SIEMENS

Scheme of Work

The magic of making electricity

Introduction

This sequence of lessons explores how electricity was first generated in a way that could do useful work. This first part uses the idea of 'hand crank' technology to introduce the idea of using movement to produce electricity. The next section looks at how this can be scaled up using a flow of water and the final part looks at the possibilities that large scale electricity generation made possible.

The materials therefore present pupils with opportunities to apply their understanding of circuits and consider how technological changes impact on people.

Overall learning objectives	Overall learning outcomes
• To understand how creative thinking and scientific ideas can be harnessed to solve problems and improve quality of life • To understand how natural resources can be used to provide useful services • To apply ideas about generating and using electricity to powering circuits	• To explain how electricity can be produced and used • To suggest advantages it offered • To apply ideas about circuits to solve problems and develop solutions

Curriculum learning objectives:

Let there be light will support the following national curriculum learning objectives at KS2.

Science:

Pupils should be taught to:

- associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- use recognised symbols when representing a simple circuit in a diagram.

Technology:

- understand how key events and individuals in design and technology have helped shape the world

Geography:

- describe and understand key aspects of human geography, including: types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water

Links to Curriculum for Excellence and Northern Ireland Curriculum are also available at: www.siemens.co.uk/education/curriculum

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Technology Explorer

Energy Explorer

Episode 1

The magic of making energy

Resources required:

- ☐ Hand crank torch (real or image)

Learning objectives

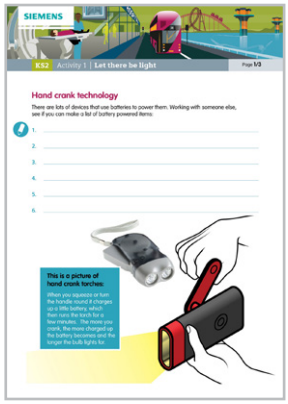
- To understand how electricity can be made and used
- To apply ideas about generation to a range of contexts
- To identify advantages and disadvantages of a particular technology

Learning activities

1. **Start off by asking pupils if they think it is possible to make electricity and encourage ideas**.

Display these on the board. They might include:

- Lightning
- Generating a static charge, such as rubbing your feet on a nylon carpet
- Using a battery
- Setting up a petrol generator
- Building a power station



Then ask which of these might be useful if you were stranded a long way from anywhere and needed electricity to produce light. Show pupils an image of (or preferably a real) hand crank torch and explain how it works.

Ask what is being turned into what and draw out that movement is being turned into light.

2. **Say that this is only practical for devices that use a relatively small amount of electricity (i.e. devices that might otherwise be battery powered).** Ask for suggestions as to what else could have a 'hand crank version'. Ask pupils to come up with ideas and sketch them.

Display the sketches around the room and ask pupils to go round an look at them. They should then identify advantages and disadvantages of 'hand crank technology' and summarise these in a table. *Use activity sheet 1*.

Outcomes

- To describe what 'hand crank technology' can do
- To suggest various applications
- To identify advantages and disadvantages

Episode 2

Electricity from falling water

Resources required:

- ☐ plastic cotton reel
- ☐ an axle (knitting needles are good but plastic rod is safer)
- ☐ plastic card
- ☐ plasticine

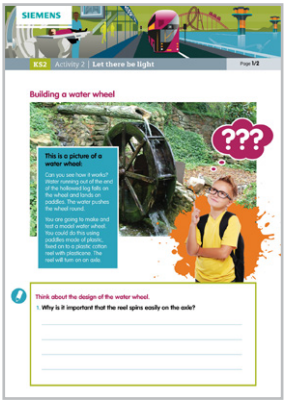
Learning objectives

- To understand the advantages of water powered generators
- To investigate features of water turbine design
- To evaluate their designs

Learning activities

1. **Show the hand crank torch again and ask pupils to recall the advantages and disadvantages of this technology**. Two of the limitations are that it gets quite tiring to repeatedly squeeze and relax a handle and that it doesn't actually produce much electricity.

2. **Show a picture of (or, preferably, demonstrate) a stream of water from a tap and ask for ideas about how the force of water falling could be used to produce electricity.** Draw out that a water wheel is a good way of doing it as it changes the direction into rotation.



Ask pupils to design, construct and test simple water wheels. This can be done in various ways but one of the easiest is using *activity sheet 2*.

Each group will need a plastic cotton reel and an axle (knitting needles are good but plastic rod is safer). They will also need plastic card and plasticine. The idea is for the plastic card to be cut up to make the paddles and attached to the cotton reel using plasticine. Corrugated plastic (often known as corriflute) is good for this.

This activity can be made more challenging if pupils can decide how large to make the paddles, though thought needs to be given as to how cutting can be achieved safely. The activity is even better if each group has a set area of plastic and has to decide how to divide it. Water wheels should then be tested in the stream of water.

3. **Show image of turbine linked to generator and explain that this can produce electricity.**

Then ask for ideas about how a steady flow of water, large enough to turn a big water wheel and power a large generator, might be achieved. Show picture of Cragside, point out the raised lake and explain that this was the first place ever to be powered using falling water, turning a wheel and driving a generator.

Outcomes

- To explain the advantages of a water wheel to power a generator
- To have tested and evaluated a model water wheel
- To understand how this was applied practically

Episode 3

Not one house but a whole town

Resources required:

- [ ] Image of Craigside
- [ ] Cardboard box (or similar container style)
- [ ] Bulbs
- [ ] Battery
- [ ] Wire

Learning objectives

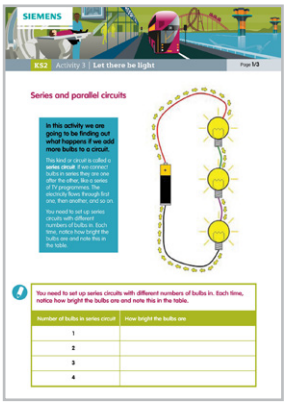
- To understand the advantages of electric lighting over gas lighting
- To understand about the use of parallel circuits
- To apply and test these ideas

Learning activities

1. **Show a picture of Cragside and say that this was possible because the owner of the house was wealthy and also knew how to use scientific and technical ideas (Sir William Armstrong was a major shipbuilder on the River Tyne). The next step was to make electric lighting available to ordinary people.**

Say that in the 1870s street lighting consisted of gas lights. These had to be lit as it went dark, turned out at the end of the night and needed cleaning. Electricity didn't need any of these. In 1881 Godalming became the first town to have electric street lighting, using water wheels and a Siemens alternator.

However, when lots of bulbs are joined to one supply, something rather odd can happen. Either demonstrate or (preferably) ask pupils to investigate what happens if more and more bulbs are linked to one power supply. Ask pupils to put more bulbs in a series circuit and see what happens. As more are added, they all become dimmer.



Now introduce the idea of parallel circuits and show how bulbs connected in parallel are all 'fully bright', irrespective of how many are connected. Pupils can now work in table groups to set up circuits and see how a parallel arrangement enables several bulbs to be lit at once. This activity can be developed (equipment allowing) by asking pupils to bring in cardboard boxes (or other such container) and decorate them to represent houses. Each house can then be fitted with a light and several houses powered from one source. *Use activity sheet 3*.

Pupils should record the arrangement using circuit diagram conventions, including symbols.

Outcomes

- To explain the advantages of electric lighting
- To test and evaluate a parallel circuit compared to a series circuit
- To explain the practical application of this.