

17
I64ES
25
4H-414
MP
1981



Electric/Electronic Project Guide

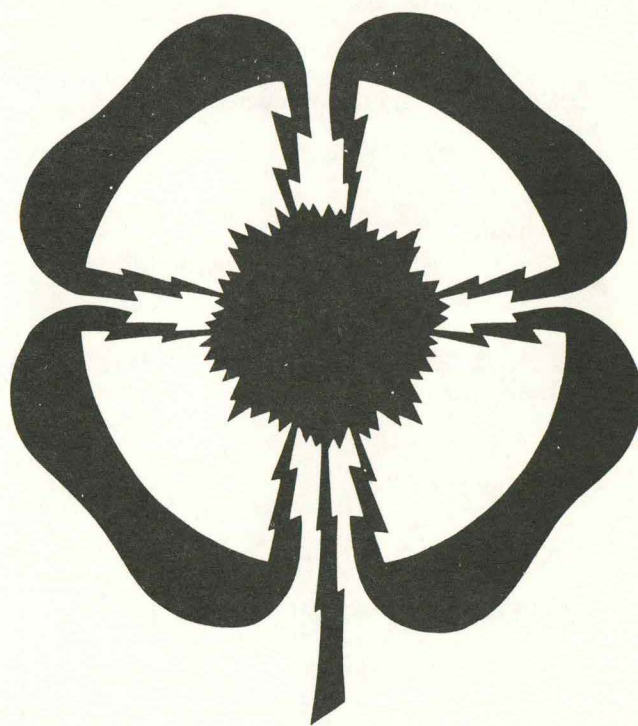
Objectives

To help you:

- Develop an understanding of the basic principles and theories of electricity.
- Understand the important effects electric energy has on people and their environment.
- Develop the knowledge of safe practices and procedures to prevent personal injury and property damage.
- Acquire knowledge regarding efficient utilization of electric energy through the production of heat, light, power, communications and computations.
- Increase your awareness, concern and knowledge regarding generation, transmission and distribution of electric energy.
- Explore career opportunities associated with the electric and allied industries.

All 4-H members are encouraged to:

1. Plan your project with the help of your leader or parents. Record your plans on 4H-91-2 or 4H-91-4.
2. Read project literature—especially as it relates to things you want to learn and do in the project.
3. Obtain help through educational meetings held by your leader, the county extension office, or by project-related groups.
4. Give a talk or presentation related to some phase of the project.
5. Participate in project visits, trips and tours planned by leaders and members.
6. Evaluate your progress with your leader or parents. Record what you did and what you learned on 4H-91-2 or 4H-91-4.



Reference Materials

1. Exploring the World of Electricity, Unit 1, 4H-412-A, (31¢)
2. Electricity's Silent Partner—Magnetism, Unit 2, 4H-412-B, (28¢)
3. Working with Electricity, Unit 3, 4H-412-C, (31¢)
4. Electricity for Family Living, Unit 4, 4H-412-D, (42¢)
5. Behind the Switch, Unit 5, 4H-412-E, (38¢)
6. Electronics for Communication, 4H-415-V, (70¢)

Cooperative Extension Service
Iowa State University
Ames, Iowa 50011

STATE LIBRARY OF IOWA
17 I64ES 25 4H-414 -MP 1981 sdoc
/Electric/electronic project guide



Unit 1 – Electricity

Things to Learn

- A. What electricity is
- B. Electricity and atoms
- C. Current and voltage
- D. How batteries work
- E. Conductors and nonconductors
- F. Circuits
- G. Resistance
- H. The magic of light
- I. Keeping electricity your friend

Things to Do

Make a list of energy-using appliances and devices.
List ways electricity is used in other 4-H projects.
Talk to an adult about ways electricity is used at his or her place of work.

Draw a picture of an atom and its parts.
Note ways you can make static electricity.
Make dancing dolls from static electricity.

Draw diagram of an electric system and a water system to show how they are alike.
Make a list of appliances in your home that use 220-240 volts.

List appliances at home that use batteries.
Electroplate some metal household objects.

Test some objects with a 1.5-volt battery, a 1.5-volt bulb, and a wire circuit to see if they are conductors or insulators.

Make a simple circuit.
Make a circuit board to show series and parallel wiring.
Make a simple fuse.

List the ways resistive heating is used in your home.
Demonstrate how resistive heating works.

Use an old light bulb to make a demonstration board.
Conduct a lighting survey at home.

Conduct a hazard hunt.
Check newspapers for a week for stories of electricity accidents.
Check appliances for the Underwriters Laboratories seal.
Read up on first aid for electric shock.

Unit 2 – Magnetism

Things to Learn

- A. What magnetism is
- B. How to make a magnet with electricity
- C. How to use an electromagnet

Things to Do

Make your own magnet to use as a compass.

Make an electromagnet using a steel knitting needle, copper wire, and a dry cell battery.
List the ways magnets are used around the house.

Make a simple buzzer like the one used in some alarm clocks.
Construct a simple telegraph station.

Things to Learn

- D. How to use magnetism to help measure electricity

- E. How electricity makes motors run

- F. How to make electricity from magnetism

- G. How a transformer works

Things to Do

- Build a simple electric meter.
- Make a galvanoscope to measure the voltage of batteries.

- Construct a simple electric motor.

- Use your galvanoscope and a magnet to make electricity.
- Use your DC motor to make an electric generator.

- List the ways a transformer is used in your daily life.

Unit 3— Working With Electricity

Things to Learn

- A. Wires and cords

- B. Electrical connections

- C. How to construct basic equipment

- D. Home wiring circuits

- E. Planning home wiring

- F. Grounding

- G. Home wiring equipment

- H. Maintaining home electric equipment

Things to Do

- Make a display board of cords and their uses.
- Conduct a cord survey of your home.

- Make a display of different types of plugs and their uses.
- Demonstrate how to connect a screw terminal, how to prepare a Western Union splice and a rat-tail splice.
- Demonstrate how to prepare, splice, and tape wires.

- Make an extension cord.
- Rewire a lamp.
- Make a trouble light.

- Sketch and explain the general layout of your home wiring system.

- Find out which lights and outlets are on which circuits at home.
- Draw an electrical plan of your home.

- Make a test lamp.

- Make a display board of wiring cables and conduits.
- Explain how a 3-way switch and a 4-way switch operate.
- Explain how fuses and circuit breakers operate.

- Check appliances for safety.
- Show how to check an appliance cord and plug.
- Make an appliance service chart.

Unit 4— Electricity for Family Living

Things to Learn

- A. The nature of light
- B. Types of light sources and fixtures
- C. How to plan a lighting system
- D. Heating appliances
- E. Using motors instead of muscles
- F. Cooling with electricity
- G. Electric appliances
- H. Choosing and operating appliances
- I. Maintaining home appliances
- J. How much electricity you use

Things to Do

- Check light levels at various places in your home.
Check reflectances of several samples of wallpaper.
Show how to correct glare, contrast, and direction in poor lighting situations.
- Show how different types of incandescent and fluorescent bulbs are used.
Demonstrate the effect of bulb type on glare and how shading and indirect lighting reduce glare.
Conduct a home lighting survey.
Take a lighting field trip.
- Demonstrate a well-lighted and a poorly-lighted grooming center.
Show how a chair and floor lamp should be placed for hand sewing.
Demonstrate proper light levels and lamp positions for reading or study.
Build a study lamp.
- Make popcorn two ways.
Make a list of all the electric cooking appliances in your home.
Show the difference between a steam-and-dry iron and a dry iron.
- Make a list of all electric appliances and add up the total watts of appliance power you have.
Write down the names and uses of appliances that use electric motors.
- Demonstrate how refrigeration cycle works.
Collect pictures of refrigerants used in past.
- Report on the invention of the telephone, radio, or television.
Explain how a stereo system operates.
Visit a retail electronic store or repair shop.
- Demonstrate points to consider when buying an appliance.
List measures you can adopt at home to help conserve energy.
Figure efficiency of air-conditioning units.
- Build a "caddy" for cleaning equipment.
Show an early model of an appliance and compare with a new model.
- Estimate the monthly cost of using several of your appliances.

Unit 5— Behind the Switch

Things to Learn

- A. Electricity
- B. Generating electricity
- C. How hydro power works
- D. The steam cycle
- E. Fossil fuels—a gift from the past
- F. Nuclear power
- G. Energy from the sun
- H. Energy from the earth
- I. Planning for power
- J. Transmission lines

Things to Do

Describe the difference between power and energy.
Discuss how more energy can be conserved with club members.

Demonstrate how electricity is generated using a coil, magnet, and a meter.
Get information from your electric power supplier on how they serve local customers.

Find out about nearest hydro-electric plants in your area.
Show how much water would be needed to produce all the electricity used in your community.

Ask your power supplier how much electricity is generated by the steam cycle.
Find out where the water used to generate your power supply comes from.

Take a trip to a natural history museum to learn how coal, oil, and gas deposits were laid down.
If possible, visit a coal mine, oil refinery, or a natural gas well or pumping station.

Discuss with other club members how fossil fuel and nuclear plants are alike and how they are different.
Discuss ways that radioactive material is used in hospitals, industries, and so on.

Make a solar hot-dog cooker.
Make a cardboard box you can heat with solar energy.

Check with a university or museum geologist for facts on geothermal energy.
Check on windmills used in your area.
Find out about biomass conversion in your area.

Check with your power supplier to find out the local load pattern.
Find out how much electricity is used in your community now and what is predicted for 10 years from now.
Give a report to your club on the pros and cons of the issues raised by public interest groups.

Find out where transmission lines run near your home, where they start, and where they go. Ask your power supplier.

Things to Learn

K. Distribution

L. Electricity for sale

Things to Do

See if you can follow the lines from your home back to the distribution transformer servicing it. Watch your newspaper for reports of power outages and how they were repaired.

Bring a recent bill to a club meeting and determine the cost per day and cost per kWh. Practice meter reading with your club members.

Electronics

Things to Learn

A. How a radio works

B. How a vacuum tube works

C. How an amplifier operates

D. What are transistors

E. How an intercom works

F. How a portable radio works

G. How a regenerative receiver works

H. How a one-transistor amplifier works

I. How radio waves are made

J. How a radio voice transmitter works

K. How a thermoelectric refrigerator works

Things to Do

Build a crystal radio.

Replace the crystal detector of your crystal radio with a vacuum tube. Open a discarded vacuum tube and study its parts.

Build a triode tube amplifier. Use the amplifier to amplify the sound of your crystal radio.

Build a two-transistor amplifier. Amplify the signal from your crystal radio.

Obtain an intercom kit and assemble it. Make your home or farm more convenient by using the intercom.

Obtain a 6-transistor, 2-diode portable radio kit and assemble it.

Build a receiver using a size "D" flashlight battery for power.

Build an amplifier to increase the signal from your crystal radio.

Build a 1-transistor code transmitter. Learn Morse code and send messages.

Build a 2-transmitter radio voice transmitter. See how far it will send signals and demonstrate it to your friends.

Build an experimental thermoelectric-heater-generator.

Cooperative Extension Service, Iowa State University of Science and Technology and the United States Department of Agriculture cooperating. Charles E. Donhowe, director, Ames, Iowa. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914.



and justice for all

The Iowa Cooperative Extension Service's programs and policies are consistent with pertinent federal and state laws and regulations on non-discrimination regarding race, color, national origin, religion, sex, age, and handicap.

STATE LIBRARY COMMISSION OF IOWA

Historical Building

DES MOINES, IOWA 50316