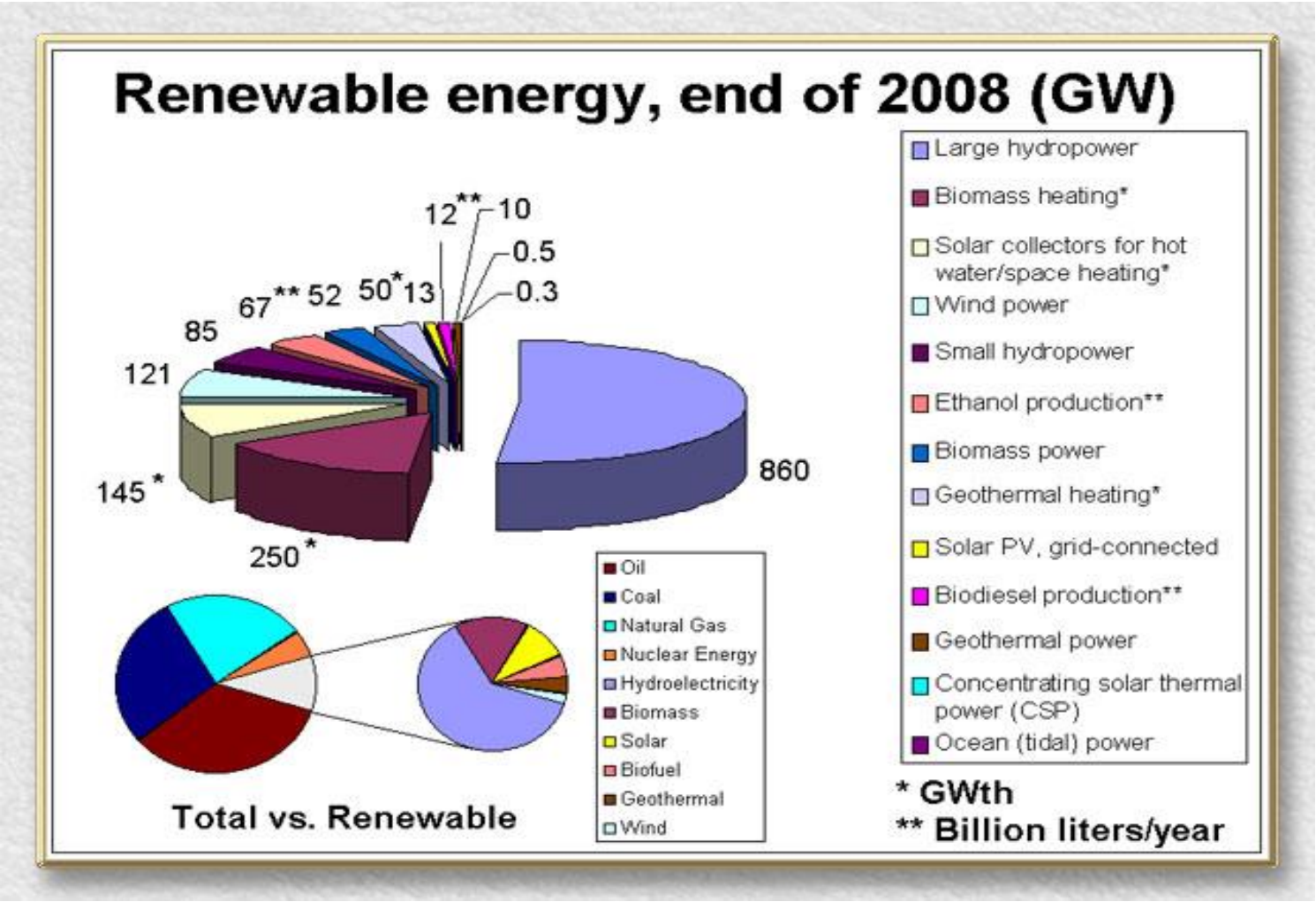
Station #1 | Interpreting Infographs

1. Identify and <u>explain</u> each of the energy sources (5) illustrated in the infograph.
2. What do the white and black circles imply in terms of energy production and use?
3. Identify the countries that are using each of the energy sources (5). What do they all have in common?
4. In at least 4 sentences, explain how access to technology may have an impact to what energy sources are used? THINK- industrialized vs. non-industrialized nations.

Station #2: Interpreting Graphs



1. Briefly describe what is happening in the larger graph above.

2. Which renewable energy source is most widely used?

3. Sort the power sources above in the larger graph into the categories below:

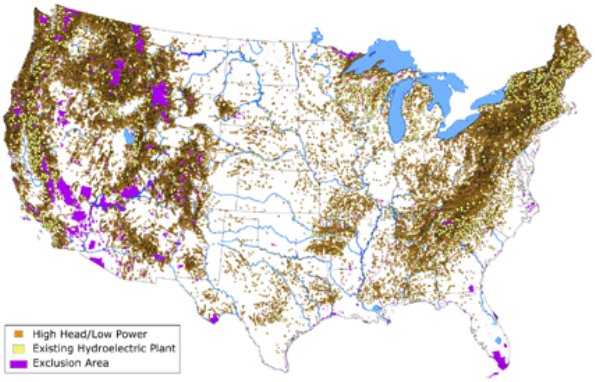
HYDROPOWER	BIOMASS	SOLAR	GEOTHERMAL	WIND

4. Look closely at the smaller circle graph titled *Total vs. Renewable*. Describe what the graph is demonstrating and describe the role that nonrenewable power has on our world energy sources in at least 4 sentences

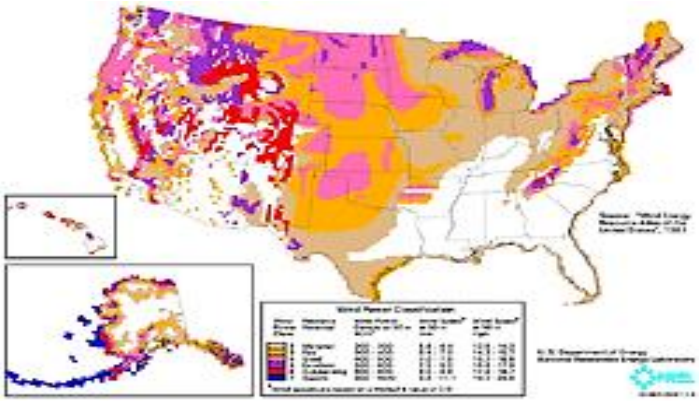
Station 3- Interpreting Diagrams

Look carefully at the diagrams below and answer the questions.

HYDROPOWER PLANTS

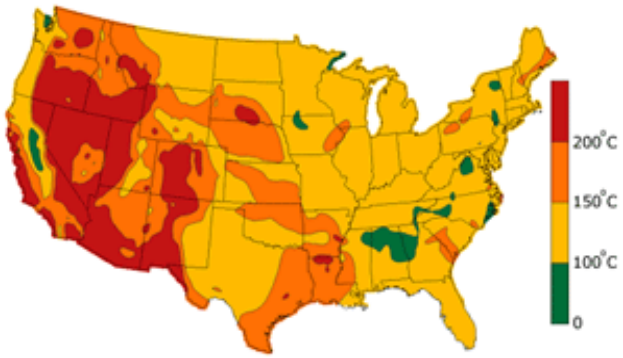


WIND POWER TURBINE



SOLAR

GEOTHERMAL



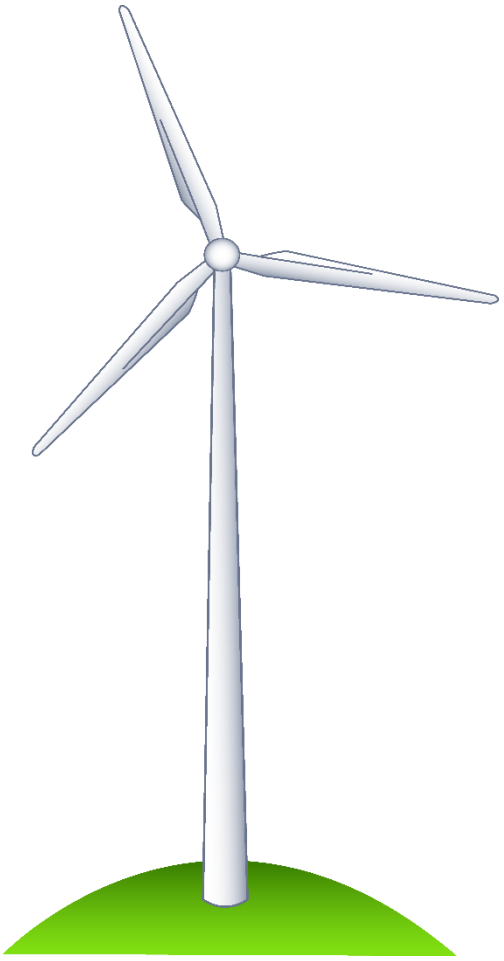
1. Briefly summarize the diagrams above.
2. Look carefully at the diagram labeled HYDROPOWER. The light areas are where the existing hydro-plants are located. Describe what the environment needs to look like for the hydro plants to exist there?
3. Look carefully at the WIND POWER TURBINE diagram. Predict what areas could have the most access to wind and write it down. IF dark areas are areas where the wind is the greatest, are they the same as what you predicted? Explain.
4. Describe where you would you would put geothermal power plants.
5. Which renewable energy source would be best to use and why?

Station # 4: Wind Energy

For hundreds of years, humans have used wind to pump water or grind grain, usually with small windmills. Large, modern wind turbines are used to generate electricity, either for individual use or for contribution to a utility power grid. Wind turbines usually have two or three blades and, because winds above the ground tend to be faster and less turbulent than those near the surface, the turbines are mounted on tall towers to capture the most energy. As the blades turn, the central shaft spins a generator to make electricity.

In recent years, wind has become an increasingly attractive source of renewable energy – wind energy is the world's fastest-growing energy technology. Wind turbines placed at sites with strong, steady winds can economically generate electricity without producing pollutants. The power in wind increases rapidly with its speed, which means that locating windmills in areas of strong winds is critical. The strongest winds in the United States tend to be in Alaska, the western United States, and the Appalachians. Wind power currently supplies about 1% of United States electricity needs, but capacity is expanding rapidly. Although wind will contribute more to the United States electric supply in the future, like hydropower it cannot be expected to supply all of our electric needs.

While wind power helps the environment by producing electricity without producing pollution, there can be negative environmental impacts of wind power generation, including wildlife deaths. However, recent studies suggest that the number of birds and bats killed by collision with wind turbines is far lower than the number killed by collisions with other tall structures such as buildings. Appropriate sitting of wind farms and individual turbines can reduce the impact on wildlife. Noise, which was a problem with older turbine designs, has mostly been eliminated through improved engineering.



1. Describe what the turbine of wind energy looks like. Describe how they work.
2. Where are the strongest winds in the United States? Why do you think they are there?
3. Why has wind become an attractive source of energy? What percentage does it supply to the United States now?
4. What are some of the negative impacts of Wind energy?

Station #5: Hydroelectric Power

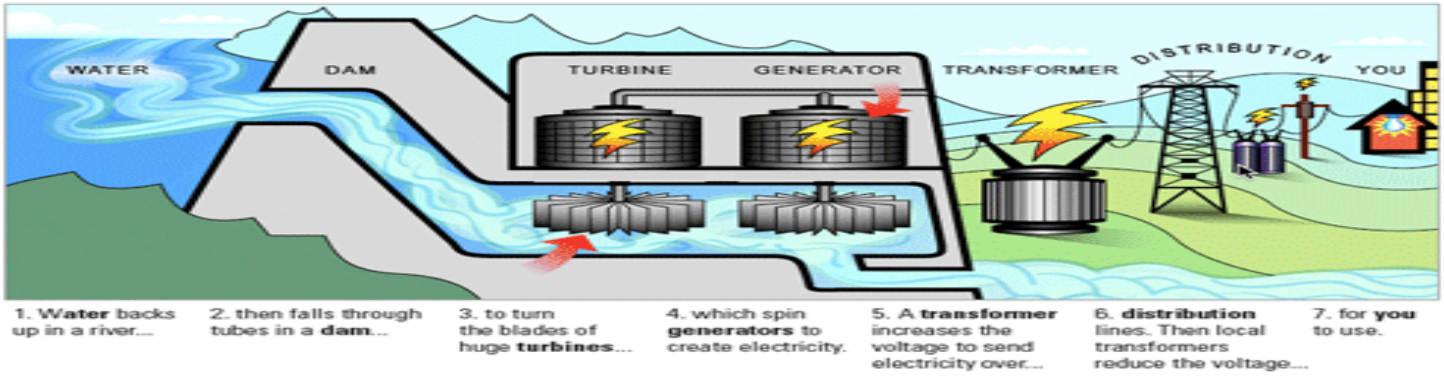
Hydropower refers to using water to generate electricity. Water is the most common renewable source of energy in the United States today. Many hydroelectric power plants use a dam on a river to store water. Water released from behind the dam flows through a turbine, spinning it, which then turns a generator to produce electricity. Electricity generated this way is known as hydroelectricity, and it accounts for about 7% of the electricity used by the nation. Hydroelectric power doesn't necessarily require a large dam – some hydroelectric power plants just use a small canal to channel the river water through a turbine. A small or micro-hydroelectric power system can produce enough electricity for a home, farm, or ranch.

The Tazimina project in Alaska is an example of a diversion hydropower plant. No dam was required. Dam sites for hydropower plants are limited both by available rivers and by competing uses for those rivers, such as recreation, tourism, industry, and human settlements. Because of such limitations, water power could never generate all the electricity used in the United States. In addition, environmental impacts are considered when locating dams.

While all hydroelectric dams have some environmental impact, the impacts vary widely, and current regulations and policies attempt to address environmental concerns. A dam may either create a reservoir or may be a run-of-river project that does not store large amounts of water but simply takes advantage of a river's natural flow. In addition to power, dams often provide other benefits such as recreation opportunities on upstream reservoirs, habitat for a wide variety of aquatic and terrestrial species, diversion of water for irrigation, and control of destructive flooding and environmental damage downstream.

Hydropower is one of the least expensive sources of electricity and areas with good sources of hydropower tend to attract industries with large needs for electricity. Major hydroelectric dams in the United States are found in the Northwest, the Tennessee Valley, and on the Colorado River.

1. Describe how hydroelectric power works.
2. Does hydroelectric power need a large dam? Explain.
3. What limits where a hydroelectric dam is located?
4. Describe some (at least 2) of the pros and cons related to hydroelectric power.



Station #6: Solar Technology

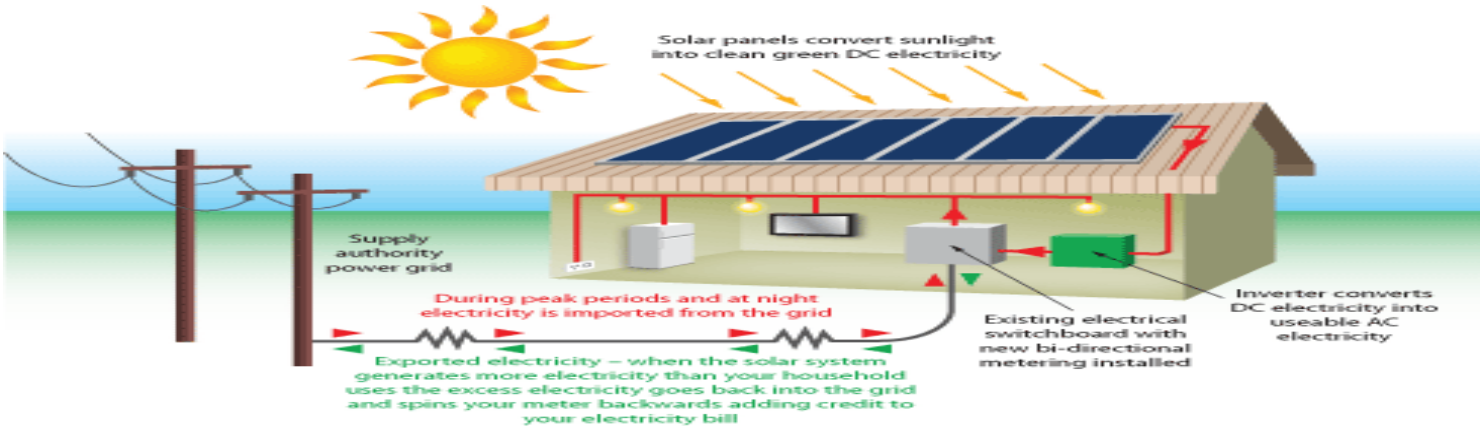
Solar technologies use the sun's energy to provide heat, light, hot water, electricity, and even cooling, for homes, businesses, and industry. Despite sunlight's significant potential for supplying energy, solar power provides less than 1% of U.S. energy needs. This percentage is expected to increase with the development of new and more efficient solar technologies.

Different types of solar collectors are used to meet different energy needs. Passive solar building designs capture the sun's heat to provide space heating and light. Photovoltaic cells convert sunlight directly to electricity. Concentrating solar power systems focus sunlight with mirrors to create a high-intensity heat source, which then produces steam or mechanical power to run a generator that creates electricity. Flat-plate collectors absorb the sun's heat directly into water or other fluids to provide hot water or space heating. And solar process heating and cooling systems use specialized solar collectors and chemical processes to meet large-scale hot water and heating and cooling needs.

Solar technologies produce few negative environmental impacts during collector operation. However, there are environmental concerns associated with the production of collectors and storage devices. In addition, cost is a great drawback to solar power. Although sunlight is free, solar cells and the equipment needed to convert their direct-current output to alternating current for use in a house is expensive. Electricity generated by solar cells is still more than twice as expensive as electricity from fossil fuels.

The parabolic troughs that make up this concentrating solar power system generate power from the sun on a large scale in California only operate during daylight hours. In contrast, a coal or natural gas plant can run around the clock, which means the cost for building the plant can be spread over many more hours of use. Around the United States, available sunlight varies considerably as a result of differences in cloud cover and latitude, and also varies with the seasons. In the summer, longer daylight hours and a higher sun angle provide more solar power, compared to the winter when the sun is up for fewer hours and at a lower position in the sky. These variations must be taken into consideration when planning solar collection facilities.

1. Describe how solar technologies work.
2. What are some uses of the solar technology?
3. What are the pros and cons of this industry?
4. Why do you think that an energy source so easily available is not more steadily used? Explain.



Station #7: fossil fuels

Fossil fuels are not a renewable energy resource. Once we've burned them all, there isn't any more, and our consumption of fossil fuels has nearly doubled every 20 years since 1900. This is a particular problem for oil, because we also use it to make plastics and many other products. Coal, oil and gas are called "fossil fuels" because they have been formed from the organic remains of prehistoric plants and animals. Coal is crushed to a fine dust and burnt. Oil and gas can be burnt directly.

The steam that has passed through the power station's turbines has to be cooled, to condense it back into water before it can be pumped round again. This is what happens in the huge "cooling towers" seen at power stations. Some power stations are built on the coast, so they can use sea water to cool the steam instead. However, this warms the sea and can affect the environment. Coal provides around 28% of our energy, and oil provides 40%. Burning coal produces sulfur dioxide, an acidic gas that contributes to the formation of acid rain. This can be largely avoided using "flue gas desulphurization" to clean up the gases before they are released into the atmosphere.

Crude oil (called "petroleum") is easier to get out of the ground than coal, as it can flow along pipes. This also makes it cheaper to transport. Natural gas provides around 20% of the world's consumption of energy, and as well as being burnt in power stations, is used by many people to heat their homes. It is easy to transport along pipes, and gas power stations produce comparatively little pollution.

Basically, the main drawback of fossil fuels is pollution. Burning any fossil fuel produces carbon dioxide, which contributes to the "greenhouse effect", warming the Earth. Burning coal produces more carbon dioxide than burning oil or gas. It also produces sulfur dioxide, a gas that contributes to acid rain. We can reduce this before releasing the waste gases into the atmosphere. Mining coal can be difficult and dangerous. Strip mining destroys large areas of the landscape.

1. Describe the three main outputs of fossil fuels.
2. Some scientists claim that fossil fuels are technically renewable. Why?
3. Identify at least 2 pros (positives) and 2 cons (negatives) for each type of fossil fuel:
   a. Oil
   b. Coal
   c. Natural gas
4. Do you think "our consumption of fossil fuels has nearly doubled every 20 years since 1900"? Explain.