Norfolk Public Schools
Science Learning in Place Plan: Environmental science Lessons

Week 7: April 27 – May 1, 2020 (Mineral Resources)

Monday	Tuesday	Wednesday	Thursday	Friday
Mineral Resources Active Reading: • Read **"Mineral and Mineral Resources"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Mineral Resources** Active Reading: • Review the passage **"Mineral and Mineral Resources"** • Complete the following sections of the worksheet: - *Identifying Main Ideas (1-3)* - *Vocabulary Development (4-8)*	**Mineral Resources** Active Reading: • Review the passage **"Mineral and Mineral Resources"** • Read and answer questions - *Vocabulary Development (9-10)* - *Recognizing Cause and Effect (11-13)*	**Mineral Resources** Compare and Contrast: • Read about surface and subsurface mining techniques. • Write a paragraph to describe some advantages and disadvantages of each technique.	**Mineral Resources** Map Skills: • Review the map of South Africa to respond to questions 1-5 of the "Map Skills" worksheet.

Week 8: May 4 – 8, 2020 (Nonrenewable Energy)

Monday	Tuesday	Wednesday	Thursday	Friday
Nonrenewable Energy Active Reading: • Read **"Energy Resources and Fossil Fuels"** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Nonrenewable Energy** Active Reading: • Read **"Energy Resources and Fossil Fuels"** • Complete the following sections of the worksheet: - *Identifying Main ideas (1-4)* - *Recognizing Similarities and Differences* (5)	**Nonrenewable Energy** Active Reading: • Read **"Energy Resources and Fossil Fuels"** • Complete the following sections of the worksheet: - *Recognizing Cause and Effect* (6-9)	**Nonrenewable Energy** Debating the Facts: • Read the **"Pipelines and Oil Sands"** article. • Complete the lesson review questions 1-4.	**Nonrenewable Energy** Map Skills: • Review the map that displays the location of coal deposits in New Zealand. • Respond to questions 1-4 of the "Map Skills" worksheet.

Week 9: May 11 – 15, 2020 (Renewable Resources)				
Monday	Tuesday	Wednesday	Thursday	Friday
Renewable Resources Classify: • Read **"What Are the Practical Sources of Energy"** article. • Construct a table to identify and sort all renewable and nonrenewable energy sources.	**Renewable Resources** Compare and Contrast: • Read **"What Are the Practical Sources of Energy"** article. • List the forms of **nonrenewable** energy identified during Monday's assignment. • Compare *disadvantages and advantages* of each identified **nonrenewable** energy source.	**Renewable Resources** Compare and Contrast: • Read **"What Are the Practical Sources of Energy"** article. • List the forms of **renewable** energy identified during Monday's assignment. • Compare *disadvantages and advantages* of each identified **renewable** energy source.	**Renewable Energy** Map Skills: • Review the map of water use in the United State, to generate electricity. • Use the map to respond to questions 1-4.	**Renewable Energy** Maps in Action: • Review the map **"Wind Power in the United States"** • Use the map to respond to questions 1-6.

CRITICAL READING *strategies*

Marking the Text

\# → Number the paragraphs

→ Circle key terms

→ Underline essential info

(...based on the reading purpose)

→ Box new vocab words

(...and define them in the margins)

Additional Ways to Mark the Text

→ [Bracket] information

(when underlining has been used for another purpose)

→ Write labels in the margins

(double underline labels to stand out from other marks)

Name_____ Class _____ Date _____

Skills Worksheet

Active Reading

Section 1: Minerals and Mineral Resources

Read the passage below and answer the questions that follow.

Certain metals are of major economic and industrial importance. Some metals can be pounded or pressed into various shapes or stretched very thinly without breaking. Other metals are good conductors of heat and electricity, or are prized for their durability and resistance to corrosion. Often, two or more metals are combined to form *alloys*. Alloys are important because they often combine the most desirable properties of the metals used to make them. Many new technologies depend on the mining of metallic minerals.

Nonmetals are among the most widely used minerals in the world. For example, gypsum has many applications in the construction industry. It is used to make Sheetrock™, or wallboard, for homes and commercial buildings. It is also a major component of concrete, which is used to build roads, buildings, and other structures. Industrial sand and gravel have uses that range from glassmaking to the manufacture of computer chips. Some nonmetallic minerals, called *gemstones,* are prized purely for their beauty, rarity, or durability. Important gemstones include diamond, ruby, sapphire, emerald, aquamarine, topaz, and tourmaline.

IDENTIFYING MAIN IDEAS

One reading skill is the ability to identify the main idea of a passage. The main idea is the main focus or key idea. Frequently, a main idea is accompanied by supporting information that offers detailed facts about the main idea.

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ 1. The value of a mineral is determined by its
- a. properties.
- b. mining technique.
- c. gemstones.
- d. alloys.

_____ 2. What types of minerals are among the most widely used in the world?
- a. metals
- b. alloys
- c. gemstones
- d. nonmetals

_____ 3. Which of the following is an example of a gemstone?
- a. gypsum
- b. sapphire
- c. gravel
- d. glass

VOCABULARY DEVELOPMENT

In the space provided, write the letter of the description that best matches the term or phrase.

_____ 4. gypsum

_____ 5. gemstones

_____ 6. industrial sand

_____ 7. alloy

_____ 8. certain metals

- a. the combination of two or more metals
- b. a major component of concrete
- c. conductors of heat and electricity
- d. topaz and tourmaline
- e. a substance used in manufacturing computer chips

Read each question and write the answer in the space provided.

9. The verb *corrode* means "wear away gradually, usually by a chemical reaction." A metal that is prized for its "resistance to corrosion" has what property?

_____

10. *Aqua* means "water" or "a light blue color." *Marine* refers to the sea. Use this information to determine what the gemstone *aquamarine* might look like.

_____

RECOGNIZING CAUSE AND EFFECT

One reading skill is the ability to recognize cause and effect.

In the space provided, write the letter of the phrase that best answers the question.

_____ 11. Why do people value gemstones?
- a. for their use in industry
- b. for their resistance to corrosion
- c. for their beauty and rarity
- d. for their benefit to technology

Read each question and write the answer in the space provided.

12. Why are alloys especially important?

_____

_____

_____

13. What are some properties of metals that give them economic and industrial importance?

_____

_____

_____

Subsurface Mining

Ore deposits that are usually found 50 m or more beneath Earth's surface are mined by using **subsurface mining** methods. A common method of subsurface mining that is used to extract coal and salt is known as *room-and-pillar mining*. In coal mines, a network of entries, called rooms, are cut into a seam, a horizontal layer of coal. Between the rooms, pillars of coal are left standing to support the roof. When the mining of rooms is completed, the pillars are then removed, beginning with pillars at the farthest point in the mine. A large room in an inactive Polish salt mine, shown in **Figure 2.2**, now welcomes tourists.

Longwall Mining

A more efficient way to remove coal from a subsurface seam is to use a method called *longwall mining*. In longwall mining, a machine called a *shearer* moves back and forth across the face of a coal seam. A shearer that is used in longwall mining is shown in **Figure 2.3**. The wall of the seam, called the *longwall*, may be more than 300 m long. As coal is sheared from the face, it falls onto a conveyor. The conveyor transports the coal out of the mine. A row of hydraulic roof supports protects the miners and the equipment. As the shearer advances forward through the coal seam, the mine roof behind the hydraulic supports collapses.

Solution Mining

For underground deposits of soluble mineral ores such as potash, salt, and sulfur, solution mining is an economical mining method. In solution mining, hot water is injected into the ore and dissolves it. Compressed air is then pumped into the dissolved ore, and air bubbles lift it to the surface.

Surface Mining

Surface mining methods are used when ore deposits are located close to Earth's surface. *Open-pit mining* is a method that is often used to mine large quantities of near-surface ore. Coal and metals such as copper are mined using the open-pit method.

In an open-pit mine, the ore is mined downward, layer by layer. First, explosives are used, if needed, to break up the ore. Then, the ore is loaded into haul trucks. The haul trucks transport the ore from the mine. Some ores, such as gold ore, are taken to heap leaching pads, such as the pads shown in **Figure 2.4**. There, the gold is extracted from the ore using chemicals.

Surface Coal Mining

The first step in surface coal mining is to remove and set aside the soil that covers the area to be mined. Next, the the rock that lies over the coal seams (*overburden*) is removed by heavy equipment in cuts that may be up to 50 m wide and over a kilometer long. The overburden is piled alongside the cut. Loaders enter the pit and remove the exposed coal seam. Once the coal is removed, the pit is refilled with the overburden and contoured. The soil that has been set aside is now laid on top of the overburden.

The scale of surface mining can be so large that restoration of original conditions is impossible. In the Appalachian Mountains of the United States, *mountaintop removal mining* displaces up to 400 feet of summits or ridges of mountains to access coal seams. Overburden is often placed in adjacent valleys over rivers and streams.

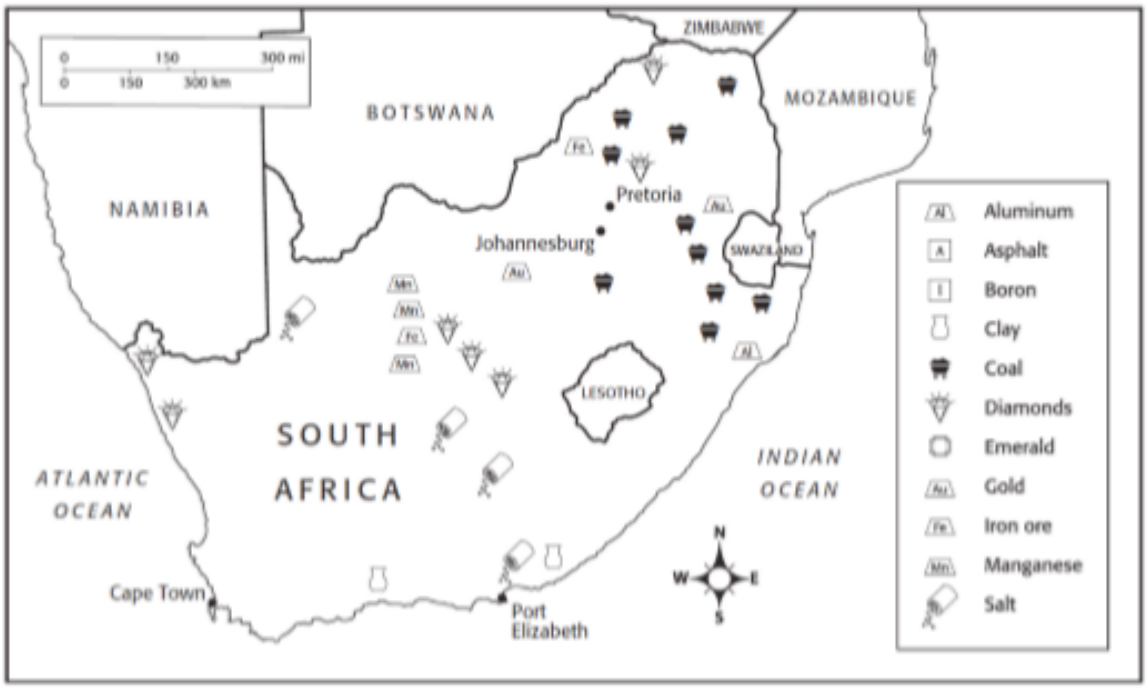
Quarrying

Building stones such as granite and marble are mined in quarries like the one shown in **Figure 2.5**. Sand, gravel, and crushed rock, known as *aggregates*, are the main products of quarrying. Quarries also produce clay, gypsum, and talc.

Name _____ Class _____ Date _____

Skills Worksheet **SOUTH AFRICA'S MINERALS**

Map Skills



South Africa is the world's leading producer of diamonds and coal. However, many other minerals, such as emeralds, iron ore, and aluminum, are also mined there.

Use the map above to answer the questions below.

1. **Using a Key** Which mineral is mined in the most locations?

_____

2. **Finding Locations** Near which two cities are most mineral deposits located?

_____

3. **Inferring Relationships** Are there more mines located near the water or inland?

_____

4. **Analyzing Data** Which minerals found in South Africa are metals? Which are precious stones?

_____

_____

5. **Analyzing Data** What mineral is found throughout South Africa?

_____

Name _____ Class_____ Date _____

Skills Worksheet

Active Reading

Section 1: Energy Resources and Fossil Fuels

Read the passage below and answer the questions that follow.

When petroleum fuels are burned, they release pollutants. Internal combustion engines in vehicles that burn gasoline and diesel pollute the air in many cities. These pollutants contribute to the formation of smog and cause health problems. Emissions regulations and technology such as catalytic converters have reduced air pollution in many areas. However, in developing countries, cars are generally older, and the gasoline that they burn contains significantly more sulfur, a pollutant that contributes to acid precipitation. In addition, the carbon dioxide released from burning petroleum fuels may contribute to climate change.

Oil spills are another potential environmental problem of oil use. Drilling in deep water or very cold ecosystems is increasing, and potential spills from the drilling process are problematic. Compared with surface wells, stopping leaks is very difficult when the wellhead is 5,000 feet under water. In arctic ecosystems, cold temperatures hinder clean-up efforts. Non-point pollution from everyday sources, such as leaking cars or improperly handled motor oil, adds more pollution to waterways but is less obvious to the public.

IDENTIFYING MAIN IDEAS

One reading skill is the ability to identify the main idea of a passage. The main idea is the main focus or key idea. Frequently, a main idea is accompanied by supporting information that offers detailed facts about the main idea.

Read each question and write the answer in the space provided.

1. What are two potential hazards associated with oil use?

_____

2. What is one reason the air in cities is often polluted?

_____

3. What factor might be contributing to climate change?

_____

4. What are issues associated with drilling in deep water and cold ecosystems?

RECOGNIZING SIMILARITIES AND DIFFERENCES

One reading skill is the ability to recognize similarities and differences between two phrases, ideas, or things. This is sometimes known as comparing and contrasting.

Read each question and write the answer in the space provided.

5. What is the difference between cars in developed countries and cars in developing countries?

_____

_____

_____

RECOGNIZING CAUSE AND EFFECT

One reading skill is the ability to recognize cause and effect.

Read each question and write the answer in the space provided.

6. What negative effects do pollutants from vehicles cause in cities?

_____

_____

7. What problem does the burning of gasoline with sulfur contribute to?

_____

_____

8. Name two things that have reduced air pollution in many areas.

_____

_____

9. What does the author suggest will reduce the negative effects of using oil?

_____

_____

Points of View

Pipelines and Oil Sands

Oil sands are mixtures of oil, clay, sand, and water. Many large deposits of oil sands are located in Canada.

The world needs oil. Oil is best known for its use as a fuel, but it also is used to make plastics, lubricants, and many chemicals. For decades, oil has been inexpensive and has been treated as an almost inexhaustible resource.

In the past decade, people have become more aware of the limited supplies of easily obtainable oil. Also, conflicts in oil-producing areas have limited supplies. Oil prices have skyrocketed. The price and new technologies have made it economically worthwhile to extract oil from places where it was once too expensive or too difficult to access.

Tar sands, which are also called oil sands, are one example of hard-to-get oil that is now being extracted. The oil from tar sands cannot be pumped out of the ground in the same way as in drilling operations. This is because the oil is very viscous and is mixed with clay, sand, and water. To access some oil sand deposits, huge mines must be dug that remove all of soils above the deposits. Then the oil and sediment mixture is extracted before the oil is separated. About two tons of sand are needed to produce one barrel of oil. This type of mining is very expensive and environmentally destructive, compared with other methods of extracting oil. New technologies are allowing oil to be extracted from deeper deposits.

There currently is debate about whether oil sands should be mined at all. The debate became even more intense in 2011 and 2012 because of a proposed pipeline—the Keystone XL pipeline—that would link the oil sands of Alberta, Canada to refineries in Texas. The Obama administration denied the permit to build the pipeline in 2012, but there are plans to submit a proposal for a similar pipeline that will take a different route.

The Case for the Pipeline

Supporters of the pipeline argue that the environmental impacts are outweighed by the creation of jobs and the enhancement of national security. Canada and the United States have been close trading partners and have been on good terms for decades. The same cannot be said of oil producers in the Middle East that supply much of the oil used in the United States. Also, political instability in the Middle East could compromise U.S. access to adequate oil supplies.

The refineries in Texas where the pipeline would terminate are built to refine oil from low-quality starting products, such as the oil sands. Although these refineries are already near capacity, a pipeline would bring a reliable supply of oil to them, and they would not have to import oil via tanker ships from other parts of the world.

The other argument for the pipeline is that it would create many jobs, both in Canada and the United States. Although there is disagreement over the numbers, there could be thousands to tens of thousands of jobs created to manufacture parts for and build the pipeline.

Finally, supporters of the pipeline suggest that the oil sands will be developed, regardless of what happens with the pipeline, because of increasing global demand for energy. Not building the pipeline will only deny jobs in the United States, supporters argue. Supporters also indicate that there are continuing efforts to make oil extraction from the Alberta oil sands more environmentally friendly.

Workers clean up along the Kalamazoo river in Michigan after a pipeline oil spill.

The Case Against the Pipeline

Arguments against the pipeline fall into two major categories: concerns over using the oil sands at all and concerns about the pipeline's route through environmentally sensitive areas.

Many scientists and environmentalists are very concerned that the development and use of the oil sands will have dire consequences for climate change. One climate scientist from NASA has stated that making full use of the oil sands would make it impossible to avoid significant and very damaging climate change, because of the huge amount of oil in the oil sands. Others claim that having this additional oil available would keep fuel prices low, which would slow efforts to switch to clean energy sources, such as solar and wind power. Most of the climate impact comes from the burning of oil. However, the production of liquid fuels from oil sands produces more greenhouse gases than production from standard oil.

The second major worry is about the pipeline itself. Oil spills happen along pipelines and have the potential to contaminate important habitats, including rivers and underground water supplies (aquifers). Along an existing pipeline from Canada to the Midwest of the United States there have been 14 spills, including one in 2011. Also in 2011, there were oil spills from oil sands pipelines into the Yellowstone River in Montana and the Kalamazoo River in Michigan.

The Keystone XL pipeline was proposed to cross a portion of Nebraska above the Ogallala Aquifer. This 174,000-mi² aquifer provides drinking and irrigation water for portions of many western states. Studies suggest that a spill could contaminate huge areas of the aquifer and disrupt drinking water supplies. This concern was largely responsible for the Obama administration's rejection of the pipeline permit.

Finally, opponents to the pipeline question the number of jobs that might be created. In addition, some labor groups in Canada oppose the pipeline because they think the majority of environmental damage may be done in Canada, while the majority of jobs created will be in the United States.

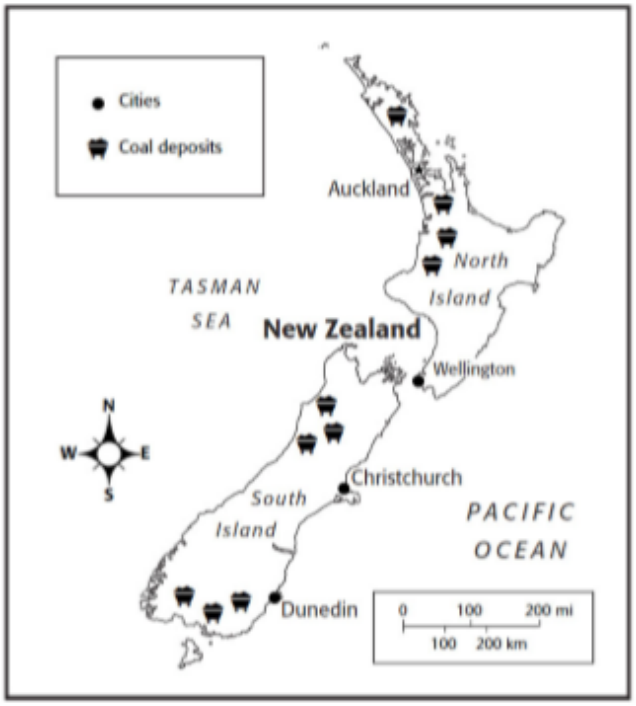
Lesson Review Questions

1.	List several ways that oil is used by the world.
2.	Describe how oil sand deposits are accessed.
3.	Explain the main points of arguments for and against the pipeline.
4.	Write a paragraph to explain and support your opinion in the debate over pipelines and the use of oil sands.

Name _____ Class _____ Date _____

Skills Worksheet **COAL DEPOSITS**

Map Skills



This map shows the location of coal mines in New Zealand. Coal is New Zealand's most common fossil fuel. Although both North and South Island have many coalmines, the mines on South Island are much more productive. South Island mines produce almost 85 percent of New Zealand's coal.

Use the map above to answer the questions below.

1. **Using a Key** Which island's coal deposits are distributed over a wider area?

_____

2. **Finding Locations** What city is farthest from a coal deposit?

_____

3. **Finding Locations** Are most of the coal mines in New Zealand near cities or some distance away?

_____

4. **Making a Hypothesis** Based on what you have learned in this chapter, what types of mining do you suppose New Zealanders use to get their coal? Explain your answer.

WHAT ARE THE PRACTICAL SOURCES OF ENERGY?

The practical sources of energy include the fossil fuels, natural gas, petroleum (or oil), and coal. Fossil fuels are referred to as nonrenewable energy sources because, once used, they are gone.

Scientists are exploring the practicality of other sources called renewable energy sources. These include sun, wind, geothermal, water, and biomass. The renewable energy resources are important in long range energy planning because they will not be depleted.

Natural Gas
Sometimes natural gas is confused with gasoline, the fuel in cars. They are not the same. Gasoline is a mixture of liquids, and natural gas is mainly methane and is piped into homes and office buildings where it is used as an energy source for heating, cooking washing, and drying. It is raw material to make other chemicals, and is the cleanest bumming fossil fuel. This means it contributes little environmental pollutants when bummed.

Petroleum or Oil
This is the black, thick liquid pumped from below the earth's surface wherever you see an oil rig. To make it useful, it is refined. Refining separates the gasoline portion which is used in transportation. Products from the remaining portions include synthetic rubber, detergents, fertilizers, textiles, paints, and pharmaceuticals.

Coal
Coal is the most abundant fossil fuel. It is not a widely used energy source due to the cost of mining and its impurities, which cause pollution (acid rain). There are two ways to mine coal; underground mining and strip mining. Disadvantage to these methods is the environmental change caused in the process. New ways of using coal are being explored, such as liquefication, in which a product similar to oil is produced.

Solar
The sun is 93 million miles away and yet, this ball of hot gases is the primary source of all energy on earth. In the hi ugh temperature of the sun, small atoms of hydrogen are fused, that is, the centers of the two atoms are combined. Fusion releases far greater energy than splitting the atom (fission, see below). Without sunlight, fossil fuels could never have existed. The sun is the supplier of energy which runs the water cycle. The uneven heating of the earth produces wind energy. Solar energy can be used to cook food, heat water and generate electricity. It remains the cleanest energy source an it is renewable. It is the hope for the energy source of the future and scientists at NREL are actively working on ways for solar energy to supply more our energy needs!

Wind
The unequal heating of the earth's surface by the sun produces wind energy, which can be converted into mechanical and electrical energy. For a long time, the energy of wind has been to drive pumps. Today windmills can be connected to electric generators to turn the wind's motion energy into electrical energy, and wind over 8 miles per hour can be used to generate electricity .It is a renewable, but unpredictable, energy source.

Wood
Wood provides U .S. homes and industries as much power as nuclear plants. Burning is the major global source of carbon dioxide in the atmosphere. Worldwide, wood is poor man's oil, providing 50-60% of the people with the barest energy necessities. Roughly half of the earth's forests have disappeared since 1950. Wood is considered a renewable energy source.

Hydroelectric (Falling Water)
When water is collected behind dams on large rivers, it provides a source of energy for the production of electricity. The enormous power of falling water is capable of turning giant turbines. These turbines drive the generators, which produce electricity. The degree of power is determined by the amount of water and the distance it falls. Hydroelectric power plants do not cause pollution, but there are fewer and fewer places to build dams. The environmental problem arises because a dam is typically built on a river creating a lake where land once stood. Water is a renewable energy source.

Ocean Tides
Ocean tides are very powerful forces. To harness the rising and falling of the tides would be an expensive process, but it would be a very important future source for Eastern United States. Perhaps underwater windmills or floating generating stations could utilize this potential energy source to produce electricity.

Geothermal
Geothermal energy refers to the energy deep within the earth. It shows itself in the fountains of boiling water and steam known as geysers. Geothermal energy was generated by the decay of natural radioactive materials within the earth. In addition it is the heat energy remaining within the earth from gravitational formation of the earth. This energy source is not popular in the United States, but Yellowstone has some geysers. Geothermal energy is used to heat some homes, greenhouses, and factories. The actual usable geothermal sites are few, but is considered a renewable energy source.

Biomass
This is garbage! As bacteria decomposes organic waste such as manure, septic tank sludge, food scraps, pond- bottom muck, etc., methane is produced. This methane is the same as natural gas from the ground. There are power plants in the United States, which use methane derived from these organic wastes (mainly manure). Some cities produce electricity by burning garbage in especially designed power plants.

Nuclear Fission
This is splitting of the uranium atom. In the 1930's scientists found that splitting the nucleus of an uranium atom releases a tremendous amount of heat energy. This knowledge was used to make atom bombs. Today, power companies use the heat produced by nuclear fission to produce electricity. Some people think nuclear energy should be our main source of future energy. Other people feel that the dangers are too great from radioactive waste products, meltdowns, and radiation exposure of workers.

Currently the nonrenewable resources supply the majority of our energy needs because we have designed ways to transform their energy on a large scale to meet consumer needs. Regardless of the source of energy, the energy contained in the source is changed into a more useful form -electricity Electricity is sometimes referred to as a secondary energy source. All the other sources are primary.

Renewable Energy Sources	Nonrenewable Energy Sources

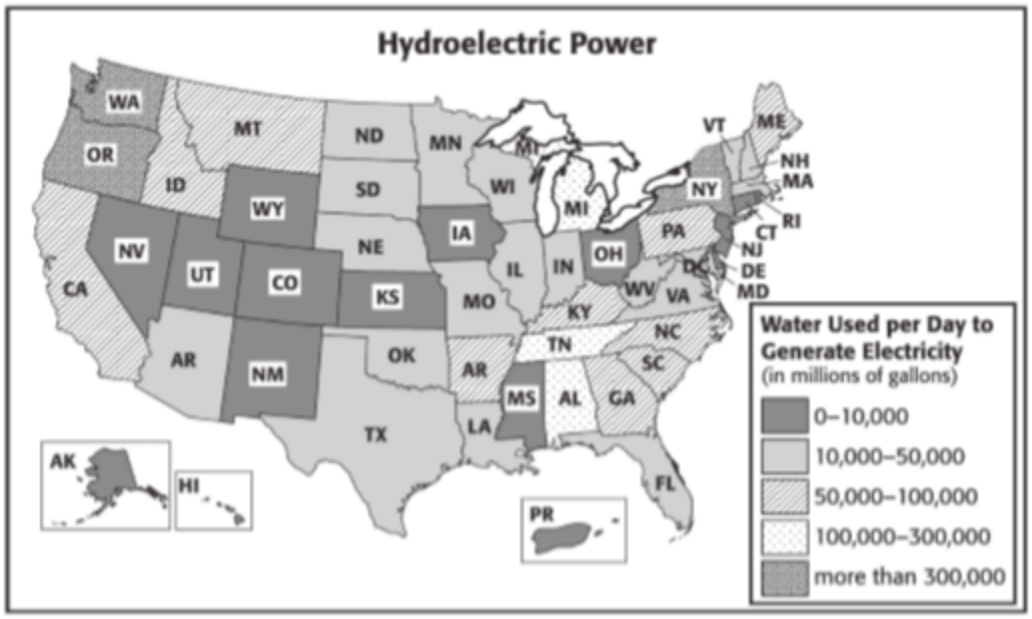
Comparing Nonrenewable Energy Sources		
Energy Source	**Advantages**	**Disadvantages**

Comparing Renewable Energy Sources		
Energy Source	**Advantages**	**Disadvantages**

Name _____ Class _____ Date _____

Skills Worksheet **HYDROELECTRIC POWER**

Map Skills



The United States is the third largest producer of hydroelectric power. Only Canada and Brazil use more water for hydroelectricity. Together these three countries make up 37 percent of the world's hydroelectric power generation. This map shows how states compare in their use of water for hydroelectric power.

Use the map above to answer the questions below.

1. **Using a Key** What three states use the most water for hydroelectric energy?

_____

2. **Analyzing Data** Do the majority of states use more than or less than 100,000 million gallons of water for hydroelectric power per day?

_____

3. **Making Conclusions** How much water per day does the state where you live use for hydroelectric power?

_____

4. **Making Conclusions** Based on what you have learned in this chapter, do you consider it a good thing or a bad thing if a state uses a high amount of hydroelectric power?

_____

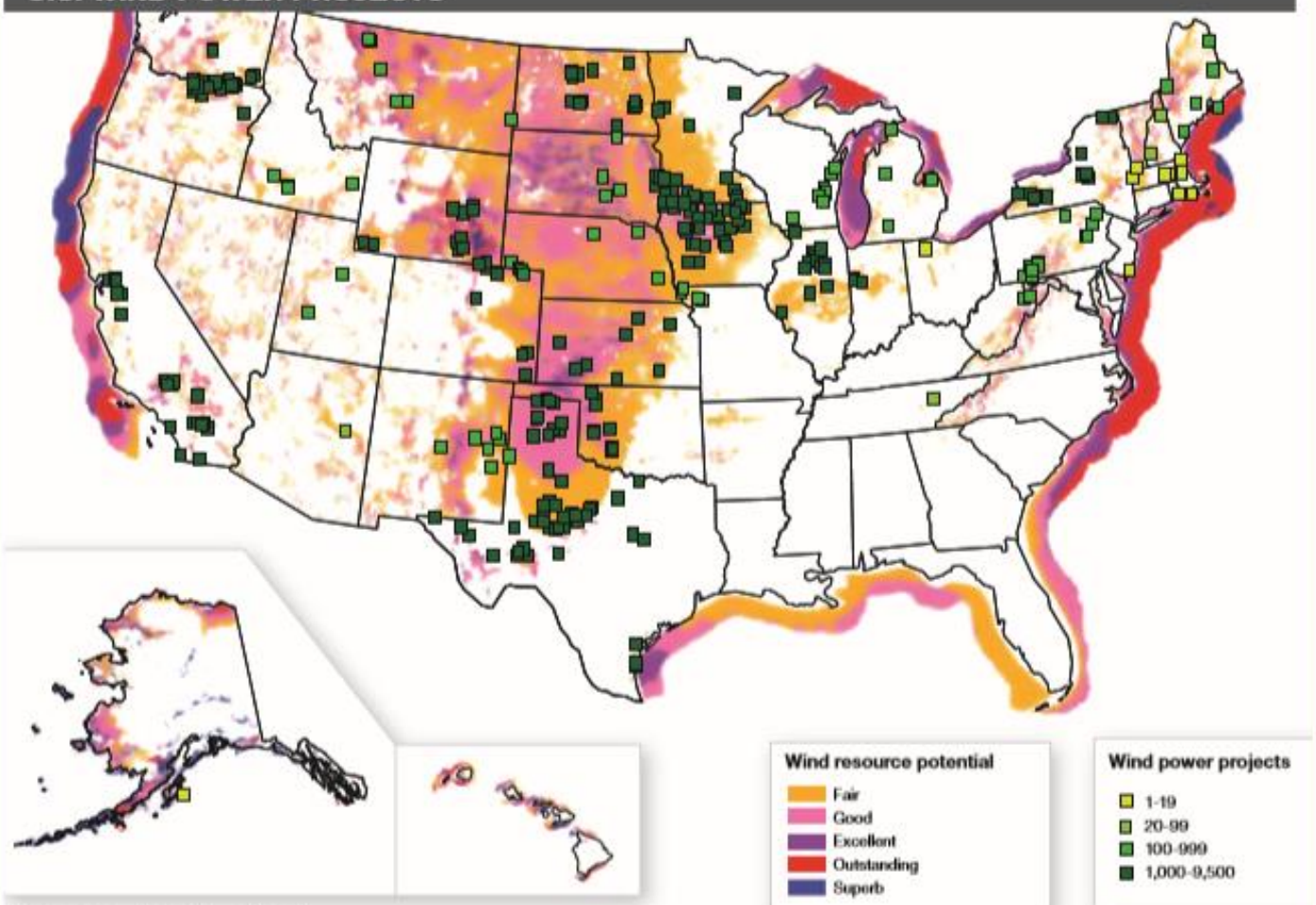
_____

_____

Maps in Action

Wind Power in the United States

U.S. WIND POWER PROJECTS



Alaska and Hawaii are not drawn to scale.

Note: Locations of wind power projects are approximate.

Source: National Renewable Energy Lab, U.S. Department of Energy

Map Skills

1. **Analyzing Data** Why are most of the wind farms located in the western and central United States and not in the eastern United States?
2. **Understanding Topography** Examine Idaho, Wyoming, Montana, and Colorado. What landscape feature might account for the strong winds in those western states?
3. **Using the Key** Use the wind power key to locate where you would plan five wind power projects that are larger than 50 MW.
4. **Using the Key** The Great Plains states have been called the "Saudi Arabia of wind energy." Use the key to explain what this statement means.
5. **Finding Locations** The first offshore wind farm in the United States is proposed off the East Coast. Find where the proposed wind farm will be located, and describe the wind conditions in that area.
6. **Using the Key** Use the map to determine which state has the greatest unused potential for wind energy. Explain your reasoning.