Class: **6th Science** Dates**: – weeks 4 and 5** Expected time on tasks: **30 Min / school day**

Week 4: Background Research, Week 5: Project

If we were on campus, this is the project we would have been doing: Apply scientific principles to design, construct, and test a device that minimizes thermal energy transfer (MS-PS3-3)

**TASK:** You will be studying how to insulate something (an ice cube) from thermal energy from the sun by building a "refrigerator"

| Content Focus and Materials | Directions | Check-ins and support | Submission of work |
|---|---|---|---|
| **Week 4: Background Research**<br>• Renewable Energy article and quiz<br>• Insulators and Conductors article and quiz<br>• Watch https://www.youtube.com/watch?v=Of8ZZngsnmk if possible.<br><br>**Week 5: Project build, redesign, and rebuild your "refrigerator"**<br>• Household materials only (no electronics, no commercial coolers)<br>• Ice cubes (two, one for each design)<br>• Written explanation (with pictures – drawn or photos) of changes to re-build and why you think the changes will improve the performance of your refrigerator.<br>• Some sort of stop watch (there's one built in to most smart phones)<br>• Weather thermometer if possible | Week 4:<br>• Read each article and take the quiz that comes with it. (check your answers AFTER you try the quiz)<br>• Watch the You Tube video if possible<br><br>Week 5:<br>• Design a "refrigerator" from common household items (no electronics, no commercial coolers) that will be able to keep an ice cube from melting for at least 10 minutes (you will time it)<br>• Once you have built your prototype, you will need to test it. Put it outside in a sunny place and time how long it takes your ice cube to melt. Make sure to note the | **E-mail office hours**: every school day, 8AM-3:30PM, after hours emails may be available if teacher schedules allow.<br><br>**Video office hours:**<br>**JOHNSTON** (history/science): Monday-Friday: 10:30 AM-12:00PM<br>**MARTIN** (math/science): Monday – Friday: 8:30 AM – 10:30 AM<br>**WHITE** (ELA/science): Monday-Thursday: 10:00 AM – 11:00 AM and 5:00PM-6:00PM | ***Since hard-copy work will not be returned to students, we request that the work on this project be submitted via email or pictures if at all possible.***<br><br>If necessary, hard-copy work can be turned in at Freiler following the calendar, however that work will **NOT** be returned to students. |

| | | | |
|---|---|---|---|
| | outside temperature where you are.<br>• Then, you will need to redesign your "refrigerator" – write (in well written sentences/paragraph) what you are changing and why you think it will improve your refrigerator.<br>• Build your 2nd prototype and test it. It is important to put your new refrigerator in the same place at the same time of day (hopefully the weather will cooperate). Time your melting ice cube and report on the results of your changes. Record the outside temperature where you are testing. | Friday: 10:00AM-11:30<br><br>***Please be on the watch for changes to Office Hours during week 5 – we anticipate being asked to go onto Freiler campus to conduct year close-out tasks.*** | **Week 4 hard-copy work is due on or before 5/15**. Week 5 work cannot be turned in hard-copy. |

**Things to turn in:**

_____ Quiz for Renewable Energy article (5/15)

_____ Quiz for Conductors and Insulators article (5/15)

_____ diagram and/or photo of your first design (5/15 if possible)

_____ Results of your first design (digital turn in only, by 5/21)

_____Written explanation of the changes you will make to your initial design and why you believe they will improve it's performance (digital turn in only, by 5/21)

_____ diagram and /or photo of your re-design (digital turn in only, by 5/21)

_____ Results of your re-design (digital turn in only, by 5/21)

# Types of renewable energy

By National Geographic Society on 02.12.20
Word Count **1,682**
Level **MAX**

Wind turbines (left) and solar panels (right) create electricity. Photo by: Christoph Burgstedt/Science Source

The wind, the sun and Earth are sources of renewable energy. These energy sources naturally renew, or replenish themselves.

Wind, sunlight and the Earth have energy that transforms in ways we can see and feel. We can see and feel evidence of the transfer of energy from the sun to the Earth in the sunlight shining on the ground and the warmth we feel when sunlight shines on our skin. We can see and feel evidence of the transfer of energy in wind's ability to pull kites higher into the sky and shake the leaves on trees. We can see and feel evidence of the transfer of energy in the geothermal energy of steam vents and geysers.

People have created different ways to capture the energy from these renewable sources.

**Solar Energy**

Solar energy can be captured actively or passively.

Active solar energy uses special technology to capture the sun's rays. The two main types of equipment are photovoltaic cells (also called PV cells or solar cells) and mirrors that focus sunlight in a specific spot. These active solar technologies use sunlight to generate electricity, which we use to power lights, heating systems, computers and televisions.

Passive solar energy does not use any equipment. Instead, it gets energy from the way sunlight naturally changes throughout the day. For example, people can build houses so their windows face the path of the sun. This means the house will get more heat from the sun. It will take less energy from other sources to heat the house.

Other examples of passive solar technology are green roofs, cool roofs and radiant barriers. Green roofs are completely covered with plants. Plants can get rid of pollutants in rainwater and air. They help make the local environment cleaner.

Cool roofs are painted white. Radiant barriers are made of a reflective covering, such as aluminum. They both reflect the sun's heat instead of absorbing it. All these types of roofs help lower the amount of energy needed to cool the building.

### Advantages And Disadvantages

There are many advantages to using solar energy. PV cells last for a long time: They can operate at about 80 percent of their intended production even after about 25 to 30 years.

However, there are reasons why solar power cannot be used as the only power source in a community. It can be expensive to install PV cells or build a building using passive solar technology.

Sunshine can also be hard to predict. It can be blocked by clouds, and the sun doesn't shine at night. Different parts of Earth receive different amounts of sunlight based on location, the time of year and the time of day.

## Wind Energy

People have been harnessing the wind's energy for a long, long time. More than 5,000 years ago, ancient Egyptians made boats powered by the wind. In 200 B.C., people used windmills to grind grain in the Middle East and pump water in China.

Today, we capture the wind's energy with wind turbines. A turbine is similar to a windmill; it has a very tall tower with two or three propeller-like blades at the top. These blades are turned by the wind. The blades turn a generator (located inside the tower), which creates electricity.

Groups of wind turbines are known as wind farms. Wind farms can be found near farmland, in narrow mountain passes, and even in the ocean, where there are steadier and stronger winds. Wind turbines anchored in the ocean are called offshore wind farms.

Wind farms create electricity for nearby homes, schools and other buildings.

### Advantages And Disadvantages

Wind energy can be very efficient. In places like the Midwest and along coasts, steady winds can provide cheap, reliable electricity.

Another great advantage of wind power is that it is a clean form of energy. Wind turbines do not burn fuel or emit any pollutants into the air.

Wind is not always a steady source of energy, however. Wind speed changes constantly, depending on the time of day, weather and geographic location. Currently, it cannot be used to provide electricity for all our power needs.

Wind turbines can be also dangerous for bats and birds. These animals cannot always judge how fast the blades are moving and crash into them.

### Geothermal Energy

Deep beneath the surface of the Earth is the Earth's core. The center of the Earth is extremely hot thought to be over 6,000 Celsius (about 10,800 Fahrenheit). The heat is constantly moving toward the surface.

We can see some of the Earth's heat when it bubbles to the surface. Geothermal energy can melt underground rocks into magma and cause the magma to bubble to the surface as lava. Geothermal energy can also heat underground sources of water and force it to spew out from the surface. This stream of water is called a geyser.

However, most of the Earth's heat stays underground and makes its way out very, very slowly.

We can access underground geothermal heat in different ways. One way of using geothermal energy is with geothermal heat pumps. A pipe of water loops between a building and holes dug deep underground. The water is warmed by the geothermal energy underground and brings the warmth aboveground to the building. Geothermal heat pumps can be used to heat houses, sidewalks and even parking lots.

Another way to use geothermal energy is with steam. In some areas of the world, there is underground steam that naturally rises to the surface. The steam can be piped straight to a power plant. However, in other parts of the world, the ground is dry. Water must be injected underground to create steam. When the steam comes to the surface, it is used to turn a generator and create electricity.

In Iceland, there are large reservoirs of underground water. Almost 90 percent of people in Iceland use geothermal as an energy source to heat their homes and businesses.

### Advantages And Disadvantages

An advantage of geothermal energy is that it is clean. It does not require any fossil fuels to function properly.

A disadvantage of using geothermal energy is that in areas of the world where there is only dry heat underground, large quantities of fresh water are used to make steam. There may not be a lot of fresh water. People need water for drinking, cooking and bathing.

### Biomass Energy

Biomass is any material that comes from plants, animals or microorganisms that were recently living. Plants create energy from the sun through photosynthesis. This energy is stored in the plants even after they die.

Trees, branches, scraps of bark and recycled paper are common sources of biomass energy. Manure, garbage and crops such as corn, soy and sugar cane can also be used as biomass feedstocks.

We get energy from biomass by burning it. Wood chips, manure and garbage are dried out and compressed into squares called briquettes. These briquettes are so dry that they do not absorb water. They can be stored and burned to create heat or generate electricity.

Biomass can also be converted into biofuel. Biofuels are mixed with regular gasoline and can be used to power cars and trucks. Biofuels release less harmful pollutants than pure gasoline.

### Advantages And Disadvantages

A major advantage of biomass is that it can be stored and used when it is needed.

Growing crops for biofuels, however, requires large amounts of land and pesticides. Land could be used for food instead of biofuels. Some pesticides could pollute the air and water.

Biomass energy relies on biomass feedstocks plants that are processed and burned to create electricity. Biomass feedstocks can include crops such as corn or soy, as well as wood.

### Hydroelectric Energy

Hydroelectric energy is made by flowing water. Most hydroelectric power plants are located on large dams, which control the flow of a river.

Dams block the river and create an artificial lake, or reservoir. A controlled amount of water is forced through tunnels in the dam. As water flows through the tunnels, it turns huge turbines and generates electricity.

### Advantages And Disadvantages

Hydroelectric energy is fairly inexpensive to harness. Rivers flow all over the world, so the energy source is available to millions of people.

Hydroelectric energy is also fairly reliable. Water is constantly flowing, so the dam does not depend on the weather and time of day the way solar and wind energies do.

However, hydroelectric power plants are damaging to the environment. When a river is dammed, it creates a large lake behind the dam. This lake drowns the original river habitat deep underwater. Sometimes, people build dams that can drown entire towns underwater. The people who live in the town or village must move to a new area.

Silt, or dirt from a riverbed, can build up behind the dam and can damage the dam, shortening its life span.

### Other Renewable Energy Sources

Scientists and engineers are constantly working to harness other renewable energy sources. Three of the most promising are tidal energy, wave energy and algal (or algae) fuel.

Tidal energy harnesses the power of ocean tides to generate electricity. Some tidal energy projects use the moving tides to turn the blades of a turbine. Other projects use small dams to continually

fill reservoirs at high tide and slowly release the water (and turn turbines) at low tide.

Wave energy harnesses waves from the ocean, lakes or rivers. Some wave energy projects use the same equipment that tidal energy projects do: dams and standing turbines. Other wave energy projects float directly on waves. The water's constant movement over and through these floating pieces of equipment turns turbines and creates electricity.

Algal fuel is a type of biomass energy that uses the unique chemicals in seaweed to create a clean and renewable biofuel. Algal fuel does not need the acres of cropland that other biofuel feedstocks do.

### Renewable Nations

These nations produce some of the most energy using renewable resources. Many of them are also amongst the leading producers of nonrenewable energy: China, United States, Brazil and Canada.

## Quiz

1 Which option MOST accurately summarizes the article without judgment?

(A) People have always gotten renewable energy from the wind, sun and Earth. Though the most popular renewable energy is solar, technologies such as wind, biomass, geothermal and hydroelectric energy work much faster and are cleaner for the environment. Because the United States produces so much nonrenewable energy, it should focus more on these.

(B) People have created a number of different ways to capture energy from the wind, sun and Earth. The primary renewable energy sources are solar, wind, geothermal, biomass and hydroelectric energy. Because each has advantages and disadvantages, scientists are continuing to work on harnessing renewable energies that cause less harm.

(C) There are many advantages and disadvantages to the different types of renewable energy available. While most people are familiar with solar and wind energy, they are probably surprised to learn about geothermal and hydroelectric energy. Because hydroelectric energy can flood habitats and towns, it should be eliminated immediately.

(D) There are many reasons why people are more interested in renewable energy today than ever before. One of the most interesting types of renewable energy is called biomass, which can only be created from plants and used to power cars or trucks. Because of its limited uses, wind and solar energy are better options for countries that are trying to help the environment.

2 Read the list of sentences from the article.

1. *These active solar technologies use sunlight to generate electricity, which we use to power lights, heating systems, computers and televisions.*
2. *Other examples of passive solar technology are green roofs, cool roofs and radiant barriers.*
3. *The water is warmed by the geothermal energy underground and brings the warmth aboveground to the building.*
4. *When the steam comes to the surface, it is used to turn a generator and create electricity.*

What central idea do these details support?

(A) Types of renewable energy can be accessed, collected and used in different ways.

(B) Renewable energy can be gathered from the sun, the wind or the water in the Earth.

(C) One of the most common uses for renewable energy is the heating and cooling of homes.

(D) Scientists are still learning which aspects of renewable energy harm the environment.

3 How effective is the introduction [paragraphs 1-3] at introducing the topic of renewable energy?

(A) It is very effective because it summarizes the goals of renewable energy and describes the problems that must be solved in order for it to work.

(B) It is very effective because it lists some sources of renewable energy and encourages the reader to imagine experiences that show this energy at work.

(C) It is not very effective because it only describes a limited number of renewable energy sources instead of comparing them to other energy sources.

(D) It is not very effective because it briefly suggests that renewable energy can have an effect on everyday life without showing what causes it to occur.

4 Read the section "Wind Energy."

What does this section show that other sections do not?

(A) the effects of ocean winds and tides on renewable energy

(B) the different places that renewable energy is gathered

(C) how renewable energy was used by groups of people in the past

(D) how renewable energy can be captured in a variety of ways

## Answer Key

1 Which option MOST accurately summarizes the article without judgment?

(A) People have always gotten renewable energy from the wind, sun and Earth. Though the most popular renewable energy is solar, technologies such as wind, biomass, geothermal and hydroelectric energy work much faster and are cleaner for the environment. Because the United States produces so much nonrenewable energy, it should focus more on these.

**(B) People have created a number of different ways to capture energy from the wind, sun and Earth. The primary renewable energy sources are solar, wind, geothermal, biomass and hydroelectric energy. Because each has advantages and disadvantages, scientists are continuing to work on harnessing renewable energies that cause less harm.**

(C) There are many advantages and disadvantages to the different types of renewable energy available. While most people are familiar with solar and wind energy, they are probably surprised to learn about geothermal and hydroelectric energy. Because hydroelectric energy can flood habitats and towns, it should be eliminated immediately.

(D) There are many reasons why people are more interested in renewable energy today than ever before. One of the most interesting types of renewable energy is called biomass, which can only be created from plants and used to power cars or trucks. Because of its limited uses, wind and solar energy are better options for countries that are trying to help the environment.

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# Insulators and conductors

By Encyclopaedia Britannica, adapted by Newsela staff on 01.21.20
Word Count **400**
Level **MAX**

Image 1. Workers climb an energy tower to remove a glass insulator on the outskirts of Mendoza, Argentina, in 2003. They will replace the old insulator with a new, organic one. Photo by: Daniel Garcia/AFP/Getty Images)

Materials that conduct heat or electricity are known as conductors. Materials that do not conduct heat or electricity are known as insulators. Insulators and conductors have many useful functions.

**Electrical Conductors**

Materials that allow electricity to pass through them easily are called electrical conductors. Examples of these materials include many metals, such as iron, steel, copper and aluminum.

Electrical objects use metal parts to conduct electricity. Examples include the copper wires inside electrical leads, the metal pins in plugs and the metal wire filaments in light bulbs.

In a simple electrical circuit, copper wire is used to carry electricity. It carries the electricity from an energy source (such as a battery) to an electrical component (such as a lamp, motor or bell).

Carbon is an electrical conductor, even though it is not a metal. Water also conducts electricity, which is why electrical objects should not be used near water.

## Electrical Insulators

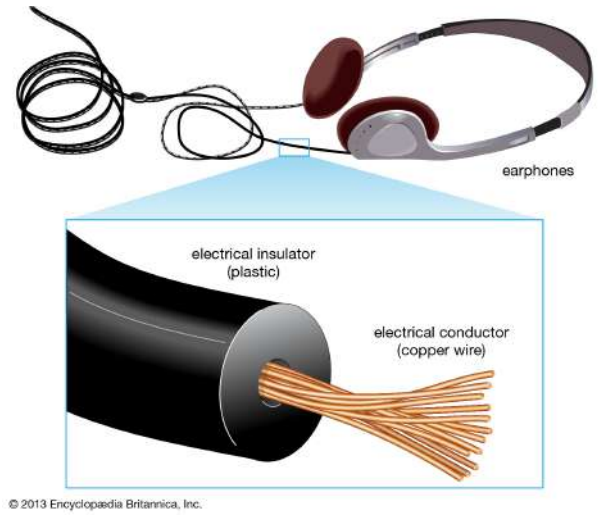
Materials that do not allow electricity to pass through them are called electrical insulators. Examples of these materials include plastic, rubber, wood and glass. Air is also an insulator.

Most electrical objects are made using insulators to keep them safe. Plugs, for example, have plastic cases. Electrical wires are wrapped in plastic, which is flexible as well as insulating.

The copper wires used in simple electrical circuits are coated in plastic. This prevents electricity from flowing out of the circuit.

## Thermal Conductors

Materials that allow heat to pass through them easily are called thermal conductors. Metals, such as aluminum, copper, steel and iron, are all good thermal conductors. Thermal conductors can be useful when it is necessary to cool things down, or heat them up, quickly. A metal saucepan is one example of a good thermal conductor. It allows heat to transfer quickly to the food inside it.





## Thermal Insulators

Materials that prevent heat from passing through them are called thermal insulators. A good thermal insulator will keep cold objects cold for a long time, and hot objects hot. Wood, plastic and many fabrics, such as wool and cotton, are good thermal insulators. Thermal insulators are good materials for keeping people warm. Clothing, carpets and curtains are examples of everyday thermal insulators.

## Quiz

1 Which sentence from the article is BEST illustrated by Image 2?

(A) Air is also an insulator.

(B) Plugs, for example, have plastic cases.

(C) Electrical wires are wrapped in plastic, which is flexible as well as insulating.

(D) Metals, such as aluminum, copper, steel and iron, are all good thermal conductors.

2 Based on Image 1 and the article, what conclusion can be made?

(A) Rubber allows electricity to pass through it.

(B) Plastic allows electricity to pass through it.

(C) Steel does not allow electricity to pass through it.

(D) Glass does not allow electricity to pass through it.

3 Which sentence from the article would be MOST important to include in a summary of the article?

(A) Materials that do not conduct heat or electricity are known as insulators.

(B) Carbon is an electrical conductor, even though it is not a metal.

(C) The copper wires used in simple electrical circuits are coated in plastic.

(D) A metal saucepan is one example of a good thermal conductor.

4 Read the sentence from the article.

*Wood, plastic and many fabrics, such as wool and cotton, are good thermal insulators.*

How does this detail develop a central idea of the article?

(A) It gives examples of materials that allow heat to pass through them easily.

(B) It gives examples of materials that prevent heat from passing through them.

(C) It gives examples of materials that do not allow electricity to pass through them.

(D) It gives examples of materials that allow electricity to pass through them easily.

## Answer Key

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