

A resource for teaching sustainable energy in Primary Schools

1st and 2nd Class



A resource for teachers

This resource will help you bring the topic of sustainable energy into the classroom in the context of the Primary Science Curriculum and the Green-Schools programme. It will help children learn about energy in a real world way, exploring how and why as a society we need to develop new ways to meet our energy needs. This resource makes teaching energy engaging as children see it as relevant to their own lives and future well-being. As children learn about sustainability, they will develop behaviours that benefit them and wider society. Overall, the resource will help children gain an understanding of our current energy challenges and potential future solutions.

How to use this resource?

There are five chapters in this booklet covering the topic of sustainable energy. Each chapter has the following structure:

- Aims
- Overview
- Working scientifically skills
- Primary Science curriculum link
- Resources
- Main body of lesson
- Extension

All chapters have supporting interactive whiteboard activities and PowerPoint slides (for those teachers who do not have access to an IWB) and photocopiable master sheets to help learning. These can be accessed and downloaded at www.seai.ie/teaching-sustainability

Other resources from SEAI for schools

- All teaching resources are on our website www.seai.ie/teaching-sustainability
- If you would like hard copy resources e-mail schools@seai.ie
- We can visit your school and run workshops for pupils and teachers. See www.seai.ie/teaching-sustainability/primary-school/ for more details and bookings.
- Your pupils can enter SEAI's One Good Idea competition to showcase their energy projects www.seai.ie/onegoodidea
- The **e** icon is used in this booklet to identify lessons that involve pupils in saving energy at school, go to this website for resources www.energyineducation.ie

SEAI supporting Schools

SEAI works with the public, businesses, communities, schools and government to achieve a cleaner energy future. We run campaigns and initiatives to increase awareness on sustainable energy and change behaviours. Children are key to this sustainable energy transition.



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This programme was researched and developed by the School of STEM Education, Innovation and Global Studies and the Centre for the Advancement for STEM Teaching and Learning (CASTeL) in DCU Institute of Education.

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e Look for the this icon to find lessons that can be used to involve pupils in energy saving in school in conjunction with the Energy in Education programme. www.energyineducation.ie

CHAPTER 1: Introducing Energy

Aim

The aim of this chapter is for the children to learn about the energy that is used in the production of food.

Overview of Chapter

The lesson explores how food is produced and the role energy plays in food production. The story of chocolate and bread are used as examples.

Working Scientifically Skills

Through discussing and reflecting on the different scenarios in this chapter, the children will be applying and developing the following working scientifically skills:

- Observing
- Predicting
- Investigating and experimenting
- Measuring
- Recording and communicating

Primary Science Curriculum link

Strand unit: Myself



Lesson 1 – Where does our food come from?

Lesson link

Before beginning this lesson you might like to revisit:

**Junior and Senior Infants Programme Chapter 1 Lesson 1:
Sources of Energy - Guzzler needs food**

Resources

Bar of Chocolate, A slice or loaf of bread

IWB 1 / PowerPoint 1: The Story of Chocolate

IWB 2 / PowerPoint 2: The Story of Bread

PCM 1: The Story of Chocolate

PCM 2: The Story of Bread

Scissors, Glue sticks

Activity type: Discussion

Show the class the bar of chocolate and the slice or loaf of bread and discuss with the children where they think these items came from. They should discuss the kinds of energy they think were used in getting the chocolate and the bread to the classroom.

Questions to promote discussion

- 1 Where did we get the bar of chocolate / bread from?
- 2 Where does a shop get the chocolate / bread from?
- 3 How do you think these items get to the shop?
- 4 How do you think milk gets from a farm to a factory?
- 5 Where did the farmer get the milk?
- 6 What did the cows eat to make the milk?
- 7 What helped the grass to grow?
- 8 Where did the flour come from?
- 9 What helped the wheat to grow?

Activity type: Discuss and sort

Use the **IWB 1 and 2** activities to help the children discuss the story of chocolate and the story of bread.

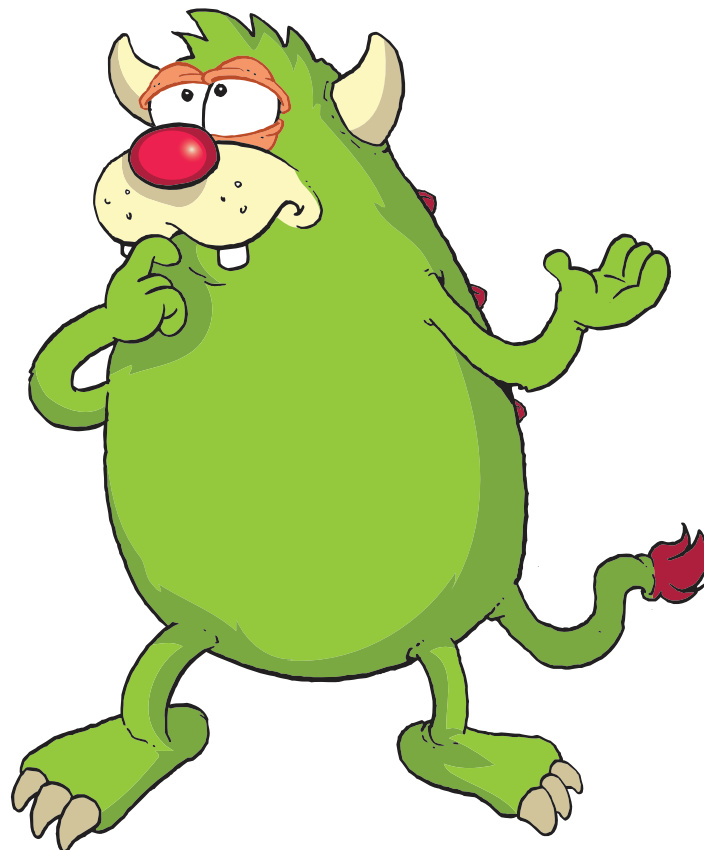
If you do not have access to an IWB use **PowerPoints 1 and 2**.

Using **PCMs 1 and 2** the children can cut out the pictures of the 'story of chocolate' and the 'story of bread' and sequence them. They can then discuss the energy that is used at each stage of the process.

Extension

Resources

Activity from the book **Guzzler Investigates Energy: Energy Chains** (pages 7 and 8)



CHAPTER 2: Energy in our Lives

Aims

The aims of this chapter are for children to become aware of a range of energy sources and to introduce the concepts of renewable and non-renewable energy sources.

Overview of Chapter

This chapter introduces the children to the concepts of renewable and non-renewable energy and focuses on sources of renewable energy. Wind energy is explored and children have the opportunity to design and make a land yacht.

Working Scientifically Skills

In this chapter the children will be applying and developing the following working scientifically and designing and making skills:

- Observing
- Predicting
- Investigating and experimenting
- Measuring
- Recording and communicating
- Designing and making: exploring, planning, making and evaluating

Primary Science Curriculum link

Strand unit: Heat; forces; properties and characteristics of materials; magnetism and electricity

Lesson 1 – Sources of energy

Resources

IWB 3 / PowerPoint 3: Guzzler at home

IWB 4 / PowerPoint 4: Guzzler going for a walk

IWB 5 / PowerPoint 5: Guzzler sun bathing

IWB 6 / PowerPoint 6: Guzzler doing his homework in front of coal fire

IWB 7 / PowerPoint 7: Guzzler doing his homework in front of gas fire

IWB 8 / PowerPoint 8: Guzzler doing homework in front of a radiator

Activity type: Discussion

Use **IWB activities 3 – 8** to promote discussion about different sources of energy.

If you do not have access to an IWB, use **PowerPoints 3-8** to discuss different sources of energy with your class.

Questions to promote discussion

- Guzzler at home – what is happening in the picture? How do you think Guzzler feels? What should he do? why?
- Guzzler is going for a walk, it is windy – what is happening in the picture? How would he feel? Why is Guzzler cold?
- Guzzler sun bathing – what is Guzzler doing? How would he feel? Why is he hot?
- Guzzler is doing his homework in front of the fire – can you tell what is in the fire?
- Guzzler is doing his homework in front of a fire – what fuel is being used to run this fire? (*it is an enclosed gas fire*)
- Guzzler doing his homework in front of a radiator – what is making Guzzler warm?

Lesson 2 – Renewable and non-renewable energy (i)

Resources

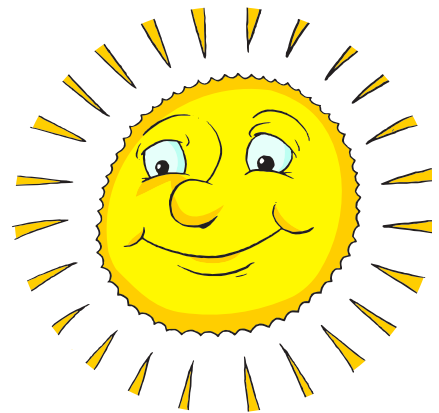
PCMs 3, 4, 5, 6: Pictures of renewable and non-renewable energy (sun, wind, coal and oil)

Teacher note: The key concept in this activity is that some sources of energy are permanent and long lasting (*renewable* - e.g. wind and solar) but other sources, such as coal and oil can only be used once and there is a limited supply of them (*non-renewable*).

Activity type: Game

This activity is a whole class musical chairs style game; you will need a space free of chairs and tables (e.g. PE hall).

- You are provided with **PCMs** of pictures representing coal, oil, sun, wind. For a class of 30 children print out:
 - Sun x 5
 - Wind x 5
 - Coal x 10
 - Oil x 10
- Scatter the **PCMs** around the room. Ask each child to stand on a picture and remember the picture on which they are standing. Explain that the pictures on which they are standing represent different sources of energy that we can use to produce energy for our homes.
- Explain to the class that when you (the teacher) clap your hands, they must walk around the pictures and when you clap your hands again they must find a picture to stand on.
- As the children walk around the room remove some of the coal and oil pictures only. When you clap your hands again, like musical chairs, the children should try and find a picture on which to stand. Repeat this step until only the sun and wind pictures remain.
- When each child is removed from the game, ask them to sit down and give them one of the coal or oil pictures.
- By the end of the game only children with the 5 sun and 5 wind pictures should be left standing. The class will be split in two teams: one team of non renewables (sitting down) and one team of renewables (standing).
- Ask the class to hold up the pictures they have and conduct a whole class discussion on what the class think happened in the game.



Questions to promote discussion

- 1 What happened in the game?
- 2 What do you think is the difference between the two teams?
- 3 Why do you think one team is still standing and the other team sitting down?
- 4 Is there a difference between the different types of energy? What is it?

Lesson 3 – Renewable and non-renewable energy (ii)

Resources

IWB 9 / PowerPoint 9: Renewable and non-renewable sources of energy

PCM 7: Renewable and non-renewable energy

Scissors

Activity type: Discuss and sort

Use **IWB 9: Renewable and non-renewable sources of energy**.

If you do not have access to an IWB use **PowerPoint 9**. Photocopy one copy of **PCM7** per pair of children and ask them to cut out the pictures. They must group the pictures into two groups: renewable and non-renewable sources of energy.

Discuss the choices the children made. It is important to encourage the children to justify reasons for their choices (i.e. why they classified a particular energy source as either a renewable or non-renewable source).

Thinking about all three lessons: what have we learned?

Questions to promote discussion

- 1 In the picture where Guzzler is sun bathing - How do you think Guzzler was feeling? What was making him hot? Do you think the sun's heat would ever run out? Why?
- 2 How about in the other pictures where Guzzler was sitting beside sources of heat (*coal, gas, and oil used to fuel his radiator*). Do you think the heat from the fires or the radiator could ever run out? How might they run out?
- 3 Do you think we could use the sun's energy and the wind to heat our houses? How could we do this?

Lesson 4 – Design and make a land yacht

Resources

IWB 10 / PowerPoint 10: Land yachts

Some materials that could be used to make the land yachts: Straws, balloons, paper plates, tissue paper, paper, fabric, masking tape, wheels and axles, lollipop sticks, match-sticks, skewers, pipe cleaners, cello tape, glue, blu-tack, scissors, box of wheels, spools.

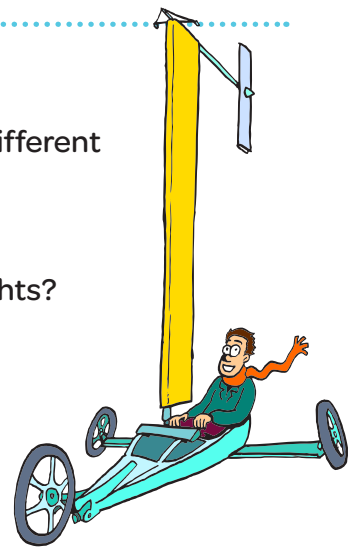
If your class requires additional information to build a land yacht or a balloon buggy refer to the book **The Energy File: How to make a land yacht/balloon buggy (pages 6 and 8)**.

Activity type: Design and make

Using **IWB 10/ PowerPoint 10** show your class the illustrations of the different land yacht designs. Discuss the features of the land yachts.

Questions to promote discussion

- 1 What are the similarities and differences between these land yachts?
- 2 How do you think they move?
- 3 What materials are they made from?
- 4 Where do you think these land yachts get their energy to move?
- 5 How do you think a land yacht uses energy?



Exploring

Discuss criteria the children think would be important for making a land yacht. Record children's ideas and then select 3 or 4 criteria that all children must take into account when designing their land yachts.

For example

It must travel a set distance (30 cm)

It must have a sail

It must be able carry a certain weight e.g. €2 coin

Show the children the materials that are available to them to make the land yacht.

Planning and Making

In groups children discuss their designs and make a detailed drawing of their land yacht design. They then make their yachts.

Teacher note: Photograph the designs of each group at various stages in the design process. This can be used to make a class/ group collage.

Evaluating

Provide each group with the opportunity to present their designs and finished land yachts to the rest of the class. Encourage them to discuss their designs and whether or not their land yachts met the criteria outlined at the beginning.

Questions to promote discussion

- 1 Did you follow your original design?
- 2 Did you encounter any difficulties?
- 3 How did you overcome these?
- 4 What do you like most about your land yacht?
- 5 If you were to make another land yacht is there anything you would change?
- 6 How do you think you could make your land yacht move faster?
- 7 What kind of energy do land yachts use? (*wind*)
- 8 Is this renewable or non-renewable energy? (*renewable*)



CHAPTER 3: Energy Long Ago

Aims

The aims of this chapter are to enable the children to discuss sources of light from past to present day, realise that we need light to see and understand that shiny objects are not sources of light.

Overview of Chapter

Light is a form of energy. In this chapter the children engage with activities that are aimed at developing their understanding of light. They examine changes in sources of domestic lighting from the past to the present and explore the differences between sources and reflectors of light.

Working Scientifically Skills

In this chapter the children will be applying and developing the following working scientifically and design and make skills:

- Observing
- Predicting
- Investigating and experimenting
- Estimating and measuring
- Recording and communicating

Primary Science Curriculum link

Strand unit: Light

Lesson 1 – History of light

Lesson link

Before beginning this lesson you might like to revisit: **Junior and Senior Infants Programme Chapter 3 Lesson 1: The story of cooking**

Resources

IWB 11 / PowerPoint 11: Guzzler and lights through time

Activity type: Discussion

Use **IWB 11** to help the children learn about sources of light that have been used throughout the ages. If you do not have access to the IWB use **PowerPoint 11** to discuss the light sources through time.

Questions to promote discussion

- 1 What is the source of light in each picture?
- 2 What kind of energy does it use?
- 3 Do we use that as a source of light today?
- 4 How do the sources of light change?
- 5 Of the last two (*more modern images*) which light bulb do you think is most energy efficient?
- 6 Why do we need energy efficient light bulbs?

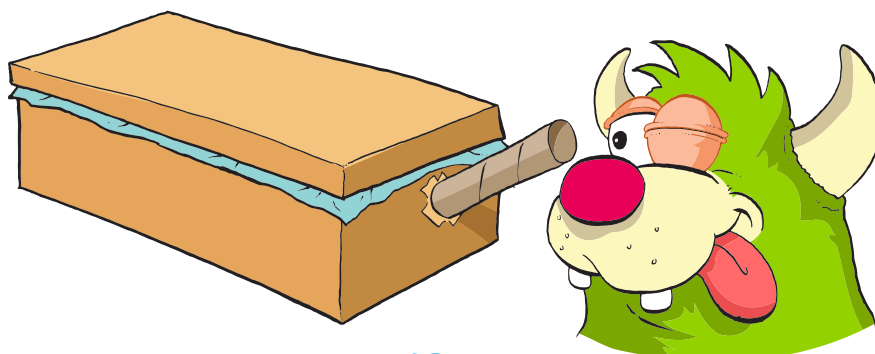
Lesson 2 – Do we need light to see?

Resources

IWB 12 / PowerPoint 12: Guzzler investigates - do we need light to see?

PCM 8: Recording sheet

Dark Box: Shoe box with lid, black sugar paper to line the shoebox and lid, kitchen roll holder, scissors. Selection of objects to test e.g. pencil, coins, small toys, eraser, plastic cubes.



Teacher note: How to make a dark box

- 1 Line a shoe box and shoe box lid with black sugar paper.
- 2 Cut a hole about 10 cm in diameter in the side of the shoe box - the hole should be big enough to fit a kitchen roll.
- 3 The children will use the kitchen roll as a viewfinder to try and see the different objects inside the box.

Before doing the activity with the children look through the viewing hole and ensure that no light is getting into the box. If light is getting in re-line with more black sugar paper.

Place the objects listed in the resource section above on the desk for the children to see.

Activity type: Investigation

The aim of the activity is to help children realise that we need light in order to see.

Ask the children to discuss the objects and their properties and then predict whether or not they will be able to see these objects in complete darkness. Use **IWB 12 / PowerPoint 12 / PCM 8** to assist and record their predictions .

Place the first object inside the shoe box.

Place the lid on the shoe box and ask the children to look inside the viewing hole. Ask them can they see the object (*they should not be able to see the object as there is no light*).

Move the lid across the top of the shoe box to allow some light to get into the box. Ask the children to look in the viewing hole again and see if they can now see the object (*they will be able to see the object this time as there is light*). Repeat this with every object.

Discuss the activity with the children.

Questions to promote discussion

- 1 Could you see any of the objects in the dark box when the lid was on?
- 2 Why do you think you could not see the object when the lid was on?
- 3 Could you see the object when the lid was opened?
- 4 Why do you think you could see the object then?
- 5 What does this tell us about light and vision?

Lesson 3 – Shiny objects

Resources

IWB 13 / Powerpoint 13: Are shiny objects sources of light?

PCM 9: Recording sheet

Selection of 'shiny' objects to test: E.g. coin, pencil (white and yellow), aluminium foil, keys, sparkly jewellery, white paper, gold paper, toy, torch, small mirror

Dark Box (shoe box lined with black sugar paper)

Teacher note: Often children believe that 'shiny' objects such as aluminum foil or sparkly jewellery are sources of light. They are not, they reflect light.

Activity type: Investigation

Show the children the objects they are going to test and ask them to predict whether they think they will be able to see the objects if placed in the dark box. Encourage the children to give reasons for their predictions. They could record their predictions on **PCM 9** or on **IWB 13 / PowerPoint 13**.

Place the first shiny object in the dark box, replace the lid and ask the children to look through the viewing hole to see whether or not they can see the object. Repeat this for the rest of the objects. Finally place a lit torch inside the box and replace the lid. Ask the children to look through the viewing hole again to see whether or not they can see the torch.

Recording

They record their findings on **PCM 9** or **IWB 13**.

Discuss findings with the children.

Questions to promote discussion

- 1 What objects could you see in the dark box?
- 2 Why do you think you could not see these objects?
- 3 Why do you think you saw the torch in the box?

Extension

Resources

Activity from the book **Guzzler Investigates Energy: Energy long ago and energy worldwide (pages 11 - 16)**

CHAPTER 4: Heat and Temperature

Aim

The aim of this chapter is for children to measure and record the temperature of cold and warm water.

Overview of Chapter

In this chapter children learn how to read and record temperature using a thermometer. They also measure and record what happens to water as ice melts.

Working Scientifically Skills

In this chapter the children will be applying and developing the following working scientifically skills:

- Observing
- Predicting
- Investigating and experimenting
- Estimating and measuring
- Recording and communicating

Primary Science Curriculum link

Strand unit: Heat



Lesson 1 – Observing a thermometer

Lesson link

Before beginning this lesson you might like to revisit: **Junior and Senior Infants Programme Chapter 4: all lessons**

Resources

PCM 10: Looking at thermometers (one per group)
1 thermometer per group, magnifying glasses, A4 paper, scissors, crayons, rulers

Activity type: Observing

Hold a classroom discussion about thermometers and their uses.

Questions to promote discussion

- 1 What is this?
- 2 Why do we use thermometers?
- 3 Who uses thermometers?
- 4 Do you have any thermometers in your homes?

Divide the class into groups, the size of which will depend on how many thermometers are available. Distribute a thermometer to each group. Encourage each group to carefully examine their thermometers. They can use a magnifying glass.

Questions to promote discussion

- 1 What colour is the liquid inside your thermometer?
- 2 What material do you think the thermometer is made from?
- 3 Is there anything written on it?
- 4 Can you make the coloured liquid inside move? How?
- 5 What would happen to the coloured liquid inside the thermometer if you held it in your hand for a minute?

On **PCM 10** each child then makes a detailed drawing of their thermometer and writes three observations they made about their thermometer. They then discuss their observations with the whole class.

Lesson 2 – Reading and taking the temperature

Resources

PCM 11: Measuring hot and cold
Thermometers, plastic cups, measuring jug, water

Activity type: Measure and record

In this activity the children measure and record the temperature of cold and warm water. Divide the class into groups, the size of which will depend on how many thermometers are available.

Give each group a beaker (Beaker A) of cold water and a thermometer.

Ask them to measure the temperature of the water and record the temperature on **PCM 11**. Remind the children to leave the thermometer in the water for a 'wait time' to allow for an accurate reading.

Give each group a second beaker (Beaker B) of warm water. They measure the temperature of the water and record it on **PCM 11** (*remind the children about the 'wait time' for accuracy*).

A reporter from each group reports back to the whole class.

Lesson 3 – Investigating temperature

Resources

PCM 12: Testing hot and cold

A tray of ice cubes, 1 plastic beaker per group, 1 thermometer per group, water, measuring jugs, kitchen paper, timer

Activity type: Measure and record

Teacher note: In this activity children explore how tap water turns cold when ice is added. They will also learn how to measure the change in temperature.

Investigation Question: “What happens to the temperature of tap water if you add ice?”

Divide the class into groups, the size of which will depend on how many thermometers are available.

In groups the children discuss what they think will happen (predict) to the temperature of a beaker of tap water if they add an ice cube. They discuss their predictions in groups and record them on **PCM 12**.

Each group is given a beaker of tap water. They take an initial reading and record the temperature on **PCM 12**.

Each group then puts an ice cube into the beaker and measures the temperature after 1 minute. They record the second measurement on **PCM 12**.

They then take 5 or 6 further readings (at 1 minute intervals) and record the different readings on **PCM 12**. They then discuss their results with the whole class.

Questions to promote discussion

- 1 What happened to the temperature of the water when you added the ice cube?
- 2 Why do you think this happened?
- 3 Did the temperature keep getting lower?
- 4 Why do you think this happened?
- 5 Did the temperature begin to go up again as time went on?
- 6 Did you predict that this would happen?
- 7 Why do you think this happened?

CHAPTER 5: Save Energy, Save Water

Aim

The aim of this chapter is to raise awareness about the use of water at home and in school and to introduce the concept that wasting water is wasting energy. It challenges children to consider how they use water and encourages them to consider ways in which water can be saved.

Overview of Chapter

This chapter opens with a discussion on the uses of water. The second lesson promotes discussion about saving water and children are encouraged to make suggestions as to how Guzzler can save water.

The children are also encouraged to design posters about saving water in the school. This activity can be used as part of a whole school energy conservation plan, such as SEAI's Energy in Education Programme www.energyineducation.ie and An Taisce's Green-Schools Programme.

Working Scientifically Skills

While engaging with the different activities in this chapter the children are provided with opportunities to apply and develop the following working scientifically skills:

- Estimating and measuring
- Observing
- Predicting
- Analysing (Sorting and classifying)

Primary Science Curriculum link

Strand unit: Caring for my locality and area

Lesson 1 – Water water everywhere e

Lesson link

Before beginning this lesson you might like to introduce the Water Cycle. See the activity from the book **The Energy File: The water cycle (page 36)**.

Review: Energy Saving actions by reading **Guzzler's Big Book** with your class

Resources

A selection of plastic bottles: 330ml (small); 1L (medium) and 2L (large), measuring jug, a large basin and sink

Activity type: Discussion

Hold a whole class discussion on how we use water in our lives every day. Record children's responses. For each use given by children discuss whether the water used is hot or cold. Ask the children to think about how energy is used to heat water and how energy might be used to treat and transport cold water to our taps.

Questions to promote discussion

- 1 Before you came to school today did you use any water? Give an example of how you used water.
- 2 Can you think of other times when you use water at home?
- 3 Have you used water in school today? When?
- 4 Can you think of other times we use water in school?
- 5 When do we use hot or cold water?
- 6 How do we use energy to get hot water?
- 7 How is energy used to get cold water into our homes?

Activity type: Predict and observe

Show the children the three different sized bottles (330ml - small, 1L - medium and 2L - large). In front of the class fill each bottle with water using a measuring jug. Different children could fill each bottle.

Leave the three full bottles in a position where all the children can see them. Ask the children to predict how many of these bottles of water they think it will take to do different daily routines. Record their responses on the IWB and compare the actual amounts (given below) with children's predictions.

Questions to promote discussion

- 1 How many small bottles of water do you think it takes to brush your teeth?
(between 1 and 4 litres or 3 to 12 small bottles)
- 2 How many large bottles of water do you think it takes to use the dish washer?
(20 litres or 10 large bottles)

- 3 How many large bottles of water do you think it takes to have a bath? (*up to 80 litres or 40 large bottles*)
- 4 Are you surprised about the amount of water we use for each of these activities?
- 5 How could we use less water when brushing our teeth/ washing dishes/ washing ourselves?
- 6 Can you think of other ways we could save energy?

Ask the children to suggest ways to use the water in the bottles after finishing the activity to demonstrate that you are not wasting water eg. water a plant or water the school garden.

Extension

Resources

Activity from the book **Guzzler Investigates Energy: Saving energy in the kitchen** (page 24)

Activity from the book **The Energy File: How to build a water wheel** (page 10)

Lesson 2 – Help Guzzler save water

Resources

Review: Energy Saving actions by reading **Guzzlers Big Book** with your class.

IWB 14 / PowerPoint 14: Guzzler and water

Activity type: Discussion

Discuss the different scenarios in **IWB 14 / PowerPoint 14** on how Guzzler could save water.

Scenario 1: Brushing his teeth – with the water running

Scenario 2: Watering flowers – leaving the hose on

Scenario 3: Using the dishwasher – he puts in his favourite cup on its own for 90 minutes because it's his favourite cup!

Scenario 4: Getting out of the bath

Questions to promote discussion

- 1 When you are brushing your teeth do you leave the water on?
- 2 In the kitchen; do your Mum or Dad put on the dishwasher when it's not full?
- 3 Does your Mum or Dad put on the washing machine with one jumper in it?
- 4 How do you or your Mum/Dad water the plants and flowers at home? Do you use a hose or a watering can?
- 5 Do you ever help to wash the car? Do you use the hose? Do you use a bucket?

After introducing water use at home discuss with the children how water is used in school. The children could make a whole class poster on ways to save water in the school. They could also make little posters to be placed at different positions in the school to remind children to save water as part of the **Energy in Education Programme**. Go to the website for factsheets and videos on saving water in schools.

Extension

Resources

Activities from the book **Guzzler Investigates Energy: A visit to a smart planet (page 18)**, **Composting (page 20)** and **Paper recycling (page 21)**.

Activity from the book **The Energy File: Test your energy IQ (page 42)**.





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