the same time. The student diagram might look something like this:

![Water Cycle Diagram]

**Application**
First ask students to use the diagram they developed to explain to a partner where drinking water comes from. Next, ask students to refer to the diagram to identify which stage of the underground water cycle would be impacted by each of these human activities. In each case, challenge them to predict the likely impact on the amount of water available in wells in the area.

- Paving large areas of the surface for parking lots and streets (Reduces absorption into the ground, increases run-off into streams).
- Cutting down forests (Less water is absorbed into plants through roots, so more water might be available for wells BUT less moisture is released through leaves into the atmosphere, so rainfall might be less.)
- Flooding fields to irrigate crops (If water is drawn from rivers, might increase water absorbed)

**Check for Understanding**
The weather forecast for south Texas for many weeks has been “hot and dry.”

- Why should homeowners who depend on a well for their drinking water be concerned? Use the cycles diagram to explain your answer.

**Rubric**
2 – This response gives a valid reason with an accurate and relevant explanation that uses the cycles diagram.
1 - This response gives a valid reason with an inaccurate, irrelevant, or no explanation or does not use the cycles diagram.
Vocabulary and Concept Development: Cycles and Climate Patterns
Activate prior knowledge of climate regions by challenging students to sketch a picture of a landscape. Their sketch must include at least one plant, one animal, and a typical house.

Ask half of the students to sketch a desert landscape, and the other half to sketch a rainforest. When the sketches are complete, have students pair up to compare and contrast their landscape pictures.

Ask the students what single factor caused the differences in the landscapes. They should recognize that available water for plant, animals and humans is the key factor determining differences in the landscape.

Activate prior knowledge of latitude and longitude and deductive reasoning with this map activity:
Provide the students with an outline world map with a simple latitude and longitude grid overlay. Have the students practice latitude and longitude skills while locating and labeling desert and rainforest regions. They should label the desert regions in orange or red and the rainforest areas in green.

When the labeling is completed, ask the students to identify the pattern that emerges and to speculate about causes. (They should note that rainforests occur in a band along the equator, while the Earth’s deserts are found in two bands roughly located along the Tropics of Cancer and Capricorn.) Ask the students to speculate on why this pattern of precipitation differences may exist. Explain that the concept of cycles in the atmosphere can help explain climate patterns.

Use the reading Global Circulation Patterns (Visual 2) to help students understand what causes the climate patterns they discovered in the distribution of rain forests and deserts. Use a globe or a large ball and a slinky to model the bands of air circulation that rise near the equator and fall near 20 degrees north and south latitude.
Photos of earth taken from space clearly show the Arabian Peninsula and North Africa. But they seldom allow a good view of the Amazon Basin—it is usually covered with clouds.

Why might photographers have a better view of the deserts than the rainforests? Use the concept of cycles to explain your answer.

**Rubric**

2 – This response gives a valid reason with an accurate and relevant explanation that uses the concept of cycles.

*Sample Response:* Student explains a clear connection between high temperatures and low rainfall with a reduced amount of cloud cover and uses an understanding of water cycles to explain.

1 – This response gives a valid reason with an inaccurate, irrelevant, or no explanation that uses the concept of cycles.

*Sample Response:* Student correctly answers that less rainfall occurs in desert areas, but explanation reveals only a partial understanding of the water cycle or no explanation is given.

**Extending and Refining: Rain Shadow Effect and Sea Breezes as examples of local or “micro climate”**.

Background: Some differences in climate may result from conditions of the atmosphere or the land that affect relatively small areas. Two examples are the Rain Shadow Effect and the Land Breeze/Sea Breeze change often observed along the coast.

**Rain Shadow Effect** - Where prevailing winds pass over bodies of water and then encounter high mountains, a rain shadow may result. On the windward side of the mountains, lush vegetation covers the slopes. As clouds are forced higher and the air cools, precipitation increases. The air that crosses the top of the mountains is therefore very dry. On the leeward side of the mountains, very dry, almost desert conditions exist.

[Click here for an animation to illustrate this effect.](#)
**Physical Systems** - Just as the health of the human body depends on proper balanced functioning of the circulatory, digestive, respiratory, and other systems, so the health of our environment depends on earth’s physical systems. Components of physical systems may be distant from each other, so the relationship of a local body of water, landform, or topographic region to other parts of its system may not be readily apparent. The student needs to understand the interdependence of parts of the physical system and the need for them to achieve balance.

**Activating Prior Knowledge from History through Poetry:** Read aloud the Langston Hughes Poem “A Negro Speaks of Rivers” (Visual 4). What rivers did the poet mention? Why have rivers been important to humans and their activities throughout history?

**Vocabulary and Concept Development: River Systems**

Use the slideshow Rivers and Streams to present students with information about the components and stages of streams as they make their way from an inland source to the sea.

Have students read Introduction to Rivers (Handout 4)². As they read, have them highlight the following vocabulary words: *source, course, meander, tributaries, oxbow, runoff, mouth, delta, erosion, sediment, estuary, brackish.* The word deposition should be added in the margin, and students can infer its meaning from the reading.

Working in pairs, have students create flashcards for the vocabulary words. On one side of a card, have them write a word, and on the other side, the definition. They may add pictures if they choose.

Show the graphic of the Colorado River (Visual 5). Have the pairs of students line up their vocabulary cards in a vertical line on their desktops to label the graphic as you start from the source of the river and point to areas along it. See the teacher’s guide to Visual 5.

To help students organize information about the river system, provide them with a graphic organizer in the shape of a river system (Handout 5). This organizer is used to represent the components of the physical system. Help students to recognize the pattern by showing them photos from space, maps showing river systems, etc. Find two graphics of Delaware’s surface water systems at:

- [Delaware Major Surface Water Systems](#)
- [Satellite Image of Delaware](#)

Have them label the graphic organizer “Highlands” across the top and “Sea” at the bottom. (Be certain that students understand the direction water will flow in the system, as a common misconception is that rivers get their water from the sea.) It may be helpful to have students add directional arrows on the diagram.

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²The lexile level of this reading, without pictures, is 1260. The previously viewed power point presentation, pictures, and accompanying activity will serve to lessen the reading load.
Review the character of the stream near its origins, mid-stream and near the mouth. Review the idea of erosion and deposition, which students first encountered in science studies in elementary school. They should remember that fast-moving water near the source causes more erosion. Rock and soil particles are carried downhill and may be deposited near the mouth of the stream or carried into the sea.

Next have the students label the organizer with the vocabulary terms at the appropriate place on the diagram. Alternately, provide them with printed labels to place on the diagram. This will provide an informal assessment of student understanding of the key vocabulary.

**Extending and Refining Knowledge About River Systems with Poetry and Photos**

Read the poem “Wilderness Rivers” by Elizabeth Coatsworth (Visual 6). Ask the students which part of the graphic organizer is probably described by the poem. How can they tell?

Next read "The River that Meanders" (Visual 7). Ask the students to contrast the look and behavior of this stream to the one described in Coatsworth’s poem. How and why might people use these rivers in different ways?

Present the students with photos showing streams at various stages and ask them to place or associate the photo with the part of the stream where it might occur (Visual 8).

Next add a set of photos showing activities of humans along the river (Visual 9). Ask students where along a stream or river these activities would most likely be found. Kayaking, whitewater rafting, and troutfishing are possible in upstream areas, while cargo ships and barge traffic are commonly found downstream.

Ask the students to match construction projects of humans (bridge, dam, port, wastewater treatment plant, hydroelectric dam) with the part of the stream system where they would be built.

Point out that many communities use rivers as a primary source for drinking water.³

- What would happen if river water upstream was diverted for industrial purposes or irrigation?
- How might pollution from upstream facilities affect the lives of people downstream?

**Application: Looking at River Systems Around the World**

Use an atlas map showing physical features, or online source, to allow students to examine several river systems in other parts of the world. For each system, have the students apply vocabulary learned to identify the source, the mouth, the delta (if present), tributaries, the main stream, etc.

Ask students to identify a large city located on a river.

³ Teaching Tip: At this point, the book “Letting Swift River Go”³, by Jane Yolen, provides a true story of a town that was flooded in order to provide drinking water to Boston. The stories of the original residents are available on several websites, including: [http://insideout.wbur.org/documentaries/hauntingquabbin/](http://insideout.wbur.org/documentaries/hauntingquabbin/)
• How might the people of the city make use of the river?
• How might they change the river by their activities and by construction projects?

Ancient civilizations often started in river valleys. Using an unlabeled map of the Nile (Visual 10), the Tigris-Euphrates (Visual 11), or the Yangtze (Visual 12), ask the students to speculate on what part of the river system people chose to settle. [mid-stream or near the mouth] Why? [agriculture depends on lots of water, deposition of soils produced by erosion upstream provides good cropland near the mouth of the river.] Have students use atlases to confirm their predictions.

Application: Constructing a River Puzzle
Distribute Handout 6, River Puzzle to students. (Note: There are two pages; the front and the back of the original activity page.) Have them cut out the parts, and then lay them out in an order that represents what they have learned about how man interacts with the physical system of a river, using the features at each point in the river system to the best advantage.

Teaching Tip: At this point in the unit, the book “A River Ran Wild”4, by Lynne Cherry, will provide students with an example of the impact of human development on a river system.

Check for Understanding
Use a map of the Colorado River System5 (or another suitable river system) to answer these questions:

• How have humans adapted their activities to take advantage of the Colorado River system?
• What are some ways humans have altered or changed the Colorado River?
• How have the actions of humans affected the Colorado River System?

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4 The lexile level of this book is 670, at the low end of the 6th grade range.
5 Maps of the Colorado River are available in classroom sets from the Delaware Geographic Alliance office.
Lesson Two: Humans Respond to Environmental Conditions

Essential Question

- How do physical processes affect human activity in this sub-region?
- How can we use knowledge of cycles and systems to predict environmental hazards?

Instructional Strategies

Concept and Vocabulary Development:
Concepts: Adaptation Strategies (extracting and gathering resources; choice of economic activity; design and construction of shelter, clothing, and transportation)
Vocabulary: natural resources, adaptation, alteration, perception, hazard, risk

Activating Prior Knowledge/Vocabulary and Concept Development: Adaptation
Ask the students to think about a time when they found themselves in a new group or in new surroundings. What are some strategies they used to adapt to the new situation? (Notice what types of clothing were needed, move out of the way of activity going on, find out where resources were located.) The ability to assess a new place and decide how to use the assets available is a survival strategy people have used since ancient times. But not every person or group of people reacts in the same way.

Extending and Refining: Adaptation Strategies in History
Just like today, people in ancient times made geographic choices regarding the environment. They could choose to stay in an area and adapt to the conditions there, or they could move to another area with resources and conditions they liked better. As civilizations developed, most groups of people chose to stay in one place; nomadic people moved more often. The cultures of both groups developed to give them skills in adapting to the environment- including possible environmental risks. Look at the chart (Visual 13) to gather information about settled people and compare their ways of life.

- Based on the chart, how do you think nomadic people would react if the river nearby flooded? How do you think settled people would react? What are your reasons?
- Which group would be most affected by a flood? Why?

Extending and Refining: Reactions to Natural Hazards
Background: When we assess the relative safety of a place, some natural hazards are easy to spot. A cliff is clearly a dangerous place! Other hazards may not be so apparent. Tectonic plates may shift and cause earthquakes. Earthquakes can touch off tsunamis thousands of miles from the original shock. When people are faced with natural hazards, there are basic strategies they use to deal with the situation:

- They can migrate or move away from the area to an area that seems safer.
- They can stay in place, but make plans for emergency evacuations.
- Use tools and technology to warn of danger and protect from harmful conditions.
- Accept some risk. Make plans for responding to people in trouble and repair or rebuilding of damaged property.
- Discount the risk as not very likely.
Perception plays a big part in decision-making. In general, people tend to underestimate the danger of natural hazards and overestimate their ability to cope. Use the DGA slideshow Natural Hazards to introduce and/or reinforce the concepts of natural hazards and how people tend to respond to them. Sometimes the amount of risk that exists is underestimated. It may surprise you to learn that floods account for more loss of life and property than other hazards in the US each year. People make decisions about how to act during an event and what to do afterwards based on their perceptions of risk.

Using the graphic organizer Rate the Risk (Handout 7), ask students to rate the level of danger they would expect if they experienced some natural hazards.

**Extending and Refining: Research**

Over time, people have developed some strategies to help them deal with natural hazards. Some strategies give early warning so people have more time to react. Others attempt to provide protection from dangers or shortages. Some strategies involve building projects to control the risk. Using available resources, students should complete the graphic organizer Dealing with Natural Hazards (Handout 8).

**Application in History:** During the Middle Ages, people living in Europe devised the “manorial system” as a way to manage risks from natural hazards. Decisions about what to plant in each field were made collectively. Individual farmers could reduce their risk by selecting plots of land in several sections of the manor. The simulation Medieval Manor allows students to practice this type of decision making and experience the intended and unintended consequences of environmental decisions.

**Check for Understanding**

Two places in Latin America were recently damaged by violent earthquakes. The quakes were about the same in level of severity, but Chile experienced far less loss of life and damage than Haiti.

Why might the earthquake in Chile have caused less damage? Explain your answer using what you have learned about the strategies people use to deal with natural hazards.

**Rubric**

2 – This response gives a valid reason with an accurate and relevant explanation.

1 – This response gives a valid reason with an inaccurate, irrelevant, or no explanation.
Lesson Three: Farmers Interact with the Environment

Essential Questions

- How do Earth’s physical processes shape the surface of earth?
- How do physical processes affect human activity?
- How can we use knowledge of cycles and systems to predict environmental hazards?
- How can geographic principles help us make decisions about projects and problems?

Instructional Strategies

Successful farmers put geographic knowledge to work for them to grow food. Good farmers know the local environment well. They try to choose the right crops for local conditions. Sometimes they use technology to alter the local environment and increase crop yields. The intended result of their efforts is more and better crops. But altering the environment can have unintended consequences. This lesson looks at three aspects of agriculture: crop choices, terrace farming, and irrigation. All three have historical context but are still in use today.

Activating Prior Knowledge: Using Climate Patterns to Make Crop Choices

Use a computer simulation for matching suitable crops to growing conditions. (“Command Economy” from the Teaching Geography CD by Phil Gersmehl, or Activity from ARGUS Activities and Readings in the Geography of the United States, will work well.) Each of these activities supplies students with mapped information about precipitation and temperatures, and length of growing season. Crop requirements are also provided. The student receives points based on the best match for each crop. Alternately, use the following exercise with student atlases. (See Handout 9 for a copy that students can fill out.) Possible answers are shown below:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Conditions Needed</th>
<th>Best State or States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>80 day growing season. Moderate moisture. Heat tolerant.</td>
<td>Oklahoma Iowa Kansas Nebraska</td>
</tr>
<tr>
<td>Apples</td>
<td>70 days frost free. Moderate to high moisture. Cool temperatures.</td>
<td>Washington New York</td>
</tr>
<tr>
<td>Wheat</td>
<td>80 day growing season. Drought tolerant.</td>
<td>Nebraska Kansas</td>
</tr>
<tr>
<td>Rice</td>
<td>90 day growing season. High moisture and temperature requirements. No frost.</td>
<td>Florida Texas California</td>
</tr>
<tr>
<td>Cherries</td>
<td>70 days frost free. High moisture requirement. Cool temperatures for highest yield.</td>
<td>Oregon Washington Maine</td>
</tr>
<tr>
<td>Oranges</td>
<td>100 day growing season. High temperature and moderate moisture requirement. No frost.</td>
<td>Florida Texas California</td>
</tr>
<tr>
<td></td>
<td>Details</td>
<td>Locations</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Early planting preferred. 80 day growing season. Moderate temperatures and moisture.</td>
<td>Pennsylvania, Ohio, Idaho</td>
</tr>
<tr>
<td>Sugar Beets</td>
<td>90 day growing season. Moderate temperatures and moisture.</td>
<td>Illinois, Indiana, Nebraska</td>
</tr>
</tbody>
</table>

**Concept Development:** Use the reading *Terrace Farming*[^6] (Handout 10) to further develop the idea of crop choice based on geographic conditions, and to introduce farmer adaptations.

**Check for Understanding**

Use the readings *Irrigation*[^7] (Handout 11) and *Aral Sea*[^8] (Handout 12) and the photos in the readings to answer the following questions:

- What are the intended consequences of irrigation systems?
- What unintended consequences resulted from diverting the rivers feeding the Aral Sea for irrigation?
- What might the white surface in the 2004 photo be? How did it get this way?
- What is the green/brown substance in the Aral Sea in the 2004 photo? What does this signify?

[^6]: The lexile level of this reading is 1040, slightly above the range for 6th grade.
[^7]: The lexile level of this reading is 980, within the range for 6th grade.
[^8]: The lexile level of this reading is 900, within the range for 6th grade.
Lesson Four: Searching for Energy

Background: The activities of humans often require energy, and the development of energy sources is important for future development. The reading *Energy in History* summarizes the history of energy use and introduces alternative energy sources. Students should apply concepts of cycles and systems, adaptation and alteration of the environment to evaluate the likely impact of alternative energy sources.

**Gathering and Organizing Data:** Begin by posting three charts with these headings:
- Things That Use Energy,
- Things That Generate Energy, and
- Things That Store Energy.

Give each student a set of post-it notes and ask them to write words or phrases that might go under each heading. Call rows or groups of students forward to place their notes on the charts. If another student has already posted an answer, they should post next to the first one, forming a bar graph. The resulting charts will summarize student knowledge about energy users, energy producers, and energy storage. Ask the students to examine the collected data and evaluate the information.

- Are there areas that might be incomplete or where more information might be needed? Tell the students that this lesson will focus on energy use and how it impacts the environment.

**Gathering and Refining Information:** Exhibit for students two cartograms: World Energy Users and Oil Producing Nations (Visual 14).

Ask the students to speculate on the reason for the distortion patterns on the two diagrams. After they have deduced that relative size of countries has been adjusted to show the statistical differences in consumption and production, ask the students to discuss problems that might arise in the future based on the information presented.

Next distribute the student reading *Energy in History* (Handout 13) and *Alternative Energy Sources* (Handout 14). As the students read, they should develop a list of energy uses and energy sources.

- How do these compare with the lists developed at the beginning of the lesson? What are the advantages and disadvantages of each energy source used in the past?

**Application:** Have students research one of the following proposed alternative energy projects. What might be the advantages and disadvantages for each project? Are there unintended consequences to consider?

- Windfarm off the shore of Delaware and New Jersey
- Large solar array in southern Delmarva

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8 The lexile level of this reading is 970, within the range for 6th grade.
9 The lexile level of this reading is 1020, slightly above the 6th grade range. Paired reading, jigsawing, and/or using the websites noted will help with the reading load.
- Nuclear electric generating facility in northern California
- Ethanol plant in North Carolina

**Check for Understanding** (Visual 15)

This map shows where the power of the sun available in December. The lightest areas receive the most solar radiation, while the darkest areas receive the least. Use this map to answer these questions:

1. Which region of the country would be most likely to benefit from solar energy for heating in winter? Which area would benefit least? Why?
2. Which region would probably benefit from solar energy for cooling in summer? Explain why you think this is so.
3. Citizens in Texas are debating the benefits of solar energy. Why might Texans have different opinions on the usefulness of solar power?

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1 Map from: http://www.fs.fed.us/t-d/pubs/htmlpubs/htm99712805/index.htm
Visual 1               Graphic Organizer for Cycles
What is the Water Cycle?
Earth has a limited amount of water. So, that water keeps going around. We call it the water cycle. The water cycle begins with evaporation. Evaporation is when the sun heats up water in rivers, lakes or the ocean. Then turns it into water vapor or steam. The water vapor or steam leaves the body of water and goes into the air. Transpiration is the process by which plants lose water out of their leaves. Condensation is when water vapor in the air gets cold and changes back into water to form clouds. Think of it this way, when you open a cold soda on a hot summer day, your soda will start to sweat as water droplets form on the outside of the can. Precipitation occurs when so much water has condensed that the air can't hold it anymore. This is how we get rain or snow. Collection happens when the precipitation falls and is collected back in the oceans, lakes and rivers. When it falls to the ground, it will soak into the earth and become ground water. This is the water cycle and it just keeps repeating.

From: http://www.weatherwizkids.com/weather-climate.htm
**Global Circulation Patterns:** The heat of the sun is greatest at the Equator. There the air is heated and rises, carrying with it water vapor. As the air rises, it is cooled, causing frequent heavy rainfall in the tropics. The drier, cooler air falls to the surface near 20 degrees north and south. In the mid-latitudes, similar bands of air bring rains to temperate regions.
Photos of earth taken from space clearly show the Arabian Peninsula and North Africa. But they seldom allow a good view of the Amazon Basin - it is usually covered with clouds. Use the concept of cycles to explain why photographers have a better view of the deserts than the rainforests.
The Negro Speaks of Rivers
by Langston Hughes

I've known rivers:
I've known rivers ancient as the world and older than the flow of human blood in human veins.
My soul has grown deep like the rivers.
I bathed in the Euphrates when dawns were young.
I built my hut near the Congo and it lulled me to sleep.
I looked upon the Nile and raised the pyramids above it.
I heard the singing of the Mississippi when Abe Lincoln went down to New Orleans, and I've seen its muddy bosom turn all golden in the sunset.
I've known rivers:
Ancient, dusky rivers.
My soul has grown deep like the rivers.
Introduction to Rivers

Rivers are flowing bodies of waters. There are rivers on every continent (except Antarctica). Rivers are an important part of the Earth's water cycle and the sculpting of the Earth's topography as they carry huge quantities of water from the land to the sea.

The Course of a River
Rivers generally start at a source, like a snow melt (such as a glacier) or a natural spring. Most rivers flow into a larger body of water, like an ocean, sea, or large lake. The early course of a river is often in steep, mountain areas, with rapidly-flowing cold water. As a river continues along its course (which is always changing), the surrounding terrain flattens out and the river widens. Rivers often meander (follow a winding path) along their middle course. Tributaries (smaller rivers or streams) and runoff flow into the river, increasing the river's volume (the amount of water it has). Rivers often have increased volume and water speed in the spring, as snow at the river's source melts.

Most rivers end when they flow into a large body of water. The end of the river is called the mouth. At the mouth, there is usually a river delta, a large, silty area where the river splits into many different slow-flowing channels that have muddy banks. New land is created at deltas. Deltas are often triangular-shaped, hence the name (the Greek letter 'delta' is shaped like a triangle).

The Water in a River
At the source of a river, the water is relatively pure. As the water flows downstream, it picks up silt and minerals (including mineral salts) from the soil and rock in the river bed. Many other chemicals enter river water as it flows downstream, including animal waste, human sewage, agricultural (farm) runoff, urban runoff, and mining/factory effluent.

Erosion
The course of a river changes over time, as erosion caused by the flowing water and
sediment sculpts the landscape around the river. Rivers erode land and carry it downstream towards the sea or lake it flows into. This kind of erosion can even form canyons, like the Grand Canyon (eroded by the Colorado River), waterfalls, like Victoria Falls (formed by the Zambezi River), oxbow lakes, and other formations. As eroded soil is carried downstream, it is deposited at areas where the river slows, especially where the river meets the body of water it flows into (often the ocean or a lake), forming a fertile river delta that has muddy swamps and/or sandbars.

**Estuaries**
An estuary is the area where a river meets the sea or ocean, where fresh water from the river meets salt water from the sea. Estuaries are often called bays, sounds, or harbors (like Tampa Bay, Puget Sound, or Boston Harbor). Salt marshes are low, grassy, coastal areas surrounding an estuary; the tides often overflow the marsh.

Since salt water is heavier (denser) than fresh water, when the two meet, the heavier salt water sinks and the lighter fresh water rises. The rate of change in salinity (the amount of salt in the water) with depth is called the salinity gradient.

Estuaries are transitional areas between rivers and seas, and are home to many organisms that have adapted to life in brackish water (water that is saltier than river water but less salty than sea water).

From:  http://www.enchantedlearning.com/geography/rivers/
1. Source
2. Course or Meander (run your finger along a short part of the river)
3. Erosion (ask what process is happening at this point)
4. Tributary
5. Runoff (ask what is contributing to the volume of the river at this point)
6. Oxbow
7. Course or Meander
8. Sediment (ask what the river is carrying at this point)
9. Estuary and Brackish (ask students to place two vocabulary cards to describe the location and the water at this point)
10. Delta and Mouth (ask students to place two vocabulary cards for this point)
11. Deposition (ask students what process is happening at this point)
There are rivers
That I know,
Born of ice
And melting snow,
White with rapids,
Swift to roar,
With no farms
Along their shore,
With no cattle
Come to drink
At a staid
And welcoming brink,
With no millwheel
Ever turning
In that cold,
Relentless churning.

Only deer
And bear and mink
At those shallows
Come to drink;
Only paddles
Swift and light
Flick that current
In their flight.
I have felt
My heart beat high,
Watching
With exultant eye
Those pure rivers
Which have known
No will, no purpose
But their own.

-Elizabeth Coatsworth
The River That Meanders

Oh, the river that meanders has an aimless kind of flow...
in the sense that such a river seems to not know where to go.
Is it right or left, or left or right? Who cares? And I don’t know.
Yet it’s that lack of clear direction that the river seems to show!

Oh the river that meanders suggests a valley with low slope,
as it twists and turns and cuts a course that offers little hope
of telling why it went that way... an aquatic king of grope.

For the river, twisty river, looks a bit like some blue rope.

Oh the river that meanders has a kind of strange appeal...
with its artistic looking patterns... but believe me they are real.
Now you may think such rivers with the land have cut a deal,
for they take from one another, but yet they do not steal.

Oh the river that meanders lets you know where it has been
with its separated oxbows and its bank-eroding spin.
Yet that slowly moving river hardly ever makes a din,
and the river is a lifeline for feather, fur, and fin.
Oh you river, twisty river, tell me what will be your fate?
Will you twist yourself apart? Have you ever had a spate?
Those sandbanks on your inside bank don’t care if you are late.
So flow and let flow river, your meanders are just great!

Kenton Stewart

About the poem, “The River That Meanders”

Kenton M. Steward composed this poem in Russia on 6 July 1999, while flying over Siberia (from Krasnoyarsk to Tunguska, Norilsk and Khatanga). In a letter to us he explained:

"A few days earlier, while flying in a jet from Moscow to Krasnoyarsk, I noticed many interesting meandering streams from the airplane window. Indeed, although I had seen such streams before in North America, it was the undeveloped nature of the Russian terrain that seemed to enhance the beauty of the meandering streams.

After seeing many more meandering streams on 6 July and thinking about the biota associated with such streams, determining the direction of flow from the position of the sandbars, wondering about the interesting geomorphology and the give and take of such streams with land in more gently-sloping terrain, I was inspired to write some poetry aboard the plane that day. Incidentally, the term spate, for streams, is used to characterize a dramatic and large rush of water that produces a major disturbance to the stream."

The author, Dr. Kenton M. Stewart is a professor in the Department of Biological Sciences, State University of New York at Buffalo.

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Photo © Copyright 2005 Ecology Online Sweden. All rights reserved.
Visual 9
Visual 10  The Nile River

Visual 11  The Tigris- Euphrates River

http://matthew2262.wordpress.com/2011/05/02/where-is-the-garden-of-eden/
Visual 12 The Yangtze River

http://www.visitourchina.com/yangtze/more_about_Yangtze_River.html
A River Puzzle!

Every river has a beginning and an end, but a lot of different things can go on in between! The things we do in a watershed—the area drained by a river—can affect the health of rivers.

**Your challenge:** Make a healthy river that everyone can live with for a long, long time! (See other side for instructions.)

**Caution:** Before cutting puzzle pieces, copy one or both sides of the handout.

Want to learn more about rivers? Want to keep our rivers safe and clean? Go to www.nationalgeographic.com/geographyaction
Instructions:
- Copy one or both sides of this handout. Then cut out the puzzle pieces or ask a grownup for help.
- Put the SOURCE piece (the beginning of a river) near the top of a big sheet of construction paper and the MOUTH piece (a river's end) near the bottom.
- Sort the other pieces into categories: nature, urban, agriculture, industry, recreation, power.

How to Plan Your River: Consider how each activity or use along a river could affect people, animals, and plants downstream (in the direction of, or closer to, the mouth). Ask yourself:
- What are some ways that people use rivers?
- What could happen to a river when a factory is nearby?
- What happens when a town is close to a river?
- Where along a river would water be clean for swimming or fishing?
- Could building a dam change a watershed?
- Does farming affect the water in a river?
Move the puzzle pieces around until you're satisfied, then tape your river to the construction paper.

Make a Special River: Be creative! Use puzzle pieces to make a model of a river in your state. Collect pictures from magazines and make your own puzzle pieces.

Handout 6  Constructing a River Puzzle  Part 2
### Visual 13

<table>
<thead>
<tr>
<th><strong>Settled or Civilized People</strong></th>
<th><strong>Nomadic People</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Build permanent houses, public buildings, streets, etc</td>
<td>Use tents or temporary dwellings.</td>
</tr>
<tr>
<td>Have specialized jobs involving skills and use of resources; Tools and infrastructure develop to support economic activity.</td>
<td>Herding, hunting and gathering food, water, and resources from many sources. Portable tools and livestock.</td>
</tr>
<tr>
<td>Travel to gather resources and return to fixed settlement. Trade with other settlements.</td>
<td>Travel longer distances to find ideal conditions. Trade with settled people and other nomads.</td>
</tr>
<tr>
<td>Individuals or rulers own pieces of land.</td>
<td>Group control of a “territory”. People move freely within this area.</td>
</tr>
</tbody>
</table>
You may think it is unlikely that you will ever experience an earthquake or be in the path of a volcanic eruption. But what if you did? Would you survive? How dangerous do you think these natural disasters would be if you happened to experience them?

Think about each type of disaster and use the scale provided to rate your perception of the risk involved in each one.

<table>
<thead>
<tr>
<th>Natural Hazard</th>
<th>Least dangerous</th>
<th>2</th>
<th>3</th>
<th>Most dangerous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tornado</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hurricane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erosion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volcanic Eruption</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blizzard</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Handout 8  Dealing with The Environment

Over time, people have developed some strategies to help them deal with natural hazards. Some strategies give early warning so people have more time to react. Others provide protection from dangers or shortages. Some strategies involve building projects to control the risk. For each of the natural hazards below, write at least two strategies people use to deal with natural hazards.

<table>
<thead>
<tr>
<th>Natural Hazard</th>
<th>Strategies people use to adapt to or alter the environment to manage risk from natural hazards.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake</td>
<td></td>
</tr>
<tr>
<td>Tornado</td>
<td></td>
</tr>
<tr>
<td>Hurricane</td>
<td></td>
</tr>
<tr>
<td>Drought</td>
<td></td>
</tr>
<tr>
<td>Coastal Erosion</td>
<td></td>
</tr>
<tr>
<td>Volcanic Eruption</td>
<td></td>
</tr>
<tr>
<td>Flood</td>
<td></td>
</tr>
<tr>
<td>Blizzard</td>
<td></td>
</tr>
</tbody>
</table>
## Handout 9  Matching Crops to Growing Conditions

<table>
<thead>
<tr>
<th>Crop</th>
<th>Conditions Needed</th>
<th>Best State or States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>80 day growing season. Moderate moisture. Heat tolerant.</td>
<td></td>
</tr>
<tr>
<td>Apples</td>
<td>70 days frost free. Moderate to high moisture. Cool temperatures.</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>80 day growing season. Drought tolerant.</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>90 day growing season. High moisture and temperature requirements. No frost.</td>
<td></td>
</tr>
<tr>
<td>Cherries</td>
<td>70 days frost free. High moisture requirement. Cool temperatures for highest yield.</td>
<td></td>
</tr>
<tr>
<td>Oranges</td>
<td>100 day growing season. High temperature and moderate moisture requirement. No frost.</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>Early planting preferred. 80 day growing season. Moderate temperatures and moisture.</td>
<td></td>
</tr>
<tr>
<td>Sugar Beets</td>
<td>90 day growing season. Moderate temperatures and moisture.</td>
<td></td>
</tr>
</tbody>
</table>
Handout 10   Terrace Farming

TERRACE FARMING
Long ago, farmers developed a method called **terrace farming** to grow crops on steep hillsides where it would be impossible to farm in the usual way. A series of step-like benches is constructed up the side of a hill. Walls made of stone or sod support each bench. Using this method, more land can be used to grow crops. But the growing space is in a series of narrow strips, not in one large field. When irrigation is added, farmers can control the amount of water each step receives. They create a series of **microclimates**, with each step having slightly different temperatures and moisture. Skillful farmers can match each type of potato or other plant to a step with the amount of water and the temperatures it needs to grow. Another advantage is that each level slows the flow of water runoff, so there is less erosion from rain and snow. But building and maintaining the terraces and irrigation systems requires a lot of labor. Use of tractors or other traditional farm equipment is not practical in the narrow strips.

The Inca who lived in the highlands of South America used terrace farming. Ancient Inca cities were located high in the Andes Mountains. To sustain a large population, they had to develop a way to grow enough food. In the harsh climate of the Andes, agriculture is difficult. There are cold temperatures at night, tropical temperatures during the day, and a lack of dependable rainfall. Terrace farming and irrigation helped Inca farmers solve these problems. To provide the labor to build this system, the government required citizens to work on the projects at different times in their life.

1. Why did Inca farmers use terrace farming?
2. How did skillful crop choices make terrace farming work better?
3. Why did the government require citizens to help build the terrace farms?
IRRIGATION

Irrigation is one of the world’s oldest farming methods. For thousands of years people have used technology to bring water to growing crops. Irrigation may be used only during periods of drought in areas that usually get enough rain. In regions that are dry throughout the year, irrigation is essential. Civilizations in Japan, Egypt, Italy, and China have been practicing irrigation methods for centuries with success.

There are many types of irrigation in use around the world. Some systems use man-made canals to divert water from rivers. Giant sprinkler systems linked to deep wells use pipes to carry and spread water over fields. Irrigation allows entire communities of people to support themselves better. Beyond growing food for local people, certain kinds of crops can be very profitable. Examples are cotton grown in Egypt and fruits and vegetables grown in southern California.

Above, left: Spray irrigation in California citrus groves. Right: From the air, green circles in the orange desert show where irrigation is in use. Below: Rice plants grow best in very wet fields. When rains do not flood the fields, farmers use irrigation.

Water words:
When rainfall is far below the level we expect based on the usual water cycle, we say there is a drought. What is the difference between a hydrological drought and an agricultural drought?
Application: Unintended Consequences

The Aral Sea is not really a sea at all—It is a large lake in central Asia. It straddles the border between Kazakhstan and Uzbekistan. The sea is fed by two rivers. During the 1960’s, people in the former Soviet Union diverted river water to irrigate crops. When it’s done right, irrigation can be a benefit to the people of a region. But mistakes in the design of equipment and the way it is used can cause big problems. Use the following readings and satellite images to gain a better understanding of the intended and unintended consequences of irrigation.

Can the Aral Sea Recover?

The villagers of Tastapuk, Kazakhstan depend on the Aral Sea. Their traditional way of life combines herding camels with fishing. Using large nets, groups of men can collect enough fish to feed their families and also to sell at the market. But the Aral Sea has been disappearing! Each year since the 1960’s the size and depth of the large lake have declined. Why?

In the 1960’s, Soviet government planners in Moscow decided that the Soviet Union needed to grow more cotton. The climate of the region is very dry. River water was already used for irrigation of cotton fields. But the planners wanted to almost triple production. Dams were built to send more river water to the new fields. Cotton production went up, but the increase in cotton production had some unintended consequences.

The rivers no longer fed the Aral Sea, so it began to dry up. It lost half its surface area and three-quarters of its volume. The water left behind 13,000 square miles of wasteland. There were dust storms, dead fish, rusty and useless fishing boats. By 2003 there were three much smaller lakes left. Many people lost hope and left the region to find a better place to make a living. The photos below show how the Aral Sea changed between 1973 and 2004.

[Images of satellite images showing the Aral Sea]

http://en.wikipedia.org/wiki/Aral_Sea
Some local people decided to try to correct the mistake. They built a small dam to send some river water back into the lake. Other people began to repair leaks in the irrigation system. Eventually the government built a larger, more permanent dam and the northern part of the Aral Sea began to expand again. Scientists from other parts of the world helped clean up pollution, restored fish and wildlife, and provided health care and other kinds of aid to the people of the region. Slowly, the region is beginning to recover. But no one thinks the Aral Sea will ever be as large or healthy as it once was.

**Check for Understanding**

Use the readings and photos to answer the following questions:

1. What are the **intended consequences** of irrigation systems?
2. What **unintended consequences** resulted from diverting the rivers feeding the Aral Sea for irrigation?
3. What might the white surface in the 2004 photo be? How did it get this way?
4. What is the green/brown substance in the Aral Sea in the 2004 photo? What does this signify?
The sun is the best and strongest source of energy we have. Through all of human history the sun has provided light and heat for people all over the world. When people discovered how to make fire, they had a way to keep warm during long cold nights- and they had light, too! In ancient times people began to use animal power to help do the heavy work. Before long, ancient inventors found ways to use the wind to move big ships and to pump water from rivers. Later people began to use the power of river water to turn millwheels. Water powered mills were used to saw lumber, grind grain, and even turn machinery.

Each of these power sources from the environment had advantages and disadvantages. The sun gives great light during the day, but at night or on cloudy days, it leaves us in the dark. Animals must be fed and watered all the time, whether they have work to do or not. Water power works great in normal times, but when rainfall fails or there is a flood, the mill no longer gets the job done. And sailors in ancient times sometimes found themselves “becalmed” in a big ocean waiting for the winds to blow again.

The industrial revolution made energy needs more important to people in Europe and the United States. Factories full of machinery manufactured goods. The machines needed large amounts of energy. Burning wood was not sufficient. People began to turn to fossil fuels- coal, oil and natural gas. Burning fossil fuels has many benefits. Most of the energy we use today depends on burning coal or oil. Cars and trucks run on gasoline or diesel fuel. Most of the electricity in the United States is produced in plants that burn coal or oil to heat water. The water becomes steam, and the steam turns huge turbines to make electricity. One unintended consequence of burning fossil fuels has been an increase in air pollution. Mining for coal and drilling for oil are dangerous occupations, and the processes have risks for the environment. And because the United States does not produce enough oil and coal to meet all our needs, we must buy it from other oil producing countries.
Today many people are experimenting with alternative energy technology to meet energy needs. Alternative energy sources use the natural environment to make energy. Solar panels capture the power of the sun. Hydroelectric dams make electricity from water power. Windmills generate electricity by harnessing the power of the wind. Ethanol is a fuel that cars and trucks can burn. It is usually made from corn. And nuclear generating plants can make a huge amount of energy from a tiny amount of radioactive fuel. To do the best job, each alternative energy facility must be in the right location. Alternative energy facilities can have disadvantages. They can be expensive, and building them changes the land around them. But many people think that our country should try alternative energy so we will use less coal and oil.

What is alternative energy, anyway!? And why do we need them and when did alternative energy first appear in our history? We have a vague idea that these types of enhanced natural resources can save our planet, but we also have heard that alternative energy may have some disadvantages that may not be as talked about as they should be. The fact is alternative energy encompasses a myriad of sub-topics that include wind, water, geothermal, nuclear, and more.

This very important and comprehensive page is sent to you from the website that loves most things ‘green’ (including M7Ms) – benefits-of-recycling.com. There is a ton of interesting and valuable information of this site that you will want to check out, but, for now it’s all about alternative energy for kids!

*Alternative Energy For Kids / Why do we need energy?*

Many things around us require energy in order to function. TV set and stereo, microwave oven and electric kettle, computer and refrigerator – all of them need energy to work. Besides, energy is also necessary to make a car run, to keep the house warm or to heat water for showers.

Most of energy, used nowadays, is called electric energy. It is supplied to our houses constantly through wires; but in order to have energy it should first be produced.

*Alternative Energy For Kids / How is energy produced?*

Energy is produced or generated from natural resources, which are usually called energy sources. The examples of energy sources are gas, oil, water, sun and wind. However, not all energy sources are created equal. Some of them can be dangerous for the environment we live in.

For example, when oil or gas is burnt in order to produce energy or to heat the houses, a lot of harmful things are released into the air, making it bad for breathing. Besides, we have already used so much oil and gas, which was stored on our planet that only a small amount of those resources remained at our disposal.

That is why people decided to find other sources of energy, which would not harm the air and the amount of which would never end. Such types of energy sources are called alternative. Examples of alternative energy sources are solar energy, wind energy, geothermal energy and biofuel energy. All of these sources give us “clean” energy, because it is safe for people and for the environment we live in.

*Alternative Energy For Kids / What are the different types?*

**Solar Energy**

Solar Energy comes from the sun. When the sun shines, it can warm water, heat the house, and it can even produce electricity to run different electric house appliances. In order to use the energy of sun, people put special solar panels on top of their houses’ roofs.
Those solar panels can produce electricity or heat water. The amazing thing about solar energy is that it is free of charge, and it is renewable (this word means that energy from the sun never ends). People use solar energy in those places, where there is a lot of sunshine all year round. In such sunny places as California people even built large power plants, which gather sunlight and transform it into electricity for people.

**Wind Energy**

People have used the power of wind for thousands of years. Nowadays wind energy is used to produce electricity. Special wind machines are built in the areas, where strong wind blows (usually it is at the coastline).

When many wind machines are built near one another, it is called wind farm. A wind machine consists of a tower with the blades and a generator on top of it. When the wind blows, it rotates the blades. When blades spin around, electricity is produced in the device, called generator.

In order to catch a lot of wind, the towers are built very high. As with solar energy, wind energy is renewable, because wind will always blow on the Earth.

**Geothermal Energy**

Our planet Earth is very hot and contains a lot of hot water and steam deep down beneath its surface. Volcanoes are best examples of how hot our planet is in its center. People have already learned how to use geothermal energy (“geo” means Earth and “thermal” mean high temperature).

In places, where hot water is close to the Earth surface, people drill special wells and use that hot water for warming their houses. After that water is sent back into the Earth, so that no water is wasted in vain. Geothermal energy is also a free and renewable source of energy.

**Biofuel**

Biofuel is the modern alternative source of energy, which was invented to substitute gasoline, used in all the cars, trucks, and motorcycles around the globe. Gasoline is bad for the air because when it is burned in the car engine, a lot of harmful substances are released into the air.

Biofuel energy is not that harmful and can be produced from certain plants, grown specifically for that purpose. The fuel, which is produced from plants, is called ethanol and it is suitable for most of the vehicles on the roads. Some biofuel can even be produced from vegetable oil, after it has been used in the kitchen for preparing meals, like potato chips. Such fuel is called biodiesel.

Solar and wind energy, geothermal energy and biofuel are the major examples of the alternative energy sources. They are renewable and safe for humans and for the planet Earth, so in the future people will obviously use only such kinds of energy.

*Alternative Energy For Kids / Sources*

http://www.eia.doe.gov/kids/energyfacts/
http://www.eere.energy.gov/kids/renergy.html
This cartogram shows which countries use the most energy.

1. According to this diagram, which country or countries use the most energy?
2. Which countries use the least energy?
3. Why is the size of Alaska so distorted by this cartogram?

The diagram below shows who has the most oil. What countries appear to have the most oil to sell?

Who has the oil?
This map shows where the power of the sun available in December. The lightest areas receive the most solar radiation, while the darkest areas receive the least. Use this map to answer these questions:

- Which region of the country would be most likely to benefit from solar energy for heating in winter? Which area would benefit least? Why?
- Which region would probably benefit from solar energy for cooling in summer? Explain why you think this is so.
- Citizens in Texas are debating the benefits of solar energy. Why might Texans have different opinions on the usefulness of solar power?