

# BREAKING IT DOWN

with Dr. Michelle Dickinson



## ENERGY

### Welcome to Breaking It Down with Dr Michelle Dickinson.

This worksheet will help you to support your teaching after students have watched the 'Energy' episode. It contains a summary of the science knowledge, experiment instructions, topics for further inquiry, and links to the NZ curriculum at levels 3-5.

Use this sheet alongside the video of the Energy episode of "Breaking It Down with Dr Michelle Dickinson" to help with your teaching around the science of energy and electricity. During the episode, Dr Michelle Dickinson will cover the science of different types of energy including renewable energy, and take a closer look at how we generate electricity. She will talk with Professor Justin Hodgkiss of the MacDiarmid Institute about future solar cells, and conduct an experiment which students can follow along with.

### For this session, your students will each need:

- **Elastic band**
- **Piece of card**
- **Paper**
- **Blu-Tack**
- **Pencil**
- **Plastic ruler**
- **Notebook and pencil to write down their observations**

### Achievement Aims

#### NZ Curriculum Strand: Physical World

**Physical inquiry:** Identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.

### Learning Outcomes

- Understand conversion of energy between different forms, including potential energy.
- Describe the relationship between electrons and electricity in terms of 'energy'.
- Understand the difference between renewable and non-renewable energy, and be able to give examples of each.
- Conduct an experiment to demonstrate how potential energy is converted into kinetic energy.

### BREAKING IT DOWN:

Science of Energy

Energy is "the ability to do work." There are lots of different forms of energy including heat, light, sound and movement. Energy cannot be made or destroyed; it can only be changed into different forms, for example a lightbulb converts electricity into heat and light.

Electricity is a type of energy that can be used in many different ways. To understand electricity, we need to understand what's happening at a subatomic level. Inside atoms are protons, neutrons and electrons. The protons and neutrons stay clumped together in the nucleus of the atom, and the electrons spin around the centre of this nucleus. Electrons are negatively charged, and they stay in orbit because they are attracted toward the positively-charged protons in the nucleus. To create electricity there needs to be a net flow of electrons in one direction. This happens more easily in conductive materials such as metals because their atomic bonding structure creates what is called a "sea of electrons" where electrons can move more easily through the structure. Free electrons can also build up on surfaces and the release of these electrons through a conductive surface is known as 'static electricity.'

Historically, burning fossil fuels like coal, oil, or natural gas, was the main way that power stations produced electricity. As these fossil fuels are non-renewable and can also produce harmful chemicals when burned, the desire to find more sustainable ways to make electricity has been prioritised. Developments in new technologies have enabled electricity generation from energy sources that won't run out, such as wind, sun and water flow.

Wind turbines are built in places where they can catch the wind almost every day. These giant structures with huge blades turn using the force of the wind. This turns a rotor that provides kinetic energy which is converted to electricity through a generator. Another large source of energy is water through hydropower. This relies on fast-moving water, and converts the kinetic energy of that water into electricity by spinning a generator's turbine.

## EXPERIMENT INSTRUCTIONS

### Experiment 1: Catapult Plane

- Fold a 16cm x 8cm rectangle of paper in half lengthwise twice to make a narrower rectangle.
- Fold one end back on itself to make a small hook. Trap the elastic band in the hook and secure with tape.
- From card, cut out an equilateral triangle with sides 12cm long. Tape the paper hook along the centre of one face of the triangle, with the elastic band close to one corner. Clip a paperclip to the same corner.
- Launch the plane by hooking the elastic band around one thumb and pulling the back of the plane back with the other hand.

### Experiment 2: Static Mover

- Cut a small rectangle of paper, fold in half one way, open it out and fold in half the other way.
- Put Blu-Tack on one end of the pencil and stick it upright on a surface.
- Balance the paper rectangle on top of the pencil using the fold to help.
- Bring the plastic ruler close to the paper and observe what happens.
- Rub the plastic ruler against your hair a few times, then repeat the experiment and watch how the paper rotates without you touching it.

## EXPLORE FURTHER

(Use these prompts to start a discussion or further inquiry on the topic of electricity)

- How much of NZ's electricity is provided by renewable sources?
- Can waves in the ocean be used to turn a turbine?
- What is the difference between AC and DC electricity?
- How do batteries store electricity?
- How does electricity get to our homes?

## FURTHER EXPERIMENTS & INFORMATION

Further science experiments and worksheets from the MacDiarmid Institute for primary school teachers can be found [here](#).



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