INVESTIGATE & EXPERIMENT

Fruit Battery

Battery Storage

A battery is a device that stores energy and turns it into electricity. There are many types of energy, including electrical energy and chemical energy. Batteries store chemical energy and convert it into electricity. There are many types of batteries:

Alkaline batteries like AA or AAA are used to power devices around your home, such as toys, torches and Xbox remotes. These are called single-use batteries and can only be used once.

Lead acid batteries are used in cars and trucks.

Lithium-ion batteries are used in mobile phones and computers. They are rechargeable and can be used again and again. This is the most common type of battery used in a Renewable Energy Zone.

Battery storage is an important part of a Renewable Energy Zone. Batteries keep electricity flowing when the sun isn't shining and the wind isn't blowing.

The Challenge

In this STEM project, you will explore the science behind how chemical energy transforms into electrical energy and answer the question:

Which type of fruit or vegetable produces the most electrical energy?

What if I told you fruits and vegetables can also act like a battery and generate electricity? It's true! Fruits and vegetables contain acids like citric acid in lemons or phosphoric acid in potatoes. These acids can help create a chemical reaction when you insert two different metals, like zinc and copper. This reaction generates electricity! So just like a regular battery, the fruit or vegetable:

- **Stores chemical energy**
- **Turns it into electrical energy**

1. Research

The chemical energy in a battery comes from the materials inside the battery reacting with each other. When these reactions happen, they can push tiny particles called electrons through a circuit, and that's what creates electricity!

What is a circuit?
A circuit is a path made of wires that electricity can flow through. It has to be complete, like in a racetrack. If there's a gap, the race (or the electricity) can't go all the way around.

What is voltage?
Voltage tells us how strong the electrical push is in a circuit. It's like the pressure that moves electricity through the wires, and it can be measured with a multimeter or a voltmeter.

Continued on the next page...

What are electrodes?
Electrodes are the two different metals you will put into the fruit or vegetable as part of your circuit. They help create the chemical reaction that makes electricity.

Positive Electrode (+)
This is the metal that receives electrons — this experiment uses copper.

Negative Electrode (–)
This is the metal that gives away electrons — this experiment uses zinc.

It's time to conduct your own research. Are there gaps in what you know? Is there anything you don't understand or want to learn more about? Speak to your teacher and use books, websites, or videos to explore the science behind fruit batteries.

2. Write a Hypothesis

Now it's time to form your hypothesis. This is your idea that explains what you think will happen and why.

I think the [fruit/vegetable] _____ will produce the most electricity,

because [reason] _____ .

3. Variables

Variables are parts of an experiment that can change. To conduct a fair experiment, it's important to identify the variables!

Independent variable: This is the one variable that will change between each test. In this experiment you are testing how much electricity different types of fruits and vegetables can generate, so your independent variable will be the type of fruit or vegetable.

Dependent Variable: This is the variable you will measure in each test. In this experiment you are measuring how much electricity different types of fruits and vegetables generate in a circuit, so your dependent variable will be voltage.

Controlled Variables: The controlled variables are all the other things we need to keep the same between experiments to make sure every test is fair.

You can use a table like the one below to write down your variables as you prepare for your investigation:

What will I keep the same?	What will I change?	What will I measure?
• _____ • _____ • _____ • _____ • _____ • _____ • _____	• *The type of fruit or vegetable*	• *Voltage*
Controlled variables	**Independent variable**	**Dependent variable**

Adapted from: Hackling, MW 2005, *Working Scientifically: Implementing and Assessing Open Investigation Work in Science*, Department of Education and Training, Western Australia.

4. Materials Required

- Your chosen fruits and vegetables
- Copper coins or copper strips (positive electrode)
- Galvanised nails or zinc strips (negative electrode)
- Alligator clips with wires
- Measuring device, such as a multimeter or voltmeter
- Pens, pencils and paper to record your results

Safety Tips:

- Wash hands after handling fruit and electrodes
- Be cautious with sharp materials like nails and wires
- Do not consume used fruit

5. Method

1. Insert one copper and one zinc electrode into the fruit or vegetable you are testing — spaced apart and not touching.
2. Use alligator clips to connect the electrodes to your voltage measuring device, ensuring you have a closed circuit.
3. Record the voltage output.
4. Repeat for each type of fruit and vegetable.

6. Plan Your Test

Now you know your materials and method, draw a labelled diagram of your setup. How will you use the materials to create your circuit? Use labels to show your electrodes, wires, multimeter, and fruit. Make sure your drawing shows how the circuit is complete. This diagram helps to explain how your test will work.

7. Conduct Your Investigation

It's time to start your experiment! Remember to follow the method carefully and use your equipment safely.

Take photos and videos as proof of your work, which can form part of the final presentation and STEM Expo!

8. Record Your Results

Create your own method of recording results or use the table below:

Type of Fruit or Vegetable	Voltage (V)

TIP: Create a column graph showing voltage produced by each fruit or vegetable.

9. Analyse Your Results

It's time to look at your results and think about what they show. Analysing your results helps you understand what happened in your experiment and why. It shows us whether our hypothesis was correct and helps us identify patterns, errors, or unexpected outcomes. As part of your analysis, write answers for the following questions:

- **Which fruit or vegetable generated the most electricity?**
- **Did your results support your hypothesis?**
- **What do you think might explain differences between the amount of electricity generated by the different fruits and vegetables?**
- **Did anything unexpected happen?**
- **How could you improve your method?**

Extension

Want to take your experiment further? Once you've completed your main investigation, you can design your own twist!

Here are some ideas to inspire you:

- Try connecting two or more fruits or vegetables in a series circuit to increase the voltage.
- See if you can use your fruit battery to light up an LED or power a small device.
- Explore how temperature or fruit freshness affects electricity output.
- Test the same fruit in different sizes or shapes.
- Or come up with your own creative idea to test!

10. STEM Expo

It's time to communicate your findings at the STEM Expo! Can you come up with a creative way to present your process and discoveries through a report, poster, or even a video? Make sure you include:

- **Your question and hypothesis**
- **Your method and results**
- **Your conclusion and explanation**
- **Any new questions that arose from your findings**

11. Showcase at rezourceforce.com.au

Now you can share your project with the REZource Force Online Showcase. This is your chance to show your work to other schools, community members, and professionals working in the renewable energy industry.

Selected entries will be eligible to win prizes for their school!

To enter, use the QR code to fill out a short form and upload photos, videos, or documents that show what you created and what you discovered.

SCAN ME