Earth Power

Theme of the Lesson

This lesson is all about energy and forces. We look at different forms of energy and how energy can be changed from one form to another to generate the electricity that we use every day. We investigate forces and movement. We also speak to a Marine Biologist and hear about our connection with the ocean.

Curriculum Links

Strand: Energy and Forces; Living Things; Environmental Awareness and Care; Living Things

Strand Unit: Magnetism and Electricity; Forces; Light; Plant and animal Life; Science and the Environment; Environmental Awareness; Caring for the Environment

Curriculum Objectives:

- Learn about electrical energy
- Explore how objects may be moved
- Investigate falling objects
- Learn that light is a form of energy
- Develop an increasing awareness of plants and animals from wider environments
- Become aware of the importance of the Earth's renewable and non-renewable resources
- Come to appreciate the need to conserve resources
- Identify and discuss a local, national or global environmental issue
- Recognise the contribution of scientists to society
- Explore and appreciate the application of science and technology in familiar contexts

Background Science

Wind Energy

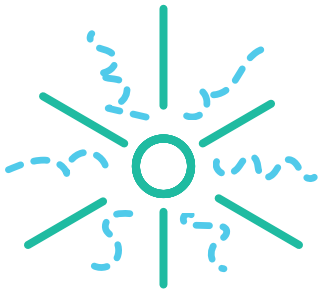
An object can only move if a force acts on it. Once that force has been applied, the object now has energy. Heat, Light, Sound and Electricity are all forms of energy. We investigate how wind can be used to generate electricity.

The Law of Conservation of Energy tells us that energy can neither be created nor destroyed only changed from one form to another. If we want to generate electrical energy, we need to change another form of energy. The Story of Energy video by SEAI provides a great overview of this process https://www.youtube.com/watch?v=uPCiHhMvgo4

Most of our energy in Ireland is generated from burning fossils fuels such as oil, coal, gas and peat (turf). These are known as fossil fuels because they are made from the remains of plants and animals that died thousands or millions of years ago and became part of the Earth. When they were alive, plants soaked up light energy from the sun, converted it to chemical energy and used it to grow. Some of these plants eventually died and over time turned into peat and coal. Some plants were eaten by sea creatures which eventually turned into oil and gas.

Fossil fuels are a source of stored chemical energy. When these fuels are burned in a power station the chemical energy changes to heat energy. The heat energy is used to boil water and make steam and steam can be used to move a type of wheel known as a turbine. The energy of movement is called kinetic energy.

Electricity is generated by moving a magnet within a coil of copper wire. In the power station, the steam turbine moves the magnet to turn kinetic energy into electrical energy.



Fossil fuels are known as a non-renewable energy source because they take so long to form that they cannot be replaced in our lifetime. They also release Carbon Dioxide gas as they are burned which contributes to climate change.

Power Station Energy Conversions

Light (from sun) → Chemical (fossil fuels) → Heat (Burning in power station) → Kinetic (steam turning turbine) → Electrical

If we use wind to generate electricity, we are harnessing the kinetic energy of the wind to turn the blades of a wind turbine. This moves the magnet within the coil of wire to generate electrical energy. We can also use water turbines built into a dam in a river (hydroelectric energy) or in the sea (ocean energy). We call these sources of energy renewable energy because once the equipment is built, the source of energy (wind or water) won't ever run out.

Wind, Hydroelectric or Ocean Energy Conversions

Kinetic (from wind or water) → Electrical

Solar energy is another form of renewable energy. Solar energy doesn't involve the movement of a turbine. Instead light from the sun is changed into heat energy to heat water (solar thermal) or directly into electrical energy using a special material called a semiconductor (solar photovoltaic or PV).

Solar Energy Conversions

Light (from sun) → Heat (solar thermal panel)
or
Light (from sun) → → Electrical (solar PV panel)

Studio Experiment

Sir Isaac Newton studied forces and how things move. He explained all of these concepts using three laws known as Newton's laws of motion. The studio experiment demonstrates Newton's First Law of Motion also known as the law of inertia. An object will not move unless a force acts on it. In other words, something needs to push or pull the object. Once something is moving, it will keep moving unless another force acts on it. In the case of the wind turbine, the force is applied when the wind pushes on the turbine blades. The wind needs to be strong enough to push against the weight of the turbine blades to get it moving. Until the wind is strong enough for the turbine blades to experience a force, the turbine is at rest. This is known as inertia.

Mark demonstrates Inertia using an orange, a glass of water, a postcard and a cardboard tube. When the orange is directly above the glass of water, it is already being pulled down by the force of gravity but it can't fall because it is being held up by the cardboard tube. When the postcard is pulled away quickly, it takes the cardboard tube with it. The orange, however, doesn't experience any sideways force from the postcard being removed. The only force experienced by the orange is the force of gravity which pulls it straight down into the glass.

Supersize Experiment

The supersize experiment continues the demonstration of inertia. The items on the table are being pulled down and held in place by the force of gravity. If the tablecloth is pulled away quickly enough these items will not experience the sideways force but only the force of gravity and will remain in place.

Equipment and Tips

for conducting the Studio Experiment in your school

Mark performs a simple studio experiment that can easily be carried out with your class. If you want to be ready to carry it out after watching the video you will need to collect the following equipment.

You will need:

- A glass partially full of water
- A piece of flat card larger than the glass (a postcard or piece of a cereal box)
- A cardboard tube from kitchen roll or toilet roll
- A mandarin orange
- A tea-towel or hand towel would also be useful

Note: This can also easily be done as a group activity with one set of equipment given to each pod. Remember to clear everything off the tables in advance. Some water will probably splash out as the orange falls into the glass but placing a tea-towel underneath each glass makes it easy to mop up the spills.

Tips for Further Investigations on Energy and Forces

Use the Lesson Plans to help your class with brainstorming ideas and coming up with a question. Remember that the children may start out with very broad ideas around questions but working through the steps in the lesson plans will help them to refine it down and come up with a testable question. The children will be more invested in their project if they are investigating a question that they developed as a class rather than one that was set by the teacher although you might want to narrow it down to ideas based on a particular theme. They may do some smaller investigations on the way towards refining their project idea and the finished project may be quite different from the original idea, but this is all part of the process.

There are lots of ways to carry out a project. It might involve a fair test investigation, some gathering of data or even a design and make project. Remember to encourage the children to make predictions and to think about the best way to record and communicate their results.

Encourage children to think about Living Things and our interaction with the natural environment. Lucy Hunt highlights the fact that phytoplankton in the sea provide 50% of the oxygen we need to breathe and the ocean also has a huge role too.

The themes in this episode could provide lots of inspiration for project ideas:

- There are lots of ideas for investigations on renewable energy on **www.seai.ie/schools**. Children might design and make their own model wind turbines or wind powered vehicles and test them in different conditions. They might make a solar oven or two and carry out a fair test by changing different variables. They might investigate what types of renewable energy work best in Ireland.
- You will also find lots of ideas for investigations on energy and forces on **www.primaryscience.ie** and **www.esero.ie/primary-level**. For investigations on weather, climate and climate change visit **www.esa.int/kids**.
- You don't need to live anywhere near the sea to get involved in protecting the marine environment. A lot of the rubbish discarded by people including plastic bags and helium balloons makes its way by wind or through rivers to the ocean. Microfibres from our clothes and microplastics like glitter are also a big problem for the marine environment. Children could investigate issues like plastic pollution and waste in school or in their local area.
- We can't all swim with sharks like Lucy Hunt, but children could carry out lots of investigations on living things in their own school grounds and see what types of habitats exist and which types of minibeasts live in different environments. Visit the National Biodiversity Data Centre website **www.biodiversityireland.ie** and the All Ireland Pollinator Plan website **www.pollinators.ie** for lots of great resources on biodiversity and pollinators, or check out the Irish Whale and Dolphin Group at **www.iwdg.ie/**

Linkages

The children will obviously be spending some time on their ESB Science Blast project but remember that this is time well spent. They will not just be doing Science but depending on the project theme, it can cross over into lots of other subjects and become the focus for cross curricular work. There can also be linkages with other projects such as the SFI Discover Science and Maths Awards, Active Flag or Green Flag. Some possible linkages.

- **Language**: Written and oral language skills through recording and communicating about their project or discussion about environmental issues as part of their project.
- **Maths**: Data collection, recording of results, tables, graphs, calculations
- **History**: Use of renewable energy in the past such as wind and water mills for making cloth and for grinding flour.
- **Geography**: Habitats around the world and on a local scale. Weather, climate and climate change.
- **PE**: Moving and travelling using renewable energy e.g. walking, cycling, scooters. Forces involved in running, throwing, bouncing or kicking a ball.

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