



Electric Energy

PROJECT PLANNING GUIDE

OBJECTIVES OF THE 4-H ELECTRIC ENERGY PROJECT

1. To develop effective 4-H leadership, character and citizenship.
2. To learn more about electricity and its safe and efficient use.
3. To create an awareness of the amount of energy used in the home.
4. To learn how to conserve energy.
5. To learn how to conserve water and the energy required to heat water.
6. To determine the energy requirements for the home or farm.

EXTENSION RESOURCE MATERIALS

4-H Electric Project Manuals and Leader Guides

- UNIT I - Exploring the World of Electricity, 4H M-3-21P
UNIT II - Electricity's Silent Partner - Magnetism, 4H M-3-23P
UNIT III - Working With Electricity, 4H M-3-25P
UNIT IV - Electricity for Family Living, 4H M-3-27P
UNIT V - Behind the Switch, 4H M-3-29P

Home Energy Publications

- HOME ENERGY I: What To Do First in Home Energy (HE-254)
HOME ENERGY IA: Energy Consumption Log
HOME ENERGY II: Save Energy by Reducing Infiltration (HE-255)
Read and Use Utility Meters to Estimate Operating Cost (Note: Energy suppliers are a good source for fuel measurement information.)
In The Bank Or Up The Chimney (HE-219)
Energy Savers "Low Cost No Cost"

Water Watch Publications

1. "Focus on Residential Water Conservation," N. C. Agricultural Extension Service, HE-250.
2. "Saving Water and Saving Energy--Calculate Your Water Savings," N. C. Agricultural Extension Service, HE-251.
3. "Water Management Checklist for the Home," N. C. Agricultural Extension Service, HE-213.
4. "Guide for Organizing a Water Conservation Program," Miscellaneous Extension Publication, CRD-907-01.
5. "Water Conservation Conference Proceedings," N. C. Department of Natural Resources and Community Development, Miscellaneous Publication, Water Supply Assistant Branch.

LEVEL 1
(9- to 11-year-olds)

<u>Things to Learn</u>	<u>Things to Do</u>
<u>Electric Terms</u> <ol style="list-style-type: none">1. Volt2. Ampere3. Watt4. Resistance5. Direct Current6. Alternating Current	<ul style="list-style-type: none">- Study Chapters I, II and III and the Glossary of Terms in Unit I.- Discuss the use of these terms with other 4-H members, your leader or parents.- List an example of each of the six terms as they apply to the use of electricity in your home.
<u>Sources of Electricity</u> <ol style="list-style-type: none">1. Power company generator2. Other generators3. Dry cell battery4. Wet cell battery	<ul style="list-style-type: none">- Turn on a light. Where did the electric energy come from?- List the generators your family owns (Example: the automobile has a generator to charge the battery).- List the uses of batteries in your home.- Study how batteries are constructed (Chapter IV, Unit I).
<u>How Electricity Travels</u> <ol style="list-style-type: none">1. Conductors2. Insulation materials3. Parallel circuits4. Series circuits5. Define resistance	<ul style="list-style-type: none">- Study Chapters V, VI and VII in Unit I.- List the insulated cords that are in your home.- Do a hazard hunt in your home and list the hazards found.- Discuss these hazards with your parents and discuss some possible ways to eliminate the hazards.- Locate the fuses or circuit breakers in your home and make sure you and your family know their purposes.- Demonstrate resistive heating.
<u>How Electricity Produces Light</u> <ol style="list-style-type: none">1. How is a light bulb constructed2. How a bulb produces light3. How a fluorescent tube is constructed4. How it produces light	<ul style="list-style-type: none">- Study Chapter VIII in Unit I.- Examine the inside of a burned-out bulb.- Draw and label its parts.- List the light bulbs in your home and their wattage.- List any fluorescent lights in your home.- Make a car lamp.- Change a fluorescent tube.
<u>Magnetics</u> <ol style="list-style-type: none">1. North and South Poles2. Attraction and repelling of poles3. How a compass works4. What is a magnetic field?5. How an electric magnet works	<ul style="list-style-type: none">- Study Unit II.- Make an electro-magnet.- Magnetize a screwdriver.- Build a simple buzzer.- Build a single electric motor.- Demonstrate a magnetic field with iron filings.

LEVEL 2
(12- to 14-year-olds)

Things to Learn	Things to Do
<p><u>Conserving Energy</u></p> <ol style="list-style-type: none">1. How to read a dial energy meter2. How to determine the amount of energy used3. The amount of electric energy your family uses each day4. How much energy is required to heat water	<ul style="list-style-type: none">- Study the Home Energy publications listed on the cover of this publication.- Draw the dials of a meter. Then draw in the hands to show a reading.- Draw the dials and hands of a different meter reading. Now determine the difference between this reading and the previous reading. How much energy was used?- Read and record the reading of your home's electric meter at the same time each day for a week. Subtract the previous day's reading. The difference in readings will tell you how much energy was used during the day.- Record your meter reading for one week. Then ask your parents to reduce the thermostat on the electric water heater. Record the meter readings for a week following water heater change. Report the difference.
<p><u>Wires and Cords</u></p> <ol style="list-style-type: none">1. Wire sizes2. Capacity of cords3. Types of cords4. Types of splices5. Types of plugs	<ul style="list-style-type: none">- Study Unit III.- Inspect all cords in the home for defects.- Keep cords repaired.- Replace defective plugs and sockets.- Make sure cords do not run under rugs or through doorways.
<p><u>Lamps</u></p> <ol style="list-style-type: none">1. Sockets2. Bulbs3. Cords4. Plugs5. Series connection6. Parallel connection	<ul style="list-style-type: none">- Repair an old lamp.- Build a study lamp.- Build a trouble light.- Wire two lights in series.- Wire two lights in parallel.
<p><u>Home Wiring</u></p> <ol style="list-style-type: none">1. Size of wire2. Fuse and circuit breaker sizes3. Wire capacity in amps and watts4. Voltage drop5. Electrical symbols	<ul style="list-style-type: none">- Replace blown fuses with correct sizes.- Reset tripped circuit breakers.- Demonstrate voltage drop.- Calculate the size (amp capacity) of the wiring system needed for a house.- Draw a house wiring plan.

Things to Learn	Things to Do
<p><u>Grounding</u></p> <ol style="list-style-type: none"> 1. Grounding outlets 2. Grounding plugs 3. Three-wire grounding cords 4. Ground fault circuit interrupter (GFCI) 	<ul style="list-style-type: none"> - Make a test light. - Test outlets for proper grounding. - Ground all motorized appliances. - Demonstrate a GFCI.
<p><u>Home Wiring Equipment</u></p> <ol style="list-style-type: none"> 1. Types of wiring cables 2. Types of conduits 3. Types of insulation 4. Types of outlets 5. Types of fuses 	<ul style="list-style-type: none"> - Replace a switch. - Replace an outlet. - Replace a light fixture. - Demonstrate three-way switches.

LEVEL 3
(15- to 19-year-olds)

Things to Learn	Things to Do
<u>Conserving Energy</u>	
<ol style="list-style-type: none">1. How turning down the heating thermostat can save energy2. How turning up the thermostat during cooling can save energy3. How saving water can save energy4. How reducing air infiltration into the house can save energy5. How adding insulation to your home can save energy	<ul style="list-style-type: none">- Study the Home Energy and Water Watch publications listed on the cover of this publication.- Set the heating thermostat at its normal setting and record energy consumption and the high and low temperatures (from local news casts) each day for a week. Reduce the thermostat setting 3 degrees for the next week and continue the recordings. Report the differences.- Set the cooling thermostat at its normal setting and record energy consumption and high and low temperatures for a week. Increase the thermostat setting 3 to 5 degrees and for the next week continue the recordings. Report the differences.- Record energy consumption for one week. Install water-saving devices on faucets and showers. Continue recording energy consumption for a week. Report the difference.- With a breeze detector, find and list as many air leaks as you can in your home. While you are doing this you should be recording energy consumption, high and low temperatures and wind (high, medium or light) daily for at least a week. Using Low Cost No Cost techniques, reduce the infiltration as much as possible. Continue the recording for at least a week. Report and explain the difference.- If your family is planning to add insulation to your home, keep a complete energy log for as long as practical before the insulation is added. Continue to keep the log for at least an equal time of similar weather after the insulation is installed. Compare the energy consumption and discuss (report) the savings.

Things to Learn	Things to Do
<p><u>Nature of Light</u></p> <ol style="list-style-type: none"> Speed that light travels Light wavelength Electromagnetic spectrum How light output is measured How illumination intensity is measured Qualities of good lighting 	<ul style="list-style-type: none"> - Study Unit IV. - Observe lumen ratings on various bulb cartons. - Measure illumination levels with a light meter. - Experiment with reflectors and diffusers. - Observe the spectrum by passing sunlight through a prism or a partially filled glass of water (use clean, smooth drinking glass).
<p><u>Types of Light Sources</u></p> <ol style="list-style-type: none"> Construction of incandescent bulbs Construction of fluorescent tubes Shapes of bulbs Types of bases or connections of bulbs Types of bulb coatings Colors of fluorescent lights 	<ul style="list-style-type: none"> - Show or demonstrate types of light diffusing bulbs. - Compare glare from different types of coated incandescent bulbs (such as clear inside, frosted or white). - Conduct a home lighting survey.
<p><u>Lighting With a Purpose</u></p> <ol style="list-style-type: none"> Light requirements for a study lamp Light requirements for a reading lamp Light requirements for a grooming lamp Light requirements for a sewing lamp 	<ul style="list-style-type: none"> - Build a study lamp. - Build a decorative lamp. - Repair an old lamp. - Improve the lighting in your home. - Give a "good" lighting demonstration.
<p><u>Heating Appliances</u></p> <ol style="list-style-type: none"> How heat is transferred How heating appliances work The purpose and function of a thermostat Learn to use one or more heating appliances 	<ul style="list-style-type: none"> - Show or demonstrate how things are cooked by the different types of heat transfer (conduction = frying; convection = baking; radiation = broiling). - Check the calibration of a thermostat. - Make a list of the cooking appliances in your home. Explain the advantages of each of the heating appliances.
<p><u>Motors Instead of Muscles</u></p> <ol style="list-style-type: none"> Principles of an electric motor Which appliances use motors 	<ul style="list-style-type: none"> - Make a list of appliances that use motors in your home.

Things to Learn	Things to Do
<p><u>Cooling With Electricity</u></p> <ol style="list-style-type: none"> 1. What is cold or cooling? 2. Define Latent Heat of vaporization and Latent Heat of fusion 3. The internal parts of a refrigerator 	<ul style="list-style-type: none"> - Pump up a tire with a hand pump. - Observe how the pump gets hot from compressing the air. - Draw the refrigerator cycle. - Demonstrate Latent Heat of evaporation by boiling water and observing the water temperature.
<p><u>Electronic Appliances</u></p> <ol style="list-style-type: none"> 1. About frequency 2. The difference between "AM" and "FM" 3. How a TV picture is produced 4. How a record player works 5. How a tape recorder works 6. How microwave ovens heat 	<ul style="list-style-type: none"> - List the electronic appliances in your home. - Observe a microwave oven. - If you have a stereo system, experiment with the speaker placement in your room. - Observe the dots on a color TV screen with a magnifying glass.
<p><u>Operating and Maintaining Home Appliances</u></p> <ol style="list-style-type: none"> 1. How to use several home appliances 2. About conserving heat and insulation 3. About "Energy Efficient Ratio" (EER) 4. How drapes help conserve energy 5. How to store and maintain appliances 	<ul style="list-style-type: none"> - Make a survey and list the electric appliances in your home. - Study operator manuals. - List the energy conservation things that you performed. - Demonstrate the effects of insulation. - Keep a record of appliance care and maintenance.
<p><u>How Much Electricity Do You Use?</u> <u>(Measuring Energy)</u></p> <p>The units of electric energy: watt, kilowatt, horsepower, KWH</p>	<ul style="list-style-type: none"> - Obtain an electric rate schedule from your electric company. - Calculate the cost of operating an appliance.
<p><u>Electric Generation</u></p> <ol style="list-style-type: none"> 1. Types of generation energy: <ol style="list-style-type: none"> a. hydro b. fossil fuel c. nuclear 2. The steam cycle 3. The principles of a generator 	<ul style="list-style-type: none"> - Study Unit V. - Draw a diagram of how electricity gets from the generator to your home. - Visit a generation station.
<p><u>Energy From the Sun</u></p> <p>Types of solar energy</p> <ol style="list-style-type: none"> a. solar thermal b. solar electric 	<ul style="list-style-type: none"> - Build a solar oven. - Build a solar collector.

Things to Learn	Things to Do
<p><u>Energy From the Earth</u></p> <ol style="list-style-type: none"> 1. Geothermal 2. Wind 3. Biomass 	<ul style="list-style-type: none"> - Measure the temperature of water from a well. - Build a model windmill. - Collect and weigh the trash from your home for a day.
<p><u>Planning for Power</u></p> <p>The peak load time for your location</p>	<ul style="list-style-type: none"> - Plan your washing, ironing, and other electrical uses during non-peak periods.
<p><u>Long Distance Energy Transmission</u></p> <ol style="list-style-type: none"> 1. The purpose of a transformer 2. Why transmission lines are high voltage 3. What is the electricity "AC" 	<ul style="list-style-type: none"> - Observe a substation. - Observe a transmission line. - Sketch a substation and transmission line.
<p><u>Distribution of Electric Energy</u></p> <ol style="list-style-type: none"> 1. Distribution lines 2. Distribution transformer 3. Service drop 4. Fuses and circuit breakers 	<ul style="list-style-type: none"> - Sketch the distribution system from the lines into your house.
<p><u>Energy for Sale</u></p> <ol style="list-style-type: none"> 1. How to read the electric meter 2. How to calculate the cost of electricity 	<ul style="list-style-type: none"> - Read your meter each month and keep a log of the readings. - Get a current electric rate schedule from your local power company and calculate your electric bills. - Calculate the cost of using various appliances.

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