Conserving Energy

Preparation Time:	Easy-to-do	**Moderate**	Extensive

Grade:	4 – 5
Focus:	How insulation helps conserve energy
Subject:	Science, Math
Materials:	See list below
Teaching Time:	Several class periods
Vocabulary:	Conservation, insulation

Learning Objective

Students will:

- distinguish between electrical necessities and electrical luxuries;
- survey their homes for energy efficiency;
- compare insulation values of various materials;
- recognize the importance of insulation as an energy saver.

Materials

- student handouts "Home Energy Conservation Checklist & My Home Energy Conservation Proposal" included
- student activity sheet "Meltdown" included
- math sheet "Insulation Percentages" included
- several thermometers for taking temperature in classroom;
- ice cubes (one for each student)
- paper cups (one for each student)
- insulation materials (large enough to wrap paper cup; assign students to bring these)

Learning Procedures

1. As a class, have students prepare a list of the 10 most needed uses of electricity at home. *(Note: these may include the stove, refrigerator, lights, heating, air conditioning, heating hot water, microwave, TV, alarm clocks, washing machine, clothes dryer, hair dryer, etc.)*

   Discuss what life would be like without these 10 most needed uses of electricity. Are these items necessities or luxuries? *(Have the class make determinations based on their opinions. There are no right or wrong answers.)*

2. Have the class list other uses of electricity outside their home that are necessities. These might include traffic lights, hospital equipment, etc.

3. Discuss with the class that there is an alternative at home to just not using electricity, and that the alternative is ***conserving*** electricity by using energy-efficient appliances and by using them wisely.

   Ask: What are examples of wasting electricity? Review your top 10 list and how electricity can be wasted by improper use. For example, running the heat with windows open, leaving lights on when no one is home, leaving televisions on when you're not watching.

4. Distribute copies of the handout "My Home Energy Conservation List" and discuss. What do students think about these conservation methods? Which ones are students already

DOWN to Earth

Insulation is rated in terms of thermal resistance, called R-value, which indicates the resistance to heat flow. The higher the R-value, the greater the insulating effectiveness.

Source: Energy Efficiency and Renewable Energy Clearinghouse

doing? Which ones do they think make a difference? Which ones do they think are too much trouble or too inconvenient?

Ask students to select several of these conservation methods to discuss with their family. Use the My Home Energy Conservation Proposal form included with this lesson and have students fill out suggestions for their family. Encourage students to take the list home.

Conserving Energy at School

5. Try to locate the areas of your classroom with the greatest heat/energy loss (during the heating season or the area of greatest cooling loss in the summer). Ask students to predict where these areas might be. Write their predictions on the board. Then place several thermometers around the classroom (by doors and windows, high in the class and low to the floor, next to an inside wall, (avoid putting a thermometer next to the heating/cooling register) and assign a team of students to take readings at various times during the day (every hour works well). Record their findings on the board by location and determine:

   - Where is the room warmest?
   - What is the coldest location?
   - Where do you think heat is moving out of the room?
   - What are your ideas for keeping heat in the room?

6. Discuss how **insulation** helps keep heat in the classroom. Insulation is any material that prevents the movement of heat.

   Tell students that they are going to conduct an experiment in class testing different types of materials for their insulation quality. Assign students to bring in a piece of insulation material that they think will help to keep an ice cube from melting. This might be a scrap of cloth, plastic, paper, etc. Ask students not to bring Thermos™ bottles or coolers.

For the experiment:

- Give each student a copy of the "Meltdown" student activity sheet to review.

- Quickly give each student an ice cube in a paper cup and instruct students to wrap the cup and cube in their material quickly.
  • Have all students place their experiment cups in the same location. Remind them that the temperature in the room can vary and that this variation would effect the experiment results.

- You will need to call out the start and check times so that all students are working on the same timeline.

- Allow students to check their experiments and record results on their student sheets.

- During the experiment as students say their cube has melted, record on the board the type of insulation material and the time.

Ask the class, which ice cube lasted longer? What was the most effective insulation? What is the purpose of insulation?

Extension Activity

In this math activity, students will take what they've learned about the value of insulation and apply it to home energy Btu use. Explain that a Btu is a measurement of energy. A Btu is equal to the energy released by one burning match. For example, if it took 40,000,000 Btus of electricity to heat a house for one year, that would be equal to burning 40,000,000 matches.

Have students use their math skills to compute the amount of energy lost by leaks and improper insulation on the "Insulation Percentages" sheet.

You may bring in a copy of an electric power bill to show how energy is recorded for billing. Your electricity bill will use kilowatt-hours to measure the energy used.

 Name: _____

Melt Down

This experiment can give you a clue about how energy used for heating and cooling your home and school can be conserved.

1. Place the ice cube in the paper cup and wrap your insulation material around the cup. Wrap tightly so that the cup can still sit upright on your desk. Do not handle your cup too much. (Remember your hands are warm!)

2. Record on the chart below the time the experiment began. Your teacher will call out this time for you.

3. Place your insulated cup in the area your teacher has set aside. (Remember temperatures vary around the class. It is important that all the cups are placed in the same location.)

4. Periodically check your cup to see how much of the ice has melted.

5. Record the progress of your ice cube. Record these stages:

   - started melting;
   - melting some;
   - mostly melted;
   - melted.

6. Subtract the time your ice cube melted from the time the experiment began to find out how long it took your ice cube to melt.

Melt Down Record

START TIME:	5 MINUTES	10 MINUTES	15 MINUTES	20 MINUTES	FINISH TIME:

1. My ice cube was wrapped in _____ .

2. My ice cube melted in _____ minutes.

Insulation Percentages

As much as 10 percent of the heat in your home is lost through air leaks, 20 percent is lost through doors and windows, 30 percent is lost through exterior walls and floors, and 40 percent lost through the ceiling and roof.

1. During the winter, the Smiths used 40,000,000 Btus of heat in their home. 16,000,000 Btus of this heat was lost through the ceiling, walls, floors, windows, doors, and air leakage. How much of this lost heat was through the ceiling and roof?

   Your Answer:_____

   A. The family installed insulation in the attic which would cut the heat loss through the ceiling and roof to 25%. How many Btus would then be lost through the ceiling and roof?

      Your Answer: _____

   B. How many Btus would be saved by this insulation in the ceiling and roof?

      Your Answer: _____

   C. How many Btus would be saved over the next five years?

      Your Answer: _____

2. Last year the Martins used 38,000,000 Btus to heat their home. 15,200,000 Btus of this heat were lost through the ceiling, walls, floors, windows, doors, and air leakage. How much of this lost heat was through exterior walls and floors?

   Your Answer:_____

   A. After installing insulation in the walls, the heat loss was reduced to 23%. How many Btus would then be lost through the walls and floors?

      Your Answer: _____

   B. How many Btus would be saved by installing this insulation in the walls and floors?

      Your Answer: _____

   C. How many Btus would be saved over the next five years?

      Your Answer: _____

Home Energy Conservation Checklist

Heating and Cooling Conservation

- Adjusting your thermostat is the best and least costly conservation measure. Try to get used to lower temperatures in winter and warmer temperatures in summer. See if your family will agree to set the temperature at 68 degrees or lower for winter heating savings, and 78 degrees or higher for summer cooling savings. You will save 5-6 percent on the utility bill!

- Locate the thermostat on an inside wall that's not near sunlight, vents or lamps. This way you'll get an accurate reading of the temperature.

- Dress appropriately. Keeping comfortable has a lot to do with how well you insulate or ventilate your own body. Try loose fitting clothing, open collars and open weaves for hot weather, layers of clothes and closed collars for colder weather.

- In cold weather, use more blankets or a down comforter.

- In the winter months, leave shades, blinds, and curtains open on sunny days so you can make use of the sun's heat. Close them on cloudy days to prevent heat loss. Reverse the process in the summer.

- Close the fireplace damper when it's not in use to prevent heat loss.

- Don't cover the top of heating or cooling vents with knick-knacks, bowls or belongings. This makes it necessary to use more energy. Also, don't hide vents behind draperies for the same reason.

- Help cool weather to come in. The more cool air you let in, particularly at night, the better. Experiment to see which windows and doors to open or close or to create the best flow of cool air through your home.

- Let hot air out. Encourage your parents to open the upper vents in your attic, and make sure any lower vents are not blocked.

- Since hot air rises, open the upper part of double hung sash windows and, in a two-story house, the upstairs windows.

- Let breezes in. If windows are blocked by shrubs or tree foliage, the bushes might need pruning.

- An exhaust fan in a window can push out warm air and pull in cool air. A window fan is more economical to run than an air conditioner. A window fan in an apartment or one-story house should be in a window on the warmest side; in a two-story house, put it in an upstairs window.

- Use ceiling fans if you have them. In the winter run them counterclockwise to force hot air downward. In the summer, run them clockwise to circulate cooled air.

- If you have central air conditioning, don't close off unused rooms or shut off vents. Rather than saving energy, this makes the system work harder.

- It may be easier to move yourself into a warm sunny room on a cold day, say to do homework or eat a snack, than it is to move that free solar heat to a cooler part of your home. And upholstered furniture, like a big armchair or sofa, will soak up the heat very nicely when placed in a sunny spot.

- Encourage your family to use storm doors and windows. Make sure the storm windows are fastened tightly and the doors are closed properly.

- When it's time to paint the outside of your home, suggest using light colors. Since South Carolina's climate tends to be warm, light-colored paint is a good choice because it reflects sunlight.

Water Heating Conservation

- Use hot water wisely. Don't let water run while you go in the other room. Don't use hot water if cold or lukewarm will do. For example, run the garbage disposal with cool water, not warm.

- Try to get in the habit of taking a shower instead of a bath. Showers typically use less hot water. Water-saving shower heads will typically pay for themselves in a few months.

- Be on the alert for leaky faucets. A two-cent washer can save hundreds of gallons of water over the course of a year.

- Wash clothes in cold water when possible.

Appliance Conservation

- Cut back on the amount of water you use for boiling eggs, potatoes and other foods. The more water you use, the more energy is needed to make it boil or simmer.

- Use pots that are the same size as a burner, so that heat doesn't escape.

- Make sure pot and pan lids fit tightly. This keeps heat inside. It also makes the food cook faster.

- If you have a toaster oven or electric frying pan, use it. They use half the electricity of an electric oven.

- Every time you use a microwave, you save energy. Microwaves not only cook food in one-fourth the time, they save 30-70% electricity.

- Avoid peeking in the oven. It not only makes a souffle fall, it drops the oven's temperature 25-50°F every time it's opened.

- Periodically vacuum the condenser coils on the back or bottom of your refrigerator. (Unplug it first!) Dust acts as an insulator on the cables, making the refrigerator work harder.

- Refrigerators and freezers work best when they are full. However, items need to have space between them so that air can circulate.

- Don't place hot or uncovered foods in the refrigerator. It takes increased energy to cool hot foods. Uncovered foods will lose moisture to the refrigerator.

- Test to make sure the refrigerator and freezer seals are working by placing a dollar bill lengthwise along the edge and closing the door. If the dollar falls, your appliance needs to have the seal replaced. An airtight seal helps the appliance work efficiently.

- Utility companies suggest that you put petroleum jelly along refrigerator and freezer seals to make them last longer.

- Defrosting frozen foods in the refrigerator helps the refrigerator stay cool. It also uses less energy than microwave defrosting and, in the case of Thanksgiving turkey, is safer than

defrosting on a countertop where bacteria might grow.

- A freezer with more than 1/4 inch of ice needs to be defrosted to save energy.

- Always wait until you have a full load to run the dishwasher, washer or dryer. Full doesn't mean overloaded. Overloading wastes energy and rarely gets the job done. On a sunny day, think about using the solar dryer - the clothes line.

- Turn off the TV, radio, computer or video game when they're not in use.

- If you have an "instant on" TV, part of the TV is actually on all the time. One way to really turn this type of TV off is to plug it into a socket that is controlled by a light switch and to use that light switch when you turn off the set.

- Encourage your family to pay attention to the yellow energy tags and labels when buying new appliances. Comparing tags is an excellent way to help your family make an energy-wise choice. The higher the efficiency level, the greater the savings as you use the appliance.

Lighting Conservation

- Use lower watt bulbs in stairwells, closets and areas that don't require reading light.

- To make a room brighter, use one bulb of high wattage. For example one 100 watt bulb uses less energy than two separate 50 watt bulbs.

- Use energy-saver bulbs. These give as much light as conventional bulbs but use less energy.

- Encourage your family to use fluorescent bulbs. These tube-shaped bulbs are comparatively expensive to buy, but are long-lasting and extremely economical over the long run.

- Suggest using light-colored lamp shades. They reflect 50 percent more light than dark shades.

- Try placing a lamp in a corner of a room. Here, it has two surfaces to reflect off of rather than just one wall.

Observe a "No Cooking Day" once a week. Eat cold cereals, sandwiches, salads and fruit. It's healthy, too.

My Home Energy Conservation Proposal

I suggest that my family look at these ways to save energy. I'm willing to do my part to see that these energy-saving ideas work for my family.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

SOUTH CAROLINA Energy Office

Living Without Power

Preparation Time:	Easy-to-do	**Moderate**	Extensive

Grade:	4 – 5
Focus:	How our life-style depends upon available electricity
Subject:	Language Arts, Social Studies
Materials:	Handouts and news clips from Hurricane Hugo included with this lesson (one per student)
Teaching Time:	One class period plus student writing
Vocabulary:	Power outage

Learning Objectives
The affect that our use of electricity has on our life-style and our expectation of services are explored as students write creative stories from factual newspaper clippings.

Students will:
- identify facts in a newspaper article;
- write a creative story using these facts and their imagination.

Learning Procedures
1. Hand out copies of the news articles that report on Hurricane Hugo and the massive **power outages** resulting from this storm that hit South Carolina in 1989. Read aloud or have students read the articles to themselves.

2. Ask students to write their answers to the questions on the Student Question Sheet or have students answer questions in a class discussion.

3. Ask students to imagine they are living in a house that uses electricity for heat, lights, appliances, etc. A storm occurs and knocks down the electric lines for several days. Have students write a short, creative story describing how life would be affected. Have students describe how they would spend their day – how they would prepare food, stay warm or cool, and use their time.

4. As an art project, have students illustrate their stories.

5. Review with the class the materials from SCE&G utility company that show how power lines distribute electricity to our homes and how downed trees can interrupt service.

Extension Activities
1. Have students rewrite their stories imagining that alternative power sources are in their home. This might include solar power heating, skylights, or their own energy "inventions," etc.

2. Have students write short compositions on energy-related topics.

Suggestions:
1. How Energy Will Affect Our Life-style in the Year 2050

2. The Day The Sun Stopped Shining

3. My New Electric Car

4. Blackout In The Big City

5. My New Energy Machine

DOWN to Earth

Commercial fossil fuels supply over three-quarters of the world's total energy requirements.

Source: Energy for Tomorrow's World

Student Question Sheet *Name:* _____

Hugo Hits South-Carolina

Read the articles attached that appeared in *The State* newspaper – "Hugo: The Aftermath" graphic & "Utilities", "Powerless relying on friends' generosity", "Storm leaves trail of destruction throughout the state" – in the days following the hurricane, then answer these questions.

1. On Wednesday, September 27, 1989, *The State* reported how many counties as disaster areas?

   _____

2. On Wednesday, September 27, 1989, *The State* reported the estimated total damage as

   _____.

3. On Wednesday, September 27, 1989, *The State* published a graphic - how many counties were damaged by the hurricane?

   _____

4. What are residents hit by the hurricane warned to do with their water to make it safe to drink?

   _____

5. In Kingsville, Lillian McFadden and her family reported that they are eating where after the hurricane knocked out her power?

   _____

6. On Wednesday, September 27, 1989, *The State* reported the status of the state's utilities. How many people were still out of power in Georgetown County?

   _____

7. How many were out of power in the Columbia area?

   _____

8. How many Carolina Power & Light customers were without power?

   _____

9. What is the longest time the power companies expected some customers to be out of power?

   _____

10. On Sunday, September 24, 1989, *The State* reported that Berkeley County had no water, no power, and minimal communications inside and outside the county. According to officials how long will it be before power is restored?

    _____

11. What percentage of the structures in Clarendon County received damage?

    _____

12. What did the residents of Eutawville and Holly Hill estimate caused the damage to their trees?

    _____

13. What two groups helped get water to the residents of Orangeburg County?

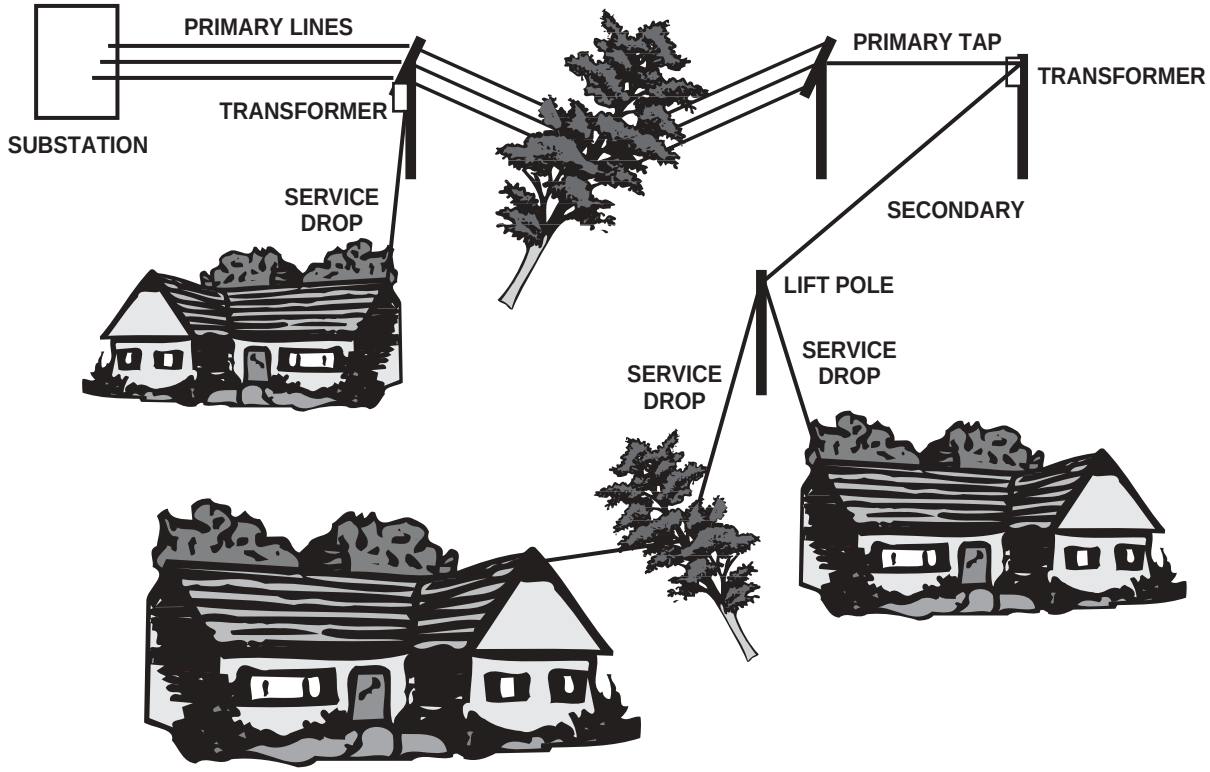
    _____

14. What were two of the most immediate needs of the people in the areas hit by the hurricane?

    _____

    _____

Storm response begins *before* the storm.



After the damage is done, we start by restoring any damage to a **SUBSTATION**. We then clear any obstructions or repair fallen **PRIMARY LINES**. This usually restores power to most customers. Next we inspect and repair **TAP** and **SECONDARY LINES** in neighborhoods. If you find yourself without power, yet your neighbor has power, it's probably because you have a damaged **TRANSFORMER** or **SERVICE DROP**. The **SERVICE DROP** is the line that comes from a pole with a **TRANSFORMER** or a pole to your house.

Before you even think about a storm, we're preparing for it. SCE&G tracks weather conditions and has plans in place, so that Mother Nature impacts your electrical service as little as possible. However if Mother Nature graces us with thunderstorms or hurricanes, damage is sure to occur. Here are some things you might want to consider:

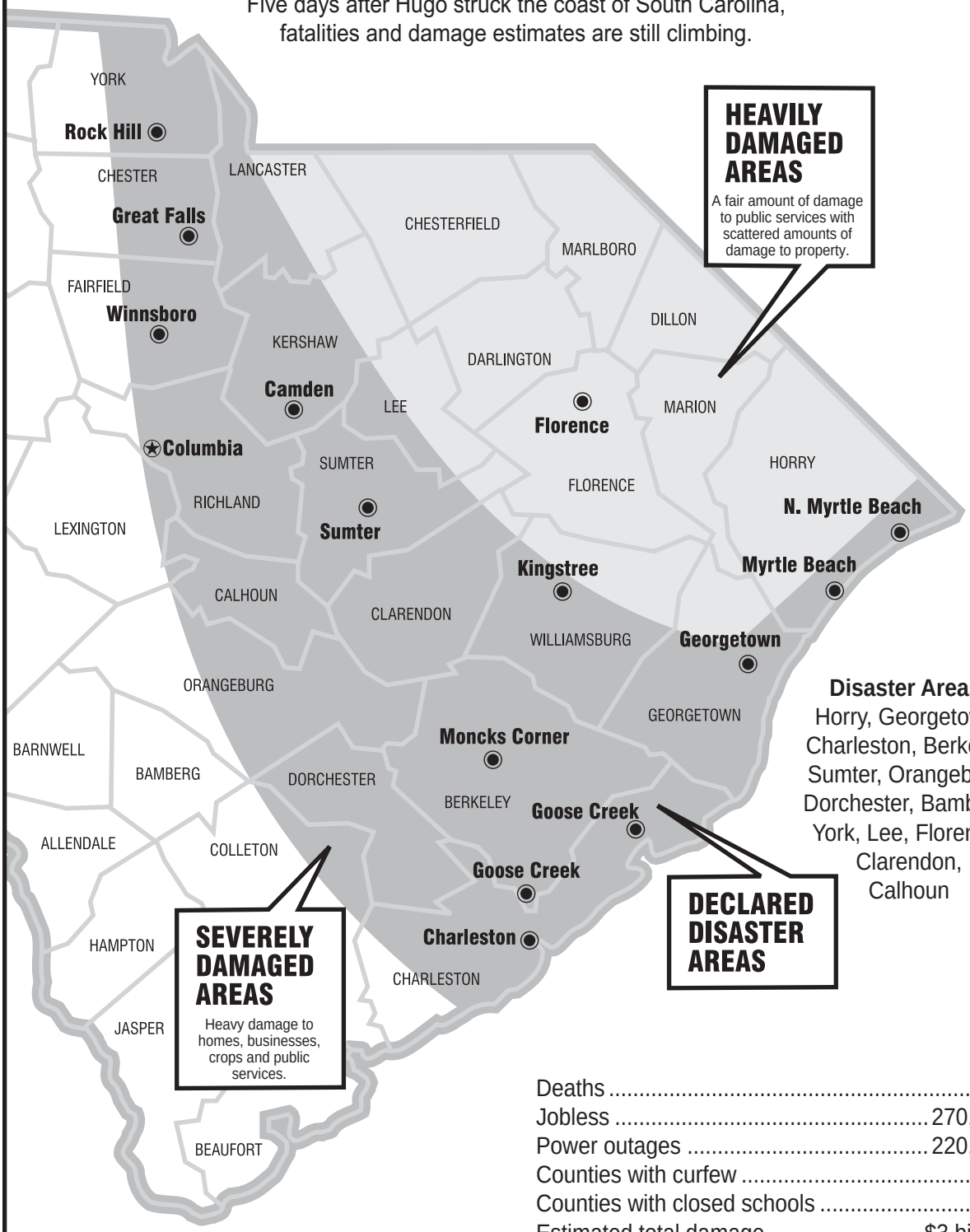
- Always keep batteries for flashlights and radios.
- Stock up on water and non-perishable food.
- Regardless of where your house number is located, mailbox or curb, make sure it's very visible. This helps SCE&G as well as firefighters, ambulances and other emergency groups locate you.

SCE&G

Hugo: The Aftermath, *The State,* Columbia, S.C., Wednesday, September 27, 1989

Extent of Damage in South Carolina

Five days after Hugo struck the coast of South Carolina, fatalities and damage estimates are still climbing.



Disaster Areas:
Horry, Georgetown, Charleston, Berkeley, Sumter, Orangeburg, Dorchester, Bamberg, York, Lee, Florence, Clarendon, Calhoun

Deaths	20
Jobless	270,000
Power outages	220,000
Counties with curfew	3
Counties with closed schools	10
Estimated total damage	$3 billion

Hugo: The Aftermath

The State, Columbia, S.C.
Wednesday, September 27, 1989

South Carolina Electric & Gas (430,000 total customers)

- Columbia area — 19,000 customers without electricity; power should be restored by late Thursday or Friday; outages in Eastover, Hopkins (off S.C. 37), Spring Valley, Briarcliff, S.C. 21 to Two Notch Road, portions of Bluff and Broad River roads and Rosewood, Veterans Hospital, Trenholm and Rockbridge roads areas.
- Ridgeway — 175 out; 1 to 2 days.
- St. Matthews, Cameron, Santee, Elloree — 350 out; 1 to 2 days.
- Charleston —100,000 out; three to four weeks.

Duke Power (450,000 South Carolina customers)

- Lancaster — serves 50,000 customers in Lancaster and Chester counties and areas south of Charlotte; about 25,000 out; two weeks.
- Charlotte — serves 235,000 customers; 60 percent out; one to two weeks.

Camden City Utility (9,000 total customers)

- Camden — 4,500 -5,000 out; two days to a week.

Carolina Power & Light (140,000 S.C. customers in Chesterfield, Clarendon, Darlington, Dillon, Florence, Kershaw, Lee, Marion, Marlboro, Sumter and Williamsburg counties)

- 50,000 out; a week or more. More than 50 percent out in Bishopville and Sumter.

Tri-County Electric Cooperative
(12,000 total customers in Calhoun, Kershaw, Lexington, Orangeburg, Richland and Sumter counties)

- 4,000 out; hope to have all restored by Sunday.

Fairfield Electric Cooperative
(13,000 customers in Fairfield, Chester, Richland, York and Kershaw counties)

- 350 out, mostly in the Lugoff area; 2 days.

Pee Dee Electric Cooperative (20,000 customers in Chesterfield, Darlington, Dillon, Florence, Lee and Marion counties)

- 7,000 out. They hope to have all of Dillon and Marion counties and 75 percent (5,000 out) of Chesterfield, Darlington, Florence and Lee counties restored by 8 p.m. Tuesday.

Santee Cooper (85,000 customers) Georgetown County

- 70 percent out in Garden City; 70 percent, Murrells Inlet; 100 percent, Pawley's Island; two to several weeks.

Horry County

- 15 percent out in Conway; 50 percent, Myrtle Beach; 40 percent, North Myrtle Beach; 60 percent, South Grand Strand; two days to several weeks.
- 5,000 out in Moncks Corner, Bonneau Beach, Pinopolis, St. Stephen; four weeks.

South Carolina Electric Cooperatives
(400,000 customers)

- Berkeley, 35,000 out; Black River, 16,000; Coastal, 50; Horry, 1,200; Lynches River, 3,500; Marlboro, 100; Pee Dee, 7,000; Santee, 24,000; and York, 6,000.
- Horry and Coastal, 2 days; Berkeley, Black River, Lynches River, Marlboro, Santee and York, a week.

Power-less relying on friends' generosity

By LORETTA S. NEAL
Staff Writer

For more than 20,000 residents of Lower Richland and Eastover, roughing it has lost its romance.

Most have been without electricity since Hurricane Hugo stomped through the Midlands five days ago, and power company officials say it could be three to five more days before the lights come back on.

They've been warned to boil their water. Ice is in short supply. The food they haven't eaten by now has spoiled. And they have to rely on friends in other parts of the county when they want to shower.

"I have had two heart attacks, and this thing (no power) is worrying me. But I have good neighbors," said 75-year-old David Crout of Reese Road in Eastover.

Crout borrowed a generator from a relative, but not before he lost all of the meat and food in his freezers.

"I went everywhere looking for ice, and I couldn't buy any anywhere," said Crout, talking above the hum of the generator.

A neighbor has been bringing him 20 gallons of water every day, however.

"They are good friends and they have been helping me and my wife, Juanita. So far we have coped, but it is hard," he said.

On McBeth Road in Eastover, Andrew McBeth is using candles for light and a friend's manual pump to get water.

"It hasn't been easy with three children," McBeth said. "I can't say we are enjoying this. To keep from losing my meat in the freezer, I cooked it all on a grill, so I don't have any more meat."

In Kingsville, Lillian McFadden and her family had no means of keeping food in the freezer and "we have lost it all." And she said eating out every day is getting expensive.

Ms. McFadden said the family travels about five miles each morning to her sister's house to dress for the day.

"It is a real hassle, but we have no choice. We are just going to have to live with it until we get power restored."

Lower Richland Boulevard resident Emily Derrick said the storm spared her home but when the power went off she lost a freezer load of home-grown vegetables and she has to drive to her sister's house in Columbia to get water.

However, life isn't as bad as it could be, especially for her two children, who have borrowed a battery powered television to help ward off boredom.

In Northeast Columbia, Jeanette Russell said she has depended on generous friends to help her cope.

"I have gotten lots of invitations out to dinners," said Mrs. Russell.

With no power, Mrs. Russell has to use candles and flashlights for light.

"I go to bed early," said Mrs. Russell. "I will never mention the old timey days again because if this is the way it was, I don't like it."

What is your family's plan in the event of a power outage? Be sure to keep candles and matches, batteries and flashlights, and other emergency equipment in good working order.

Storm leaves trail of destruction throughout the state

Excerpt from The State newspaper

Berkeley County
While historic Charleston was the focus of much of the coverage of deadly Hurricane Hugo, neighboring Berkeley County may be the unknown victim.

Saturday, the county quietly went about recovering from an estimated $300 million worth of damage.

Hugo landed a number of body blows, and officials say as many as half of all the trees in the county had been toppled by the hurricane's relentless winds.

Spokesman Gary LeCroy confirmed six deaths in the county, including two residents who apparently drowned in the Wando River.

"We got hit as bad as anyone in the state," said LeCroy, public information officer for the county's disaster preparedness agency. "The damage is very widespread, very extensive."

Saturday, officials at the disaster preparedness agency's headquarters tried to devise plans for a difficult several weeks. The realities are no water, no power and minimal communications inside and outside the county.

"Our problem is we've had a terrible time getting information to the public," said LeCroy. "We have a 7-to-7 curfew and a lot of trouble getting the word out."

Don Wohlfeil of the Lower Counties Emergency Operation's Center said most relief agencies were working with power from gasoline generators. In the county, he said, he knew of only one gas station that was open.

"We've had virtually no contact with anybody," Wohlfeil said.

Officials estimated that Berkeley County would not have power restored for two to four weeks.

Calhoun County
The storm zapped power to all of Calhoun County and downed power poles and trees. There were no fatalities, said Bill Cartwright, chief deputy with the Sheriff's Department.

Houses suffered extensive damage, including several struck by falling trees, Cartwright said. Mobile homes sustained the most damage.

"In plain and simple terms, it's much worse than we expected," said Robert Randolph, an announcer for WQKI radio in St. Matthews. "The power company and just everyday people are out with their chain saws trying to clear off roads.

"A few businesses had there windows broken. Trees have fallen all over the place, over cars, over houses. Power lines are down everywhere."

Clarendon County
Clarendon County remained without water and only spotty power service Saturday. Virtually every road in the county was blocked by fallen trees, said Emilee Hemingway, emergency preparedness director.

"It would be easier to look at the one or two buildings left and tell you what wasn't damaged," she said.

About 85 percent of the structures in the county received damage, 40 percent were destroyed, she said.

Three fire stations, the county courthouse, the police station and a National Guard Armory received damage.

A few grocery stores began opening Saturday, and county officials were seeking generators and tanks of water from any source. None had arrived Saturday.

Darlington County
On Saturday, 40 percent of Darlington County, which is served by Carolina Power & Light, had power restored. It may be Wednesday or Thursday before power is restored to the rest of the county.

Darlington County Administrator Jim Schaefer said 824 people were in county shelters Thursday night. By Friday night, the shelters were empty and closed down.

In Lamar, officials said the town has no water.

Major damage was reported to mobile homes across the county, but there was little serious damage to permanent structures.

There were no deaths, but three known injuries – none severe.

Florence County
No major injuries were reported in Florence, but officials estimate that the storm caused millions of dollars in property damage.

Downtown Florence was littered with shingles, awnings, aluminum siding, destroyed plastic signs and fallen trees.

Florence Police Lt. Robert Ross said Saturday that about 30 percent of the city was without power, but that the city's shelters had been cleaned out. Friday, about 1,500 people were in the shelters.

He said that there were no serious problems with the water system and that the area was beginning to get back to normal.

"We've been put to a crawl," he said.

Some radio stations in the Pee Dee and near Florence were asking people to call in if they knew where residents could buy ice.

Damage reports for Florence County as a whole were not available because the Florence County Emergency Preparedness Center was shut down Saturday afternoon apparently so its employees could get some sleep.

Kershaw County
Camden began overcoming its storm damage Saturday as power in portions of the city was restored, but electricity meant little to residents whose homes had been smashed by trees.

"I won't ever like the smell of pine again," Sharon Ibarra, a Kirkover Hills resident, said as she pointed to a tree in her kitchen.

The Ibarras were among about 40 residents of the Kirkover Hills section in the Kershaw County town who suffered damage to their homes and cars as Hugo virtually deforested the area.

Downtown Camden also was ravaged by the storm, but, by Saturday, most of the shattered storefronts had been boarded and glass swept from sidewalks.

County officials opened the National Guard Armory as a shelter Saturday, particular for persons with respiratory problems.

"We've still got people who need housing," said Gary Elliott, the county's emergency preparedness director.

County officials also were seeking generators to operate rural water systems, Elliott said.

City Manager Gary Cannon estimated that some residents would be waiting three to five more days for power and that trees and debris in the city's 11 parks might not be cleared completely for a year.

Some portions of the county, including the Black River Road to Lee County, remained impassable without a bulldozer, Cannon said. No monetary estimate of damage has been made, city and county officials said.

Lake Wateree
Dozens of home were damaged around Lake Wateree in Fairfield and Kershaw Counties.

"I've seen sailboats crunched by trees, docks and gazebos gone. It looks like someone blew it up," said Jean Harwell, the broker for Lake Wateree Properties. "I literally cried when I saw it."

She said Lake Road in Kershaw County seemed to be the hardest hit.

The real estate company has been trying to contact homeowners, she said.

“Everybody’s got damage. I’m trying to get them and tell that they don’t have a roof on their house or that trees are stacked on it,” Ms. Harwell said. “We cut our way back in to our house on Goat Hill Road.”

She said police set up roadblocks to keep non-residents away.

A generator on the Lake Wateree Dam was damaged early Friday, Sherry Brown, a Duke Power Co. spokeswoman, said.

“There was some minor damage when a window blew in,” she said. The generator will be repaired by next week, she said, and does not effect the operation of the dam.

Orangeburg County
The Orangeburg County communities of Eutawville and Holly Hill apparently took some of the hardest hits in the Midlands.

Residents cleaning up the aftermath of Hugo almost unanimously insist that much of the damage was caused by tornados. The evidence would seem to back up those claims.

Thousands of pin oaks and pine trees are either snapped off, uprooted or twisted like licorice. Electricity and water service have been out for more than a day, and prospects don’t look good that either will be restored soon.

All but a portion of the Santee area lacked power Saturday, while the entire Santee area was without water. Also lacking power were Bowman and Elloree.

“The National Guard is bringing in generators to help supply water for the affected areas, and the Orangeburg County Chapter of the American Red Cross is delivering emergency and water supplies as well,” Smith said.

All of Orangeburg County’s primary roads were clear Saturday afternoon, but several secondary roads remained blocked by trees.

Emergency preparedness officials had no damage estimates but said that the most structural damage was found in Eutawville and in Santee, where the roof of a Days Inn was heavily damaged.

Despite significant property damage, Orangeburg County reported only one death as a result of Hurricane Hugo.

Samuel Middleton, 69, of Route 1, outside of Eutawville, died around 1 a.m. Friday when high winds carried his mobile home 40 feet, destroying it and crushing him, said Orangeburg County Coroner Paul Simmons.

Orangeburg EMS Shift Supervisor Thomas Jones thinks county citizens’ prompt reaction and attentiveness prevented more deaths.

“Everywhere I went I saw people buying radios and flashlights and watching television,” Jones said. “I think our people listened and paid attention and knew what to look for.”

Ted Johnson, manager of the city Department of Public Utilities, said he thought 90 percent of the customers in the Orangeburg area would have power by Saturday night.

Johnson denied rumors that Orangeburg’s water was contaminated, as had been reported by several radio stations.

Williamsburg County
Kingstree Mayor Jimmy Kirby surveyed the damage to his town Saturday.

“No homes are destroyed, but many have tree damage,” he said.

“I think it really woke us up,” Kirby said. “I am 50 years old, and this is the first bad storm for me, but it goes to show the unity of the people of a small town, neighbors.”

Residents prepared for the worst by catching rain water for drinking and cooking. Kirby said, but that did nothing to solve the problem of bathing.

Since the storm, residents have been going down to Gilland Park to bathe in the Black River.

“We really should have sung, “Shall We Gather at the River,” Kirby said. “I can’t imagine what the people in Andrews thought about all the soapy water.”

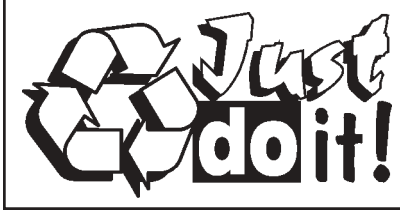
Kirby said the Carolina and Fair Deal warehouses were damaged, as was the Goldkist fertilizer plant, which had a wall blown out by the high winds.

There was damage to the roofs of the City Hall complex and to the Williamsburg County complex, Kirby said.

Shops and restaurants in the town were also damaged.

Trees in the area were devastated by the storm.

Kingstree Town Manager Ken Courtness said most of the downtown area had some sort of damage.



On warm sunny days, help hang clothes on a clothes line instead of putting them in the dryer.

Power in South Carolina

Preparation Time:	Easy-to-do	**Moderate**	Extensive

Grade:	4 – 5 and 6 - 8
Focus:	The various forms of energy used to produce electricity in South Carolina
Subject:	Science, Social Studies
Materials:	Handouts included with this lesson
Teaching Time:	One class period plus student work
Vocabulary:	Fossil fuels, nuclear reactor, nuclear fission

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

Materials
- Handout "Power in South Carolina"
- Copies of "The Energy FactBook: A Resource for South Carolina" (Optional: These are available from the S.C. Department of Health and Environmental Control's Resource Center, 1-800-SO-USE-IT, or the South Carolina Energy Office, 1-800-851-8899).

Background
Excerpts from "The Energy FactBook: A Resource for South Carolina"

South Carolina is a growing state. As our economy has developed, so too have our energy needs. In the last several decades, only four states have had higher energy use rates than we in South Carolina have had. While we use energy in every sector of the economy, industry uses the most. It takes large supplies of energy to run the mills, factories and farms that make our state prosper. Industry accounts for 41.4 percent of the state's energy use.

The transportation sector is the second largest user of energy. Being primarily a rural state, this is not surprising. We are, by necessity, a state of drivers. People in South Carolina travel extended distances to get where they need to go. It takes nearly 2 billion gallons of gasoline a year to keep South Carolinians on the move.

We use less energy in our homes. Almost 19.5 percent of the energy used in South Carolina serves to heat and cool residences, run appliances and heat swimming pools.

The commercial sector uses the least amount of energy. While this is true in most of the 50 states, South Carolina's commercial sector uses proportionately even less. Only 14 percent of the state's energy is used by businesses, schools and hospitals.

Now that you know how energy is used in our state, you may wonder what energy resources we have. Unfortunately, the answer is not encouraging. South Carolina does not have many natural energy resources of its own. The gasoline and other fossil fuels that make our economy grow must be imported from other states and countries. This carries a heavy price. It costs great sums of money to pay for the energy we need and use.

Our energy outlook, however, is far from dim. While we can't do anything about our lack of natural resources, we can do something to make us less dependent on expensive, imported fuels. With this in mind, state officials and citizens alike are actively seeking ways to improve our energy situation.

Through science and conservation, we are now using proportionally less fossil fuels. More than one-third (37 percent) of the state's energy needs are met by energy resources other than fossil fuels, much better than the national average of 14.4 percent.

In the remaining chapters of "The Energy Factbook" you'll be able to read about the exciting advances being made in South Carolina. These include experiments with new fuels as well as widespread use of nuclear energy. South Carolina is diligently looking for ways to make its energy future a bright one.

Learning Procedure

1. **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 may use videos, such as Santee Cooper's* PowerHouse Tour *to review the generation process. The illustration,* Producing Electricity*, included with this lesson gives the basics.*)

   A**sk:** 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.)*

2. Tell the class that there is a lot that you can learn about power in South Carolina from interpreting charts, graphs and illustrations, just the way they interpreted the basic illustration, *Producing Electricity*.

   Give each student or small groups of students a copy of the handout, *Power in South Carolina*, and have them read the text and interpret the graphics to answer the questions and learn more about power in our state.

Extension Activities

1. Have students research an energy source – coal, oil, natural gas, nuclear, solar power, wind, etc. – used in creating energy. Students should be encouraged to find:

   - How was it formed (for fossil fuels) or the process that causes it (solar, etc.);
   - The availability in our state, country, world;
   - Environmental advantages/ disadvantages.

2. Have students consider a good way to reduce energy use in the state and then write several paragraphs to explain. For example, they may suggest the use of more public transportation to reduce energy used for transportation (petroleum), or ways to lower residential energy use through use of solar heating or other efficient usage practices, or ways factories could save energy.

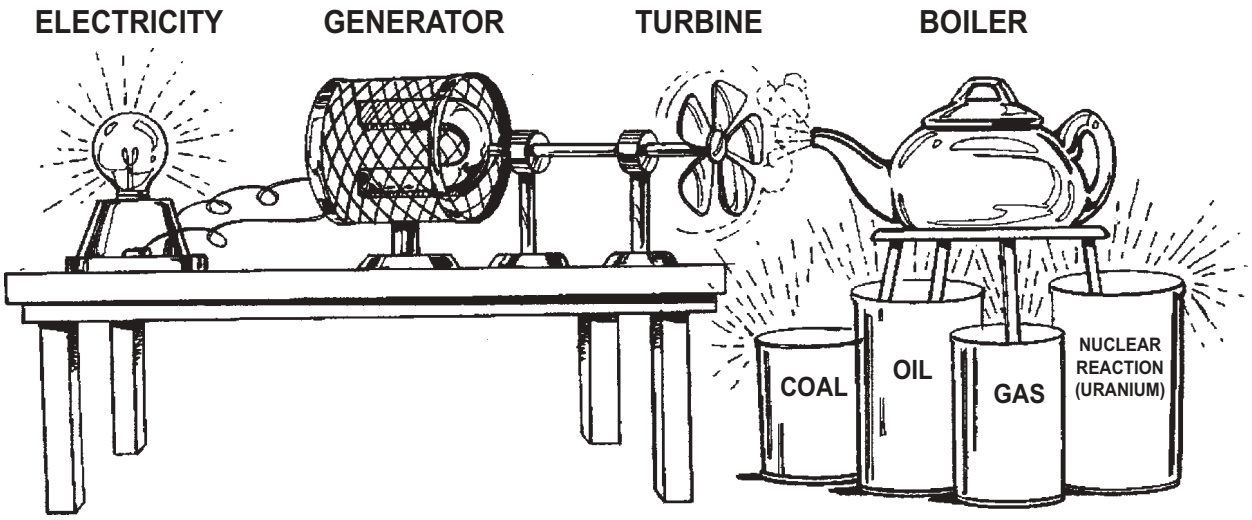
3. Have students write letters to the utility company that supplies their electricity asking about how power will be supplied in the future.

   Does your power company have any investments in renewable energy or other alternative energy technology? Why or why not?

4. Plan a field trip to a power generating facility in your area or invite a representative to come to your school.

Use energy wisely at home. Conduct a home energy audit to determine if your home is energy efficient. Your local power company can help.

Producing Electricity



FUEL SOURCE FOR GENERATING ELECTRICITY

Producing Electricity
Several fuel sources are used in South Carolina's electricity generating plants. Each of these fuel sources provides the heat that is used to create steam. This steam provides the power to turn the turbine that spins the magnet inside the coil, creating electricity. In South Carolina, a nuclear reaction creates the heat that provides about 57 percent of the electricity.

In hydroelectric facilities, no heat is needed. Falling water is used to spin the turbine.

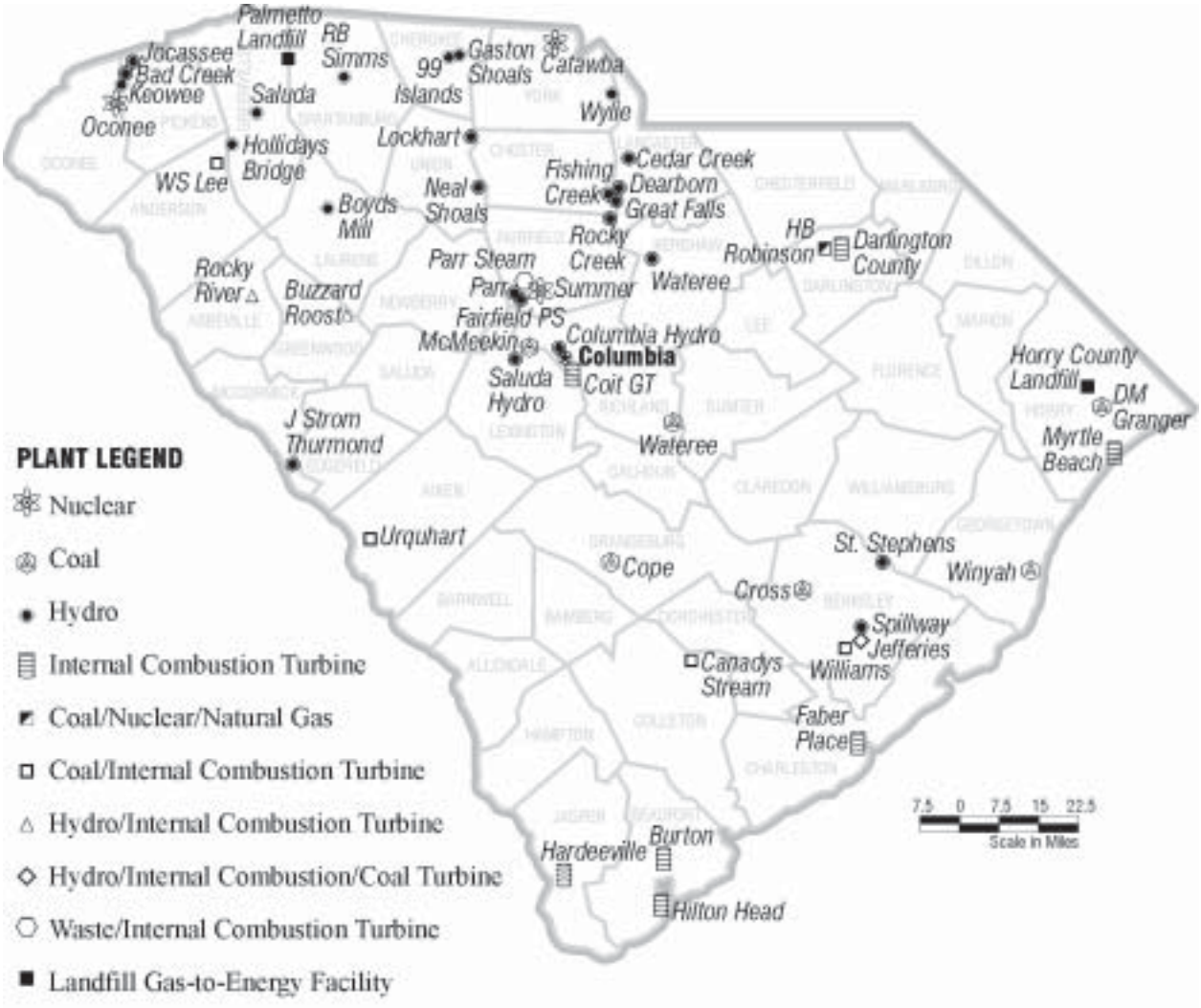
DOWN to Earth

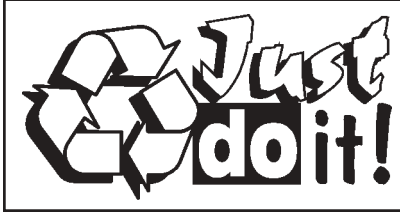
South Carolina public schools, colleges, universities and state agencies spent over $145 millon on energy in 1998. Electricity accounted for 84 percent of this expense, while natural gas accounted for 13 percent.

Source: Energy Use in South Carolina's Public Facilities, Fiscal Year 1998

Power in South Carolina

Graphs, charts and illustrations about energy in South Carolina





Encourage your family to walk or ride bikes to nearby places.

South Carolina's Net Energy Consumption by Sector, 1999

RESIDENTIAL
Electricity ..... 60.9 percent
Natural Gas ..... 21.9 percent
Petroleum ..... 10.2 percent
Biofuels ..... 5.4 percent
Coal ..... 1.5 percent

COMMERCIAL
Electricity ..... 65 percent
Natural Gas ..... 24.6 percent
Petroleum ..... 8.3 percent
Biofuels ..... 1.1 percent
Coal ..... 4.1 percent

INDUSTRIAL
Electricity ..... 24.2 percent
Natural Gas ..... 24.1 percent
Petroleum ..... 23.4 percent
Biofuels ..... 16.6 percent
Coal ..... 11.5 percent

TRANSPORTATION
Petroleum ..... 99 percent
Natural Gas ..... 1 percent

Source: 2001 S.C. Energy Use Profile

Use the information above to answer these questions about energy in South Carolina.

1. What are the sectors or categories of energy consumers in South Carolina?

_____

2. What are the four types of energy used primarily in South Carolina?

_____

3. Which sector uses the largest percentage of petroleum?

_____

4. Which sector uses the largest percentage of natural gas?

_____

Getting to Know Electricity in South Carolina

Use the information on the following pages of the *Energy Factbook* to answer these questions.

1. How many power plants are there in South Carolina?

_____

2. How many nuclear plants are there in South Carolina?

_____

3. What percentage of South Carolina's electricity is generated by nuclear power?

_____

4. How many exclusively hydro plants are there in the state?

_____

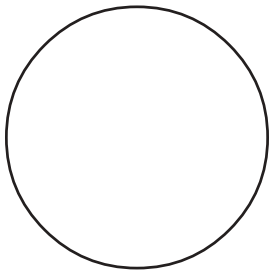
5. What percentage of the state's power comes from plants fueled by petroleum, natural gas or water?

_____

6. What investor-owned company provides the most power to the people in this state?

_____

7. Draw and label a pie chart that shows the fuel sources of the electricity generated by SCE&G.



8. What is South Carolina's public utility company?

_____

9. How many people are served by this public-owned utility?

_____

10. What percentage of electricity generated in the state is used by private homes?

_____

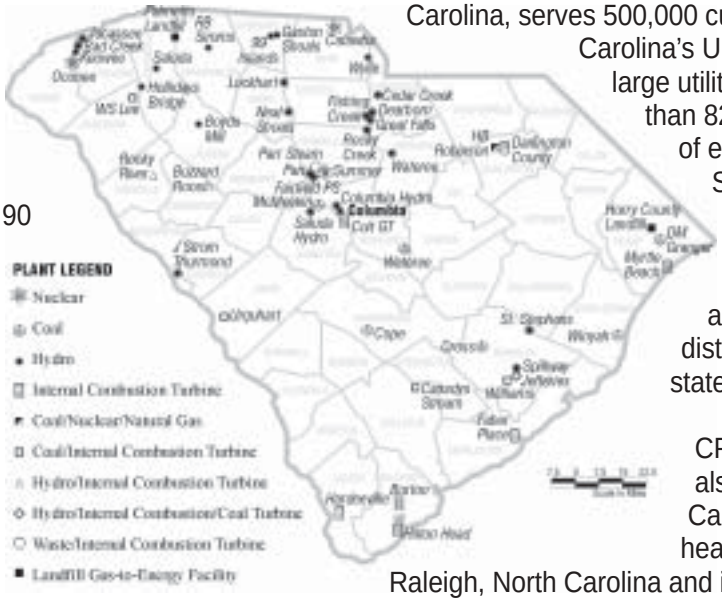
11. What are "electric cities" in South Carolina?

_____

Electricity in South Carolina

Reprinted with permission from the *Energy Factbook*

South Carolina's use of electricity continues to increase. In the past twenty years, the amount of electricity produced and used in the state has more than tripled.



As the state's economy has grown, so has its need for electricity. South Carolina power plants generate about 90 billion kilowatt hours of electricity each year. Nearly 57 percent of this electricity comes from nuclear power plants. Coal-fired plants produce almost all of the remaining electricity. Just under four percent of our electricity comes from plants powered by petroleum, natural gas or water.

South Carolina's electricity is provided by private investor-owned utilities, city-owned utilities, rural electric cooperatives and a state-owned utility.

The Investor-Owned Utilities

Four investor-owned utilities serve South Carolina: South Carolina Electric and Gas (SCE&G), Duke Power Company, Carolina Power and Light (CP&L) and Lockhart Power Company. These utilities each have an assigned service territory and a legal obligation to serve all the consumers in their territories, and are regulated by the South Carolina Public Service Commission and federal regulations. Each investor-owned utility is owned by thousands of investors who have stock in the company.

SCE&G has its headquarters in Columbia and is an important supplier of electricity in our state. It maintains 3,440 miles of transmission lines and 19,971 miles of distribution lines which serve more than 531,000 customers in the Midlands and Lowcountry. SCE&G generates and sells about 17 billion kilowatt hours of electricity each year.

Duke Power, headquartered in Charlotte, North Carolina, serves 500,000 customers in South Carolina's Upstate region. This large utility, which sells more than 82,000 gigawatt hours of electricity annually in South Carolina, maintains about 12,500 miles of transmission lines and 52,000 miles of distribution lines in the state.

CP&L, like Duke Power, also is based in North Carolina. Its headquarters is in Raleigh, North Carolina and it serves 165,000 customers in the Pee Dee region of South Carolina. CP&L sells 7 billion kilowatt hours of electricity each year in South Carolina and that electricity is sent to S.C. customers over its 1,900 miles of transmission lines and 8,123 miles of distribution lines.

Lockhart Power Company provides electric service to approximately 14,000 customers over its 90-mile transmission network. Lockhart maintains approximately 750 miles of distribution lines, sending 85 million kilowatt hours of electricity annually to its customers, and has the distinction of offering among the lowest electrical rates in South Carolina.

Santee Cooper: South Carolina's Public Utility

Santee Cooper is the state's own public utility. It was created in the 1930s to bring electricity to rural areas. When it started, less than three percent of South Carolina's farms had electricity. A decade later, Santee Cooper supplied electricity to 91 percent of the farms in the state, mostly by providing wholesale power to South Carolina's electric cooperatives.

Santee Cooper, which has its headquarters in Moncks Corner, now generates nearly 24 million megawatt hours of electricity annually. That electricity is sold to 135,000 retail customers and 15 of the state's 20 electric cooperatives. That electricity travels over 4,424 miles of transmission lines and 2,222 miles of distribution lines.

The Electric Cooperatives
About one-third of South Carolina's citizens get their power from an electric cooperative. Some co-ops are owned by the producers of the products or services they sell, but electric co-ops are owned by the users of the product (electricity). In other words, consumers also are member-owners of the co-op.

Electric cooperatives service more than 70 percent of the land area in South Carolina and serve consumers in every county in the state. Co-ops are located mostly in rural areas, small towns and suburbs of large towns. In order to reach rural locations the cooperatives have to use a lot of power lines. In fact, the co-ops use and maintain more than 82,000 miles of distribution lines, more than all other South Carolina utilities combined, in order to bring power to their more than 610,000 consumers.

S.C. electric cooperatives own power plants and also purchase almost 60 percent of the power generated by Santee Cooper. The co-ops operate on a not-for-profit basis, so all revenues above the cost of doing business are returned to the consumers in the form of capital credits.

Seventeen of South Carolina's 20 electric cooperatives are members of Touchstone Energy® - a national alliance of local, consumer-owned electric utilities committed to providing superior service and affordable rates to all customers large and small.

South Carolina's Electric Cities
South Carolina also has 22 municipal electric utilities. These 22 "electric cities" provide electricity as a public service. This electricity is often referred to as "public power." Local governments purchase electricity from investor-owned utilities and Santee Cooper at wholesale prices and then distribute the power to their customers at retail rates. Distribution systems are owned by the cities. Overall, South Carolina's electric cities sell more than 14 billion kilowatt hours of electricity to 288,000 customers each year. That electricity runs through 20,085 miles of distribution lines in order to reach its customers.

How We Use Electricity
The industrial sector uses most of the electricity produced in South Carolina. About 41.5 percent of the electricity generated goes to operate factories and mills. Most of South Carolina's industrial users of electricity are concentrated in the Piedmont counties of Greenville, Spartanburg and Anderson.

One-third of the energy produced in the state is used in private homes. Everything from the basic (refrigerators) to the frivolous (bath towel warmers) runs on electricity.

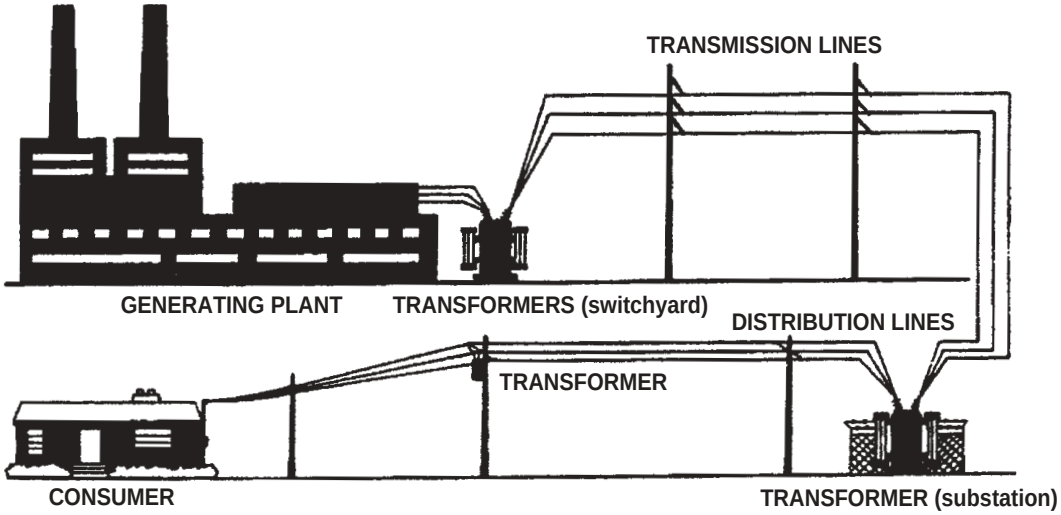
More than 13 percent of South Carolina's electric energy goes to commercial customers. Again, the biggest users are in Greenville and Spartanburg counties. Charleston County is one of the biggest users of both commercial and residential electricity.

Conclusion
Electricity is an important part of South Carolina's energy past, present and future. Its utilities provide electricity to even the most rural areas. Modern technologies including the use of nuclear fuel and pumped-storage allow us to produce energy to meet the needs of all sectors of the South Carolina economy.

Turn off the dishwasher after the wash cycle. Let dishes air dry.

How Electric Energy is Transformed, Transmitted and Distributed

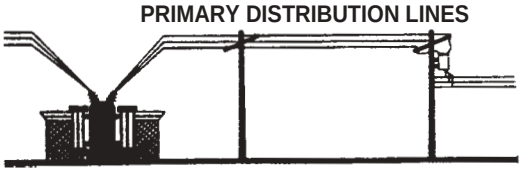
Use these illustrations to answer the questions below:

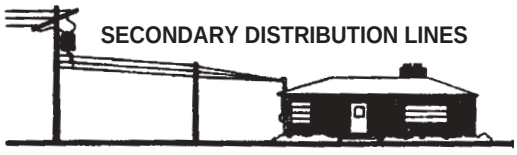


South Carolina's power plants generate 90 billion kilowatt-hours of electricity each year. Power companies in the state maintain nearly 150,000 miles of transmission and distribution lines.

Electricity, as it comes from a turbine generator, cannot be sent directly to your house. This is because electricity flows through a wire much like water flowing through a garden hose. Unless there is pressure pushing the water through the hose, it will not comes out the other end. To get electricity through the wires to your home, it must be pushed under pressure. Voltage is the term that describes this pressure. Outside the power plant, **the switchyard has transformers that increase the voltage**. This increase in **voltage** gives the power the push it needs so that it can travel the long distances to reach homes and factories many miles away. The wires that carry this high voltage are called **transmission lines**.

When the electricity gets to your neighborhood, its voltage is too high to use in homes and factories. **At a substation, transformers reduce the voltage**. The electricity leaves the substation along wires called distribution lines. These are the lines along the streets in neighborhoods. Before the electricity comes into your house, the voltage is reduced one more time by a pole transformer.





True/False

T F 1. Transformers are used to increase and decrease the voltage of electricity as it is sent from a power plant to your home.

T F 2. The voltage of electricity is changed at substations.

T F 3. Voltage is increased when power moves from transmission lines to distribution lines.

Power In South Carolina

Use the charts, graphs, and illustrations in your handout to answer these questions about Power in South Carolina.

CIRCLE THE ANSWER

1. South Carolina depends on fossil fuels from:
   a. coal mines in South Carolina b. mines in other states c. nuclear power plants.

2. Residents use:
   a. 20 percent of the state's energy b. 50 percent of the state's energy c. 70 percent of the state's energy.

3. Fossil fuels make up:
   a. two-thirds of the state's energy b. one-third of the state's energy c. half of the state's energy.

4. The Foster Wheeler plant generates power from:
   a. nuclear fission b. coal c. municipal waste.

TRUE AND FALSE

5. _____ The residential sector in South Carolina uses more natural gas than electricity.

6. _____ The commercial sector in South Carolina uses more electricity than the residential sector.

7. _____ There are more hydroelectric plants in South Carolina than nuclear plants.

8. _____ The transportation sector is the single largest user of petroleum products.

9. _____ Transformers are used in various places in distributing power from the generation station to the consumer.

CHECK THE BOXES THAT CORRECTLY ANSWER THE QUESTIONS.
YOU MANY CHECK MORE THAN ONE FOR EACH.

10. The fuel source for generating heat in the production of electricity can be:

    _____ Coal _____ Nuclear reaction _____ Natural gas _____ Oil.

11. Check the kinds of problems caused by burning oil and coal.

    ____ Air pollution ____ Water pollution ____ Land destruction

    ____ Waste products ____ Noise pollution

12. Match the fossil fuel with its most important use:

_____ coal	a. generation of electricity
_____ petroleum	b. heating houses and stores
_____ natural gas	c. transportation