

# Learn-Along-Guide

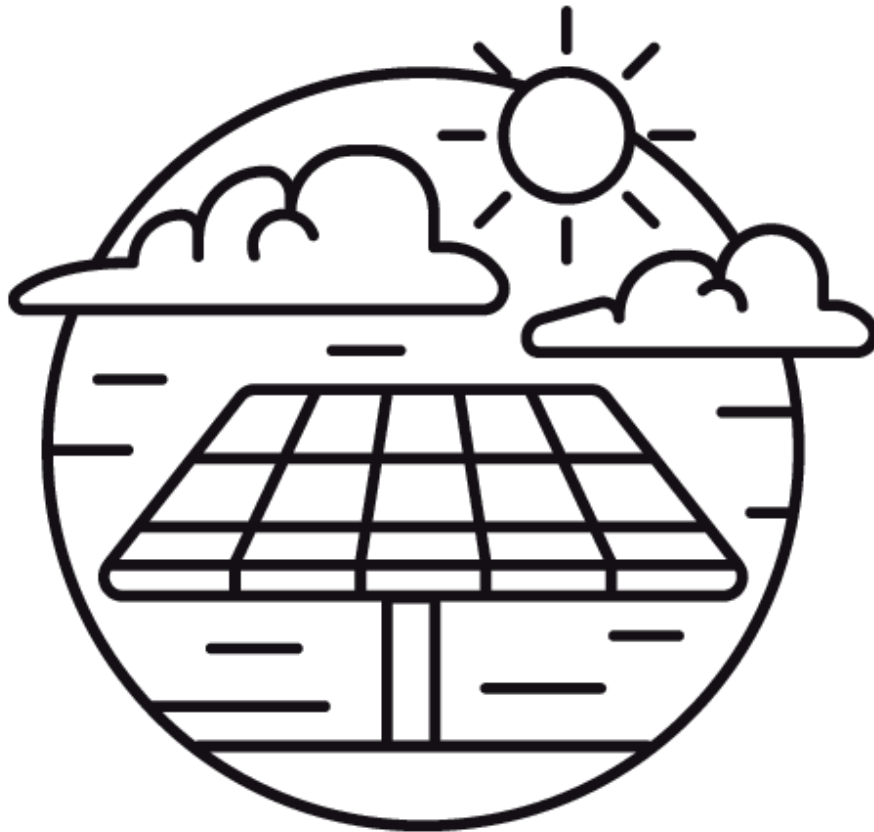
## Solar Energy

The Children's Hour radio show podcast  
<https://www.childrenshour.org/solar-energy/>



We hope you enjoyed listening to our interview with Marlene Brown, solar educator and engineer with New Mexico Solar Energy Association: <https://www.nmsolar.org/>

This guide may help your understanding of solar energy. Also, it will link you to resources where you can learn more. [Connect to Curriculum on page 11.](#)



You can color this drawing online: <https://nature.coloringcrew.com/environment/solar-energy.html>

Download a coloring book that teaches children about renewable energies such as wind, water, and solar, as well as good habits in energy efficiency to practice at home:

[https://www.energy.gov/sites/default/files/2014/10/f18/EERColoringbook\\_english.pdf](https://www.energy.gov/sites/default/files/2014/10/f18/EERColoringbook_english.pdf)

[https://www.energy.gov/sites/default/files/2014/10/f18/EERColoringbook\\_spanish.pdf](https://www.energy.gov/sites/default/files/2014/10/f18/EERColoringbook_spanish.pdf)

Humboldt County's Renewable Energy Coloring Book (2021): <https://redwoodenergy.org/coloring-book/>

Printable coloring pages about energy: <https://www.need.org/educators/awesome-extras/coloring-sheets/>

# What do you know about solar energy?

## Get Set to Listen

Read the statements below. In the “Before Listening” column, write “TRUE” if you think the statement is true. Write “FALSE” if you think the statement is not true. Then listen to the Solar Energy episode of The Children’s Hour. Based on what the expert says, check if each point is true or false in the “After Listening” column. If the statement is false, explain why it is false.

Before Listening	TRUE or FALSE?	After Listening
	1. Humans are solar powered.	
	2. Solar energy is the only type of renewable energy.	
	3. You can make your own solar panels.	
	4. Someday solar panels may be incorporated into clothing.	
	5. Solar power generated by solar panels makes up 30% of the electricity generated in the USA.	
	6. Passive solar power is when the warming nature of the sun is used to heat homes and other buildings.	
	7. To turn rays of sunlight into electricity, the element carbon is purified to make a semiconductor.	
	8. You can conserve a significant amount of energy by using LED light bulbs and by hanging clothing out to dry.	

## What did you learn?

After listening to the radio show, answer these questions:

1. What is one new fact you learned about solar energy?
2. What is one new question you have about it?
3. What is an important thing about solar energy that you think everyone should know?

# Solar energy is renewable.

**Renewable energy** is made from resources that nature will replace, like wind, water, and sunshine. Renewable energy is also called “clean energy” or “green power” because it doesn't pollute the air or the water.

**Video:** Review four types of renewable energy: solar energy, eolic (wind) energy, tidal wave energy, hydraulic energy, and geothermal energy: [https://youtu.be/Giek094C\\_I4](https://youtu.be/Giek094C_I4)



Every day, the sun **radiates** (sends out) an enormous amount of energy. It radiates more energy in one second than the world has used since time began. This energy comes from within the sun itself.

Only a small portion of the energy radiated by the sun into space strikes the earth, one part in two billion. Yet this amount of energy is enormous. Every day enough energy strikes the USA to supply the nation's energy needs for one and a half years.

About 15 percent of the radiant energy that reaches the earth is **reflected** into space. Another 30 percent is used to **evaporate** water, which is lifted into the atmosphere and produces rainfall. Radiant energy is also **absorbed** by plants, the land, and the oceans. In this way, sunlight becomes food.

Capturing sunlight and putting it to work is difficult because the solar energy that reaches the earth is spread out over a large area. The amount of solar energy an area receives depends on the time of day, the season of the year, the cloudiness of the sky, and how close the area is to the earth's equator.

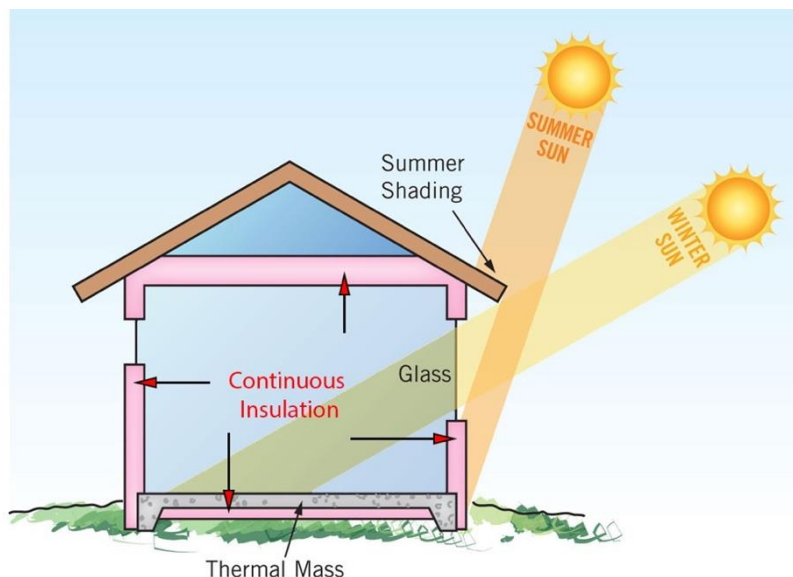
**Activity:** Build a timeline to show that **solar energy has a long history** of use by humans:

<https://www3.uwsp.edu/cnr-ap/KEEP/Documents/Activities/Doable%20Renewables/Over%20the%20Years.pdf>

## Passive and Active Solar Designs collect solar energy.

A **solar collector** is one way to capture sunlight and change it into usable heat energy. A closed car on a sunny day is like a solar collector. As sunlight passes through the car's windows, it is absorbed by the seat covers, walls, and floor of the car. The absorbed energy changes into heat. The car's windows let radiant energy in, but they don't let all the heat out.

A **passive solar** home is designed to let in as much sunlight as possible. It is a big solar collector. Sunlight passes through the windows and heats the walls and floor inside the house. The light can get in, but the heat is trapped inside. A passive solar home does not depend on mechanical equipment, such as pumps and blowers, to heat the house.



An **active solar** home, on the other hand, uses special equipment to collect sunlight. An active solar house may use special collectors that look like boxes covered with glass. These collectors are mounted on the rooftop facing south to take advantage of the winter sun. Dark-colored metal plates inside the boxes absorb sunlight and change it into heat. (Black absorbs sunlight better than any other color.) Air or water flows through the collector and is warmed by the heat. The warm air or water is distributed to the rest of the house, just as it would be with an ordinary furnace system.

### Activity: Design & Build Shoebox Passive Solar Houses

**Materials:** two small cardboard boxes, thermometer, markers, plastic wrap, black construction paper, scissors, tape, sunny day. Optional: aluminum foil, fabric, paper in various colors.

#### Procedure:

1. Gather two cardboard boxes about the same size. Cut two holes in the side of one box. These will be your windows.
2. Use markers to decorate both boxes. Make them look like houses. Be creative!
3. Place both boxes in the sun for thirty minutes to one hour. Use a thermometer to measure the temperature inside both boxes. Which box is warmer?
4. Tape plastic wrap over the windows on one box. Repeat Step 3. Did the plastic wrap keep the box warmer than before?
5. Cover the inside of the box with black construction paper. Repeat Step 3. Did the box get warmer or cooler?

**Extension:** Cover the inside of the boxes with different materials, such as aluminum foil, fabric, or paper in different colors. Which materials keep the box warmest?

Read and watch **videos** about passive solar houses made from recycled materials called "Earthships": <https://newmexiconomad.com/taos-earthships/>

**Video:** Watch a reading of the children's book "We are Building a Passive Solar House" by Martina Feirer and Alexandra Frankel: <https://youtu.be/TFyPkzWdsF4>

# How does solar energy become electricity?

Solar energy can also be used to produce **electricity**. Two ways to make electricity from solar energy are photovoltaics and solar thermal systems.

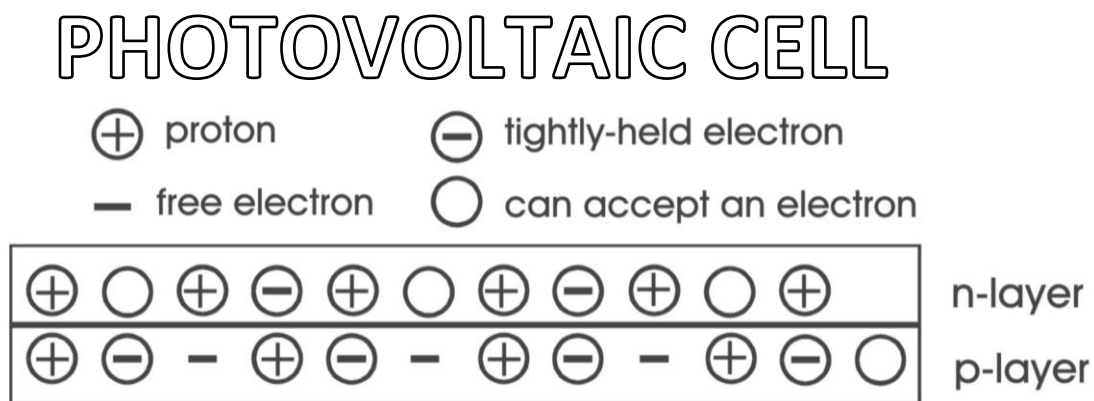
Photovoltaic comes from the words photo meaning light and volt, a measurement of electricity.

**Photovoltaic cells** are also called **PV cells** or **solar cells** for short. You are probably familiar with photovoltaic cells. Solar-powered toys, calculators, and roadside telephone call boxes all use solar cells to convert sunlight into electricity.

Solar cells are made of two thin pieces of **silicon**, the substance that makes up sand and the second most common substance on earth. One piece of silicon has a small amount of **boron** added to it, which gives it a tendency to attract **electrons**. It is called the **p-layer** because of its positive tendency. The other piece of silicon has a small amount of **phosphorous** added to it, giving it an excess of free electrons. This is called the **n-layer** because it tends to give up electrons, a negative tendency. When the two pieces of silicon are placed together, some electrons from the n-layer flow to the p-layer and an **electric field** forms between the layers. The p-layer now has a negative charge, and the n-layer has a positive charge.

When the PV cell is placed in the sun, the radiant energy energizes the free electrons. If you insert these layers into a circuit (connecting them with wires), then **electrons flow** from the n-layer through the wire to the p-layer. The PV cell is producing electricity – the flow of electrons. If a **load** such as a lightbulb is placed along the wire, the electricity will do work as it flows. The conversion of sunlight into electricity takes place silently and instantly. There are no mechanical parts to wear out.

A **solar panel** is an installation of photovoltaic cells set in a structure. Solar panels have been around since 1954 when they were invented by Bell Laboratories. Solar power's key advantage is that it produces no chemicals and is one of the cleanest forms of electricity.



**Video:** Watch an animation of how photovoltaic cells create electricity (NOVA PBS):

<https://nm.pbslearningmedia.org/resource/nvel.sci.tech.solar/solar-power/>

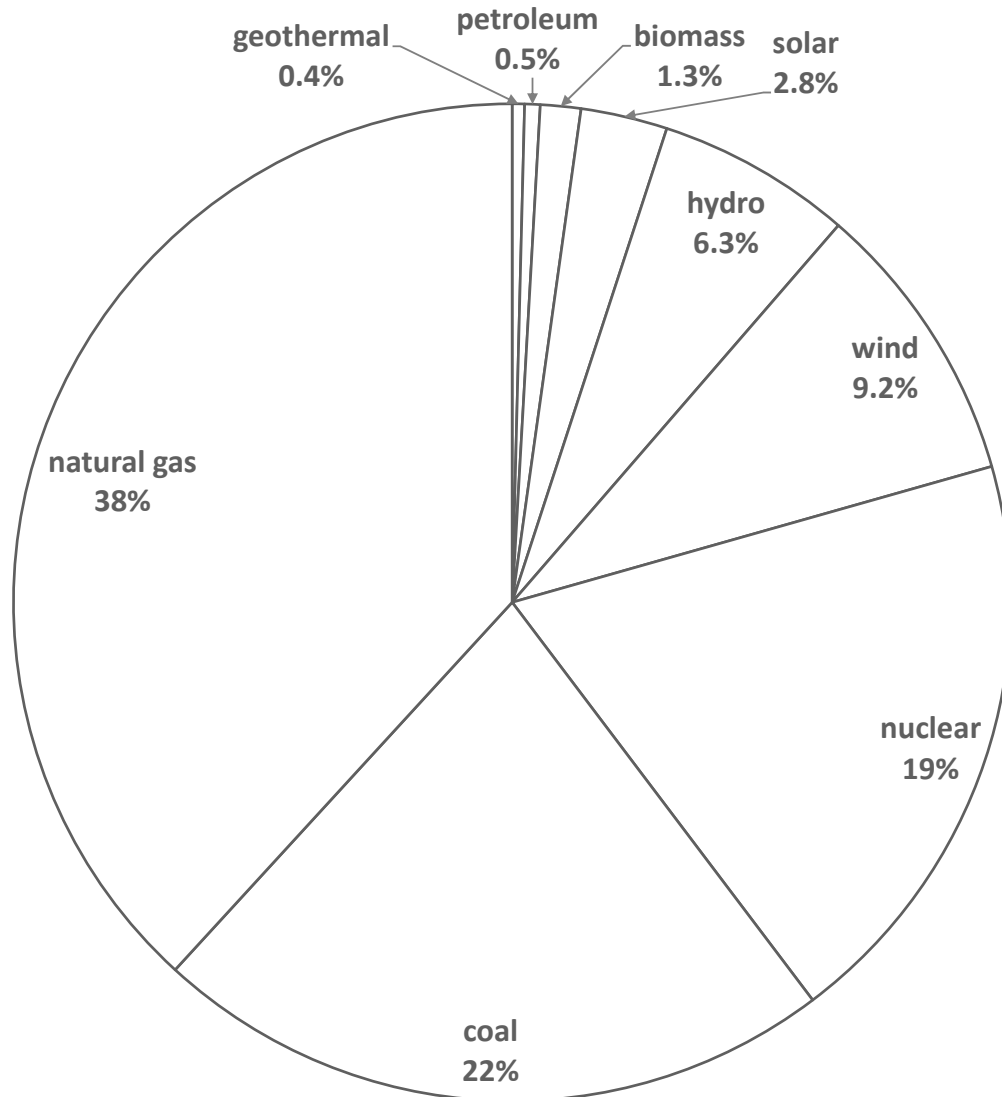
**Activity:** Through a whole-body demonstration, a group of students can reenact how solar cells produce electricity: <https://www3.uwsp.edu/cnr-ap/KEEP/Documents/Activities/TheMiracleofSolarCells.pdf>

Read more about solar panels: <https://kidadl.com/facts/solar-panels-facts-depicting-their-use-in-day-to-day-life>

# How much do we utilize solar energy?

Color the pie chart below. Use shades of green for the **renewable** energy sources. Use shades of red for the **non-renewable** energy sources.

## SOURCES of ELECTRICITY GENERATED in USA, 2021



1. What is the total amount of electricity generated by renewable resources in the USA?
2. What is the largest single source of electricity in the USA?
3. Research the sources of electricity in other countries. How do they compare to the USA percentages? What country has the highest percentage of electricity coming from solar?

(Data is from U.S. Energy Information Administration, February 2022)



# Solar Powered Cooking



**Activity:** Harness solar energy to cook food in a pizza box oven:  
<https://www.sciencebuddies.org/stem-activities/solar-oven>

**Video:** Watch the Zoom Kids test different solar cookers:  
<https://nm.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zsolar/cooking-cookies-with-solar-power/>

**Audio:** Listen to a KUNM Radio interview with engineer Kenneth Armijo and how he uses solar power to roast New Mexico green chile; also, watch a **video** of the roaster:  
<https://www.kunm.org/local-news/2022-07-11/red-or-green-scientists-test-solar-power-to-sustainably-roast-chile>



## More Solar Energy Resources

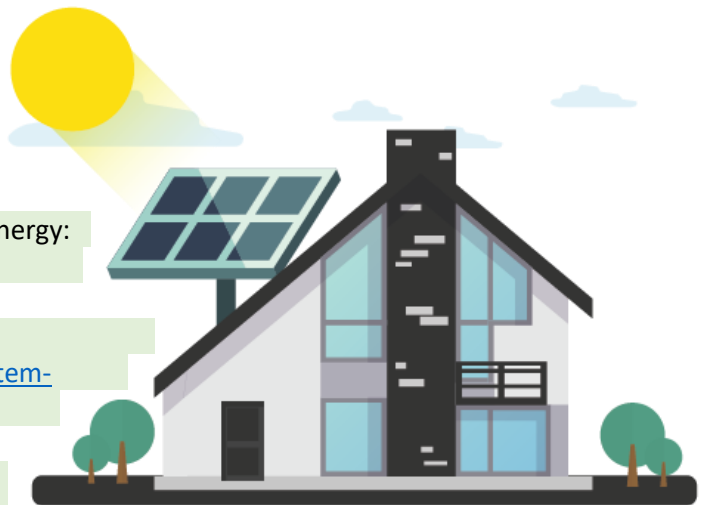
Comprehensive resource for learning about energy:  
<https://www.eia.gov/kids/>

Many activities/experiments:  
<https://www.lgcympower.com/sun-and-solar-stem-experiments-for-kids/>

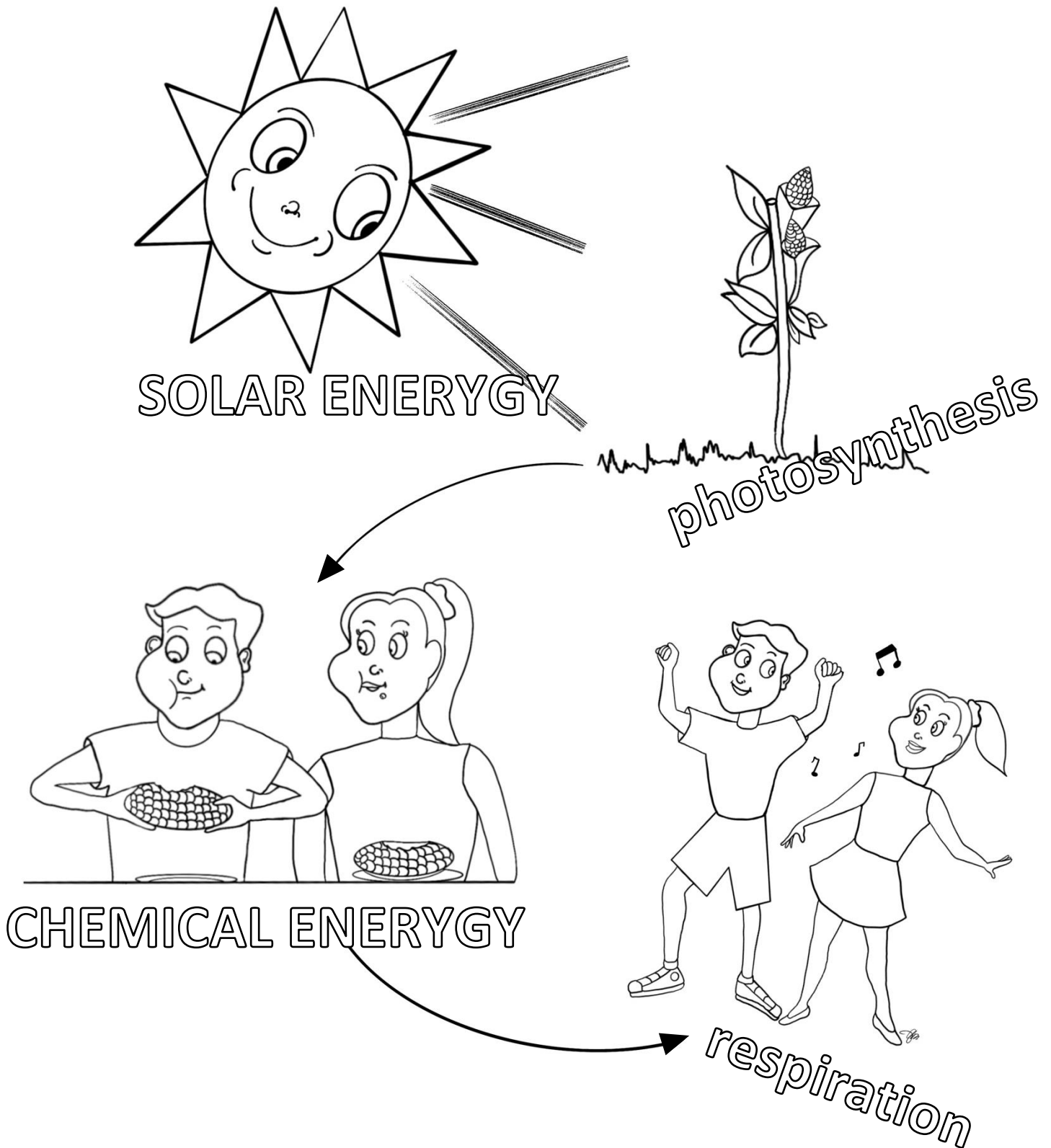
Lesson Plans and background info for grades 3-5:  
[https://www.teachengineering.org/lessons/view/cub\\_energy2\\_lesson09](https://www.teachengineering.org/lessons/view/cub_energy2_lesson09)

Watch how a teacher and his fourth-grade class went from studying electricity to making their classroom 100% solar-powered: <https://youtu.be/8IGjOtiQ1YQ>

Watch Bill Nye demonstrate how a solar sail is propelled only by sunlight and how it can be used to travel in space to detect major events (like asteroids) in our solar system: <https://youtu.be/-ZDSvnzpRNI>



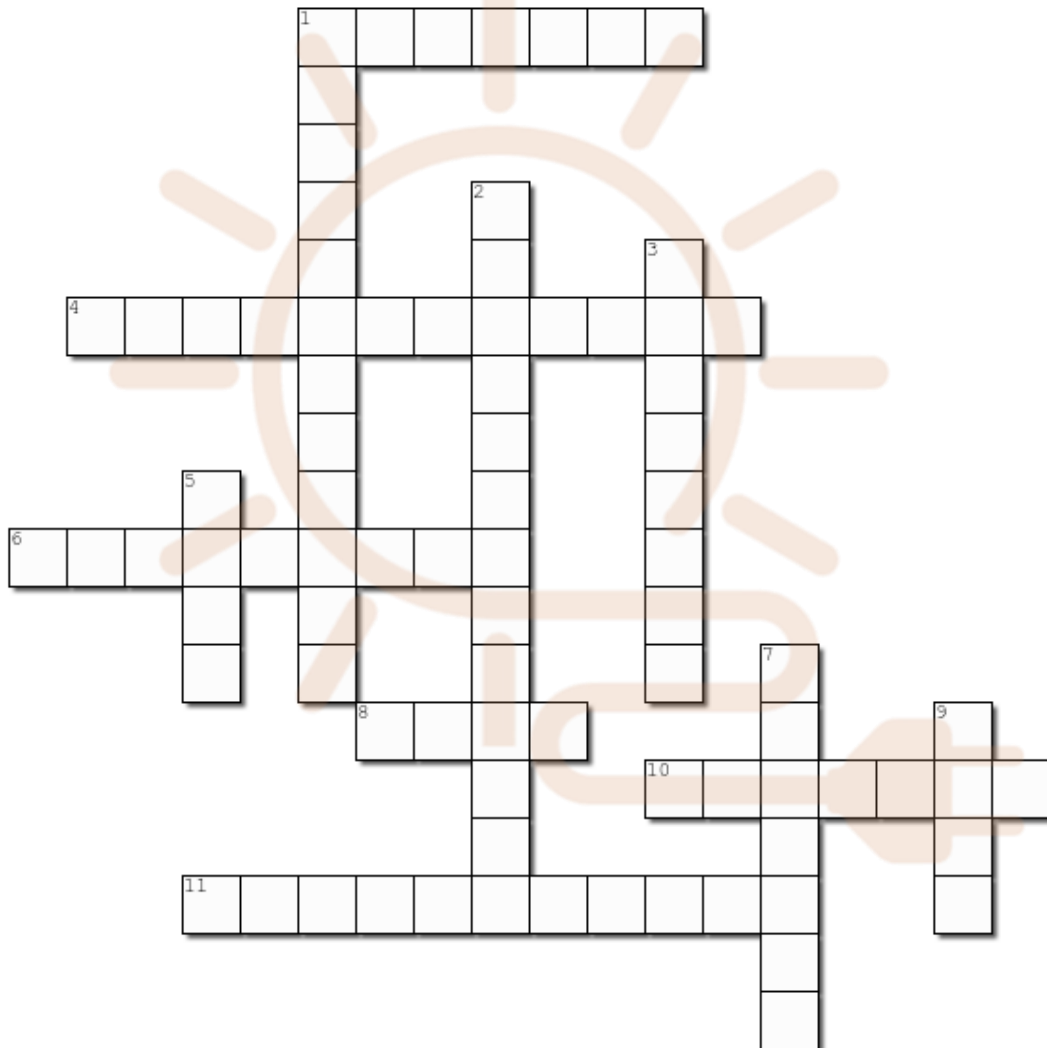
# Humans are solar powered.





## Crossword Puzzle: Solar Energy

Hint: Words used in this puzzle appear in **boldface** in this learning guide.



Created using the Crossword Maker on [TheTeachersCorner.net](http://TheTeachersCorner.net)

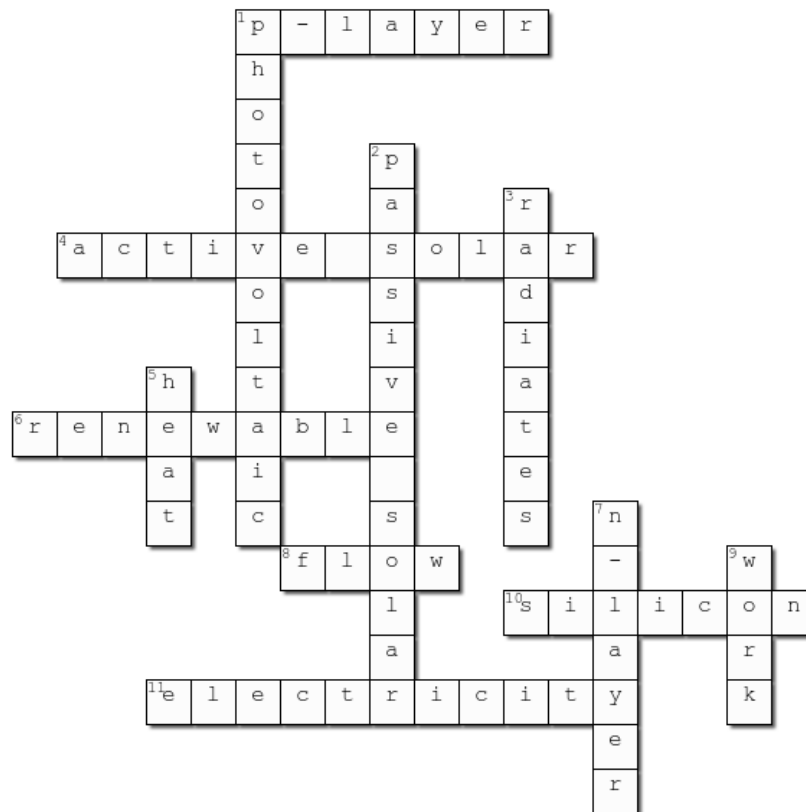
### **Across**

1. part of a PV cell that attracts electrons (positive)
4. the kind of house that uses special equipment to collect sunlight
6. Wind, moving water, and sunshine are all forms of \_\_\_\_\_ energy.
8. When a solar cell is placed in a circuit, electrons \_\_\_\_\_ from the n-layer through the wire to the p-layer.
10. Solar cells are made of two thin pieces of \_\_\_\_\_.
11. the flow of electrons

### **Down**

1. \_\_\_\_\_ cells to convert sunlight into electricity.
2. the kind of home that is designed to let in as much sunlight as possible and to trap heat inside
3. Every day, the sun \_\_\_\_\_ an enormous amount of energy.
5. A closed car collects sunlight energy and changes it into \_\_\_\_\_.
7. part of a PV cell that gives up electrons (negative)
9. Capturing sunlight and putting it to \_\_\_\_\_ is difficult.

## Crossword: Answer Key



Created using the Crossword Maker on TheTeachersCorner.net

### Across

- part of a PV cell that attracts electrons (positive) (**p-layer**)
- the kind of house that uses special equipment to collect sunlight (**active solar**)
- Wind, moving water, and sunshine are all forms of \_\_\_\_\_ energy. (**renewable**)
- When a solar cell is placed in a circuit, electrons \_\_\_\_\_ from the n-layer through the wire to the p-layer. (**flow**)
- Solar cells are made of two thin pieces of \_\_\_\_\_. (**silicon**)
- the flow of electrons (**electricity**)

### Down

- \_\_\_\_\_ cells to convert sunlight into electricity. (**photovoltaic**)
- the kind of home that is designed to let in as much sunlight as possible and to trap heat inside (**passive solar**)
- Every day, the sun \_\_\_\_\_ an enormous amount of energy. (**radiates**)
- A closed car collects sunlight energy and changes it into \_\_\_\_\_. (**heat**)
- part of a PV cell that gives up electrons (negative) (**n-layer**)
- Capturing sunlight and putting it to \_\_\_\_\_ is difficult. (**work**)

## Get Set to Listen: Answer Key

2. Solar energy is the only type of renewable energy. = FALSE [Other types are wind, hydro, biomass, and geothermal.]

5. Solar power generated by solar panels makes up 30% of the electricity generated in the USA. = FALSE [Solar is currently only 2.8% of electricity in USA.]

7. To turn rays of sunlight into electricity, the element carbon is purified to make a semiconductor. = FALSE [The element used is silicon, not carbon.]

All other statements are true.

## Connect to Curriculum

<http://www.corestandards.org>

<https://www.nextgenscience.org/>

<https://artinaction.org/standards/>

<https://www.positiveaction.net/blog/sel-competencies>

Information/Activity	Core Idea	Learning Standards
<b>p.1 Coloring</b>	Create art that represents natural and constructed environments. Describe what an image represents.	NCAS: Creating #2 K Responding #7 K
<b>p.2 Get Set to Listen; What Did you Learn?</b>	Recount or describe key ideas or details from (a text read aloud or) information presented orally or through other media.	Common Core ELA: SL 2
<b>p.3 Activity: Solar History Timeline</b>	Describe the chronology of events... Engage effectively in a ... collaborative discussion... Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details...	Common Core ELA: RI 5 (K-5) SL 1 (6-8) SL 4 (6-8)
<b>p.3, 4, 5</b>	Read and comprehend informational texts, including history/social studies, science, and technical texts...	Common Core ELA: RI 10
<b>p.4 Activity: Shoebox Passive Solar Houses</b> <b>p.7 Activity: Pizza Box Solar Oven</b>	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	4-PS3-4 MS-PS3-3 HS-PS3-3
<b>p.5 Activity: Solar Cell Demonstration</b>	Read and comprehend informational texts, including history/social studies, science, and technical texts... Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy.	Common Core ELA: RI 10 PS3.D
<b>p.6 Sources of Electricity Pie Graph</b>	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs...) Conduct short research projects to answer a question, drawing on several sources...	Common Core ELA: RI 7 (4) WHST 7 (6-8)
<b>p.8 Coloring: Humans are solar powered.</b>	Create art that represents natural and constructed environments. Describe what an image represents. The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.	NCAS: Creating #2 K Responding #7 K PSD.3
<b>p.9 Crossword Puzzle</b>	Use precise language and domain-specific vocabulary to inform about or explain the topic.	Common Core ELA: WHST 2 (6-8)

## About Us

The Children’s Hour Inc is a New Mexico-based non-profit organization that produces an award-winning children’s radio program that is educational, entertaining, and engaging, and includes kids who participate in its creation. The program is internationally syndicated broadcasting on more than 120 public radio stations worldwide. Program themes focus on civics, STEM, culture, and music education, featuring New Mexico children as co-hosts and lead interviewers. Katie Stone has been the executive producer of *The Children’s Hour* for 20 years.

For more information, contact: Katie Stone | (505) 850-3751 | [katie@childrenshour.org](mailto:katie@childrenshour.org)

©2022 The Children’s Hour Inc

## Tell us about you!

We at the Children’s Hour would like to know:

1. How old are you?
2. Was this your first time listening to a radio show or podcast for kids?
3. Was this radio show less fun or more fun compared to other things you do for fun, like playing video games or watching TV?

Less fun       More fun

4. Would you listen to a radio show again if you could?
5. Of everything you heard in the radio show, what will you remember most?

---

---

---

If you would like to draw a picture about anything you learned on the radio show, you can do so below, or on a blank page. Scan and email it to us, and we may display it on our online space.

If you would like to tell the creators of this radio show something in your own voice, you can send a voice message to *The Children’s Hour* here: <https://www.childrenshour.org>. Look for the orange button and click to record.

