

## LESSON PLAN

## Power in South Carolina

Grade 4, 6 &amp; 7



## SUMMARY

In this lesson, the students will interpret charts, graphs, and illustrations to discover the story of power in South Carolina. The students also will see how electricity is generated and distributed in South Carolina.



## LESSON OBJECTIVE

Upon completing this lesson, students will interpret charts, graphs, and illustrations to discover the story of power in South Carolina.



## ESSENTIAL QUESTION

How is electricity generated and distributed in South Carolina?



## DURATION

The activity requires one to three class periods, depending on how much research and presentation time is given.



## MATERIALS

- Internet Access
- **Carbon Footprint Survey** (handout)
- **Your Carbon Footprint Drawing** (handout)
- **What Can You Do to Reduce Your Carbon Footprint?** (handout)
- **Carbon Footprint Virtual Project** (handout)
- Crayons, Markers or Colored Pencils in the suggested colors (red, blue, green and brown)



## COLLEGE &amp; CAREER-READY SCIENCE STANDARDS 2021

## GRADE 4

## STANDARD

**4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**

## DISCIPLINARY CORE IDEA (DCI)

**PS3.B: Conservation of Energy and Energy Transfer**

Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

Light also transfers energy from place to place.

Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light.

## CROSS-CUTTING CONCEPTS (CCC)

**Energy and Matter**

Energy can be transferred in various ways and between objects.



## GRADE 6

### STANDARD

**6-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**

### DISCIPLINARY CORE IDEA (DCI)

#### **PS3.B: Conservation of Energy and Energy Transfer**

The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment.

### CROSS-CUTTING CONCEPTS (CCC)

**Scale, Proportion, and Quantity** Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.

## GRADE 7

### STANDARD

**7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.**

### DISCIPLINARY CORE IDEA (DCI)


#### **PS3.B: Conservation of Energy and Energy Transfer**

When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

### CROSS-CUTTING CONCEPTS (CCC)

#### **Energy and Matter**

Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).





## ENGAGE

Ask the class, **When we switch on a light, what is the source of this power?** Students may say power lines or power plants in general or they may be familiar with a local plant.

Ask, **How was this power created?** Review with students the basics of electric power generation. You can use videos (e.g., Santee CooperTV at <https://youtu.be/c91STdJWOYo> and NEED's Electricity Generation and Transmission at <http://youtu.be/OlrMBY1vkss>) to review the generation process.

Ask, **What can we tell about the different types of fuel sources that are used to produce electricity?** They each create heat that is used to create steam that turns the turbine that creates electricity.



## EXPLORE

Tell the class that there is a lot that they can learn about power in South Carolina from interpreting charts, graphs, and illustrations. Introduce these websites:

1. **South Carolina Profile State Profile and Energy Estimates**, [www.eia.gov/state/?sid=SC](http://www.eia.gov/state/?sid=SC)
  - Walk the students through the main sections of the website – Overview, Data and Analysis. Talk about what kind of information they might find on those pages. Have students look at the South Carolina Quick Facts page at [www.eia.gov/state/print.php?sid=SC](http://www.eia.gov/state/print.php?sid=SC).
  - Next, have students look at the Beta version website at [www.eia.gov/beta/states/states/sc/rankings](http://www.eia.gov/beta/states/states/sc/rankings) and ask what information could be helpful to them on this website.
2. **South Carolina Energy Office** – <http://energy.sc.gov/>
  - Show the students where they can find information pertaining to the assignment (i.e., South Carolina Energy Data, Renewable Energy, Residential).



## EXPLAIN

Using a jigsaw method (explained below), have the students work in groups to research an energy source (e.g., coal, oil, natural gas, nuclear, solar power, wind) used in creating energy. Have the students find the following information:

- **How was it formed or created (for fossil fuels) or what is the process that causes it (solar, etc.)?;**

- **The availability in our state;**
- **Environmental advantages/disadvantages;**
- **Five interesting facts about the energy source** in South Carolina found on the websites.

To run a jigsaw cooperative learning group activity, follow these six simple steps.

- **STEP 1:** Divide the class into groups of six students.
- **STEP 2:** Assign each student the group a different energy source to research.
- **STEP 3:** Give students time to learn and process their assigned segment independently.
- **STEP 4:** Put students who are assigned the same energy source together into an “expert group” to talk about and process the details of their segment.
- **STEP 5:** Have students return to their original “jigsaw” groups and take turns sharing the segments they’ve become experts on.
- **STEP 6:** Have students complete a task (see the Evaluation Activity) that’s reliant on them having understood the material from the contributions of all their group members.



## ELABORATE

The size of your carbon footprint indicates how much impact you have on the environment.

Complete the **Carbon Footprint Survey** and color a footprint to show the relative size of your family’s impact on the environment. The survey is available at [www.energystar.gov/ia/products/globalwarming/downloads/GoGreen\\_Activities%20508\\_compliant\\_small.pdf](http://www.energystar.gov/ia/products/globalwarming/downloads/GoGreen_Activities%20508_compliant_small.pdf).

Read the following **BACKGROUND INFORMATION** with the students.



## DID YOU KNOW?

**South Carolinians consumed 329 million BTUs of energy per person in 2018.** A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

SOURCE: <https://south-carolina-energy-office-1-1-scors-eo.hub.arcgis.com/pages/electricity-data>



## BACKGROUND INFORMATION

The light and heat from the sun support life on Earth and provide energy needed for plants to grow. Energy from the sun drives the Earth's weather and climate. The Earth absorbs some of the energy it receives from the sun and radiates (sends out) the rest back toward space. However, certain gases in the atmosphere, called greenhouse gases, absorb some of the energy radiated from the Earth and trap it in the atmosphere.

These gases act as a blanket, making the Earth's surface warmer than it otherwise would be. In the past 100 years or so, humankind has created machines, factories, and vehicles that have greatly increased the amount of greenhouse gases in our atmosphere. This increased level of greenhouse gases means more heat is held in the atmosphere and the Earth is getting warmer.

These warmer temperatures are causing changes around the world on land, in the oceans, and in the air. This could upset the delicate balance that sustains life. Whether we realize it or not, we all emit carbon dioxide, one of the greenhouse gases, through our day-to-day activities. The amount we emit is referred to as our "carbon footprint." The bigger the footprint, the more carbon dioxide that comes from each of us as a result of the choices we make.

Climate change caused by excess greenhouse gases and a big carbon footprint can cause:

- **Heat waves** that damage crops, stress livestock, and make life difficult for people;
- **More air pollution**, which is linked to allergies, asthma, and other health problems;
- **Severe storms and flooding** due to higher sea levels; and
- **Loss of habitat** as the climate changes, particularly in Arctic regions.

Families can help reduce their carbon footprint by focusing on four major areas that generate excess carbon dioxide:

1. **Housing and household energy use;**
2. **Transportation;**
3. **Personal habits;** and
4. **Recycling.**

You'll have the chance to estimate the relative size of your family's carbon footprint as well as learn easy ways you can help reduce it.

Have students take the **Carbon Footprint Survey** in class. Complete this as a whole group activity, with each student having their own footprint handout.

The **Carbon Footprint Survey** will ask a series of questions that will direct the participant to color lines around the footprint drawing. The more greenhouse gases you produce, based on your answers, the bigger the carbon footprint grows.

The following color crayons will represent the four categories of behavior surveyed.

- **Housing and Home Energy: RED**
- **Transportation: BLUE**
- **Personal Habits: GREEN**
- **Recycling Habits: BROWN**

Have the students evaluate their footprints and make some observations about how they may reduce their carbon footprint on the back of the handout.

As a class, read through the **"What can you do to reduce the size of your carbon footprint?" Handout.**



## EVALUATE

Have the student groups create a way to communicate the information they learned through their research.

Allow the groups to create a poster or online presentation using a program that the students are familiar with. Have the students share presentations, if time permits.



## E-LEARNING ACTIVITY

### RESOURCES FOR TEACHERS

See Santee Cooper's Educational Resources at <https://sites.google.com/view/santee-cooper-teacherresources/home?authuser=0>.

### RESOURCE FOR STUDENTS

See the online module about energy sources at <https://lsintspl3.wgbh.org/en-us/lesson/ttv-g3m6-Energy/1>.

# CARBON FOOTPRINT SURVEY

Some of our lifestyle choices and day-to-day activities emit excess carbon dioxide and other greenhouse gases into the atmosphere. The amount of greenhouse gases we produce is referred to as our "carbon footprint." Too much carbon dioxide and other greenhouse gases in our atmosphere can lead to unnatural climate change, which can have a harmful effect on our planet. Take this survey to get a sense of the size of your family's carbon footprint.

## HOUSING AND HOME ENERGY (RED)

1. If you live in a single-family home, **color 4 rings RED**; if you live in an apartment or other type of home, **color 2 rings RED**.
2. If you don't use energy-efficient light bulbs such as LEDs (light-emitting diode), **color 1 more ring RED**.
3. If your home doesn't have a programmable thermostat, **color 1 more ring RED**.
4. If you are not familiar with the Energy Star appliance rating system, **color 1 more ring RED**.

## TRANSPORTATION (BLUE)

5. For every small car in your family, **color 1 ring BLUE**.
6. For every medium or large car in your family, **color 2 rings BLUE**.
7. If you don't regularly change the air filter on your car and check the tire pressure, **color 1 more ring BLUE**.
8. For every airplane trip you've taken in the past year, **color 1 more ring BLUE**.

## PERSONAL HABITS (GREEN)

9. If you are a vegetarian, **color 1 ring GREEN**; if you are not a vegetarian, **color 2 rings GREEN**.
10. If you never eat organic food, **color 1 more ring GREEN**.
11. If you take baths, run the faucet while brushing your teeth or washing dishes, or water your lawn several times a week, **color 1 ring GREEN**.

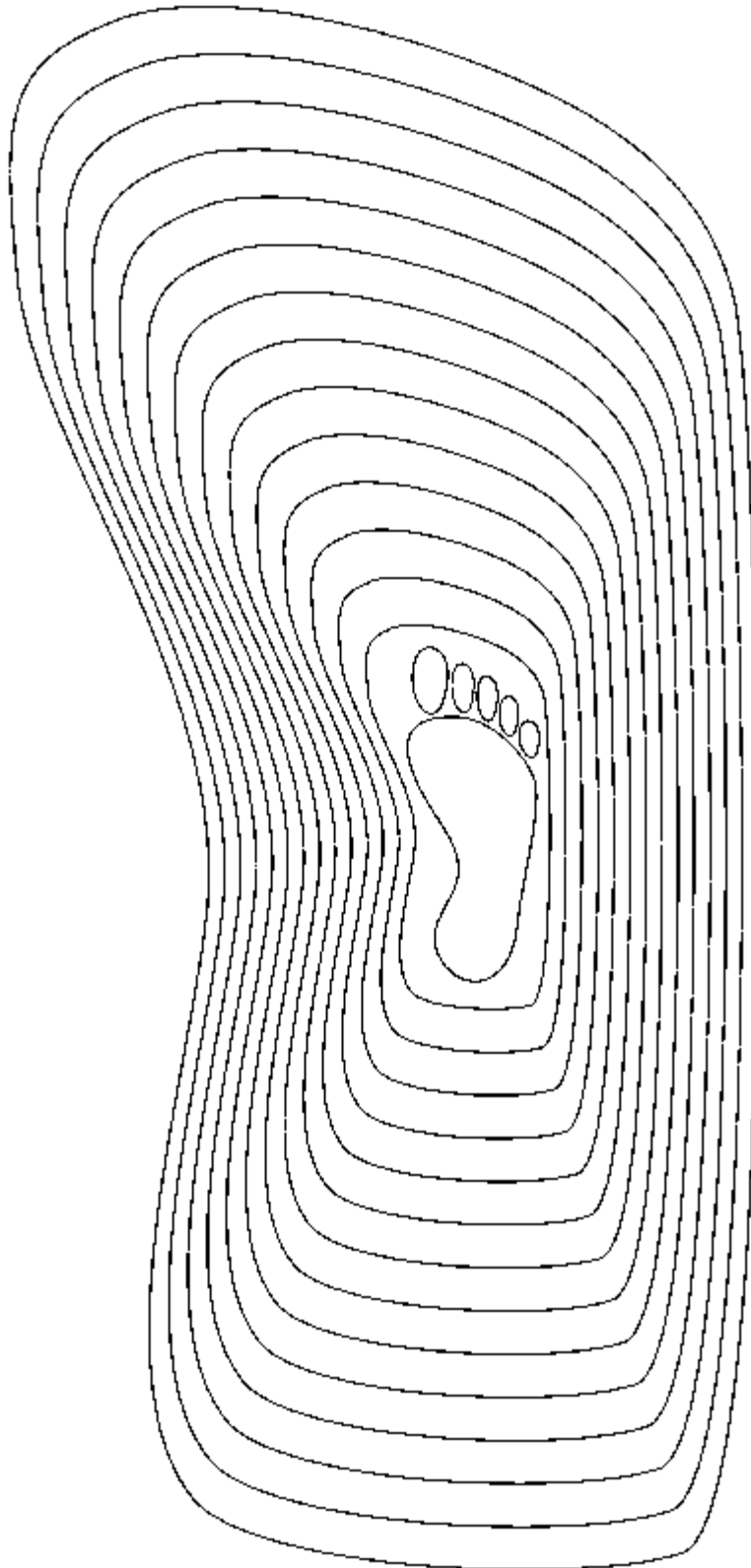
## RECYCLING AND WASTE (BROWN)

12. If you usually recycle your household trash, **color 1 ring BROWN**; if you never recycle, **color 2 rings BROWN**.
13. If you never compost your yard and kitchen waste, **color 1 more ring BROWN**.

***Now read on to learn what you can do to reduce the size of your carbon footprint.***

# YOUR CARBON FOOTPRINT DRAWING

Based on the Carbon Footprint Survey, color the rings around the footprint (start from the center) to estimate the relative size of your family's carbon footprint. What can you and your family do to reduce the size of your carbon footprint?



# WHAT CAN YOU DO TO REDUCE THE SIZE OF YOUR CARBON FOOTPRINT?

1. Single-family homes generally consume more energy per resident than multifamily housing such as apartment buildings. No matter where you live, there are things you can do to reduce the amount of energy your home uses, thus reducing your carbon footprint.
2. Energy-efficient light bulbs such as LED light bulbs consume less electricity than conventional incandescent light bulbs. Change your household fixtures to LEDs and you'll save money on your household energy bills, too.
3. A programmable thermostat turns your home's heating or air-conditioning up and down automatically, depending on the time of day. When your home's energy system is working efficiently, it wastes less energy, thus reducing your carbon footprint.
4. Energy Star rated appliances use less energy. When purchasing new appliances such as a refrigerator, range stove, microwave, or air conditioner, look for the Energy Star label to save energy, save money, and reduce your carbon footprint.
5. All gasoline-powered automobiles emit carbon dioxide.
6. The larger the car, the more carbon dioxide is emitted.
7. Cars that are properly maintained are more energy-efficient. Be sure to regularly change the air filter and make sure the tires are always properly inflated.
8. Virtually all modes of transportation consume energy, thus they impact your carbon footprint.
9. The growing, processing, packaging, delivery, and distribution of food requires energy from farms, factories, trucks, grocery stores, and more. Because a vegetarian diet does not include meat, a vegetarian tends to have a smaller carbon footprint than does a nonvegetarian.
10. The production of organic food puts less stress on the environment, so your carbon footprint is smaller if you tend to eat organic food.
11. Water that goes down our drains and sewers must be processed through water treatment plants, even if the water is clean. Using only the amount of water you really need helps reduce your carbon footprint.
12. Recycling is good for the environment because it keeps excess waste out of landfills and trash incinerators. If you recycle on a regular basis, your carbon footprint is smaller.
13. Composting is good for the environment because it keeps kitchen and garden waste out of the trash and it encourages natural gardening practices. If you compost at your house, your carbon footprint is smaller.

# CARBON FOOTPRINT VIRTUAL PROJECT

Read through the following questions, prompts, and directions and complete them accordingly. Answer these questions as best as you can. Afterward, watch the video provided and then add information to your answer. Type them in two different colors – **blue** for your initial response and **green** for your response after watching the video.

## 1. When we switch on a light, what is the source of this power?

ANSWER (before video): \_\_\_\_\_

ANSWER (after video): \_\_\_\_\_

## 2. How was this power created?

ANSWER (before video): \_\_\_\_\_

ANSWER (after video): \_\_\_\_\_

Here's a video to watch – Video One: <https://youtu.be/OlrMBY1vkss>. Use it to help answer the questions again.

## 3. What can we tell about the different types of fuel sources that are used to produce electricity?

HINT: They each create heat that is used to create steam that turns the turbine that creates electricity.

## 4. There is a lot that you can learn about power in South Carolina from interpreting charts, graphs, and illustrations. Visit these websites.

- See **South Carolina Profile State Profile and Energy Estimates** at [www.eia.gov/state/?sid=SC](http://www.eia.gov/state/?sid=SC) – and review the Overview, Data, and Analysis sections. What kind of information did you find on this page?

\_\_\_\_\_

\_\_\_\_\_

- See the **Beta Version Website** at [www.eia.gov/beta/states/states/sc/rankings](http://www.eia.gov/beta/states/states/sc/rankings). What information could be helpful to you from this website?

\_\_\_\_\_

\_\_\_\_\_

- See **South Carolina Energy Office Website** at <http://energy.sc.gov/> – and review the South Carolina Energy Data, Renewable Energy, Residential

## EXPLAIN:

Use your resources to research and explain an energy source (e.g., coal, oil, natural gas, nuclear, solar power, wind) used in creating energy. Pick one of the energy sources to answer the questions about. You may work with a friend to answer the following questions.

## 1. How was it formed or created (for fossil fuels) or what is the process that causes it (solar, etc.)?

\_\_\_\_\_

## 2. What is the availability in our state?

\_\_\_\_\_

## 3. What are the environmental advantages/ disadvantages?

\_\_\_\_\_

\_\_\_\_\_

## 4. Provide five interesting facts about the energy source in South Carolina found on the websites.

1) \_\_\_\_\_

2) \_\_\_\_\_

3) \_\_\_\_\_

4) \_\_\_\_\_

5) \_\_\_\_\_



## ELABORATE:

The size of your carbon footprint indicates how much impact you have on the environment. Complete the **Carbon Footprint Survey** and color a footprint to show the relative size of your family's impact on the environment. The survey is available at [www.energystar.gov/ia/products/globalwarming/downloads/GoGreen\\_Activities%20508\\_compliant\\_small.pdf](http://www.energystar.gov/ia/products/globalwarming/downloads/GoGreen_Activities%20508_compliant_small.pdf).

## BACKGROUND INFORMATION:

*Read this before continuing.*

The light and heat from the sun support life on Earth and provide the energy needed for plants to grow. Energy from the sun drives the Earth's weather and climate. The Earth absorbs some of the energy it receives from the sun and radiates (sends out) the rest back toward space. However, certain gases in the atmosphere, called greenhouse gases, absorb some of the energy radiated from the Earth and trap it in the atmosphere.

These gases act as a blanket, making the Earth's surface warmer than it otherwise would be. In the past 100 years or so, humankind has created machines, factories, and vehicles that have greatly increased the amount of greenhouse gases in our atmosphere. This increased level of greenhouse gases means more heat is held in the atmosphere and the Earth is getting warmer.

These warmer temperatures are causing changes around the world on land, in the oceans, and in the air. This could upset the delicate balance that sustains life. Whether we realize it or not, we all emit carbon dioxide, one of the greenhouse gases, through our day-to-day activities. The amount we emit is referred to as our "carbon footprint." The bigger the footprint, the more carbon dioxide that comes from each of us as a result of the choices we make.

Climate change caused by excess greenhouse gases and a big carbon footprint can cause:

- **Heat waves that damage crops, stress livestock, and make life difficult for people;**
- **More air pollution, which is linked to allergies, asthma, and other health problems;**
- **Severe storms and flooding due to higher sea levels;** and
- **Loss of habitat as the climate changes, particularly in Arctic regions.**

Families can help reduce their carbon footprint by focusing on four major areas that generate excess carbon dioxide:

- 1. Housing and household energy use;**
- 2. Transportation;**
- 3. Personal habits;** and
- 4. Recycling.**

In the game, you'll have the chance to estimate the relative size of your family's carbon footprint as well as learn easy ways you can help reduce it.

## CARBON FOOT PRINT SURVEY:

1. Complete the survey handed out to you or print it off in the link above. The following color crayons will represent the four categories of behavior surveyed.

<b>Housing and Home Energy: RED</b>
<b>Personal Habits: GREEN</b>
<b>Transportation: BLUE</b>
<b>Recycling Habits: BROWN</b>

2. Complete the **Carbon Footprint Survey**.
3. Color in the **Carbon Footprint** document. Color from the inside out. Each time you need to color, make sure you're coloring a new ring and are not coloring over a ring.
4. Read the **"What Can You Do To Reduce The Size of Your Carbon Footprint?"** worksheet and reflect on the information

## EVALUATE:

Create a poster (physical or virtual), online presentation, video, TikTok, song, or something else that you can share what you have learned.

## REQUIREMENTS:

One way of reducing our Carbon Footprint is to bring awareness of the issue.

- **List at least three specifics of how to reduce your carbon footprint.**
- **List at least three consequences of not reducing your carbon footprint.**
- **Include at least 2 or 3 illustrative examples.**

## FUN FACT:

Did you know that South Carolinians consumed 329 million BTUs of energy per person in 2018. A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

SOURCE: <https://south-carolina-energy-office-1-1-scors-eo.hub.arcgis.com/pages/electricity-data>

**NOTE:** This activity is shared with permission from Alexis Del Castillo.