

# CLIMATE CHANGE

## LINKS TO NATIONAL CURRICULUM

### Science

- Recognise that environments can change and that this can sometimes pose dangers to living things (Year 4, Living things and their habitats).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature (Year 4, States of Matter).

### Geography

- Understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems (Key stage 3).

## KEY LEARNING OBJECTIVES

1. What is climate change?
2. What impacts is climate change having around the world?
3. How are humans causing climate change?
4. What can we all do to stop climate change?

## Notes to Teachers

- These teaching notes run alongside a Powerpoint presentation and all slides are referred to in the notes. The information can be adapted to suit different ages of students by adding/deleting slides on the presentation and varying the level of detail used from the teacher notes.
- Activities given are suggestions only. The main purpose of these resources is to provide key information and visual aids for teachers to adapt to their needs.

## GLOSSARY OF KEY TERMS (in alphabetical order)

**Atmosphere** - the layer of gas that surrounds Earth.

**Carbon dioxide** - a gas that is formed by burning fuels, by the breakdown or burning of animal and plant matter, and by the act of breathing and that is absorbed from the air by plants in photosynthesis.

**Climate change** - a large-scale, long-term shift in the planet's weather patterns and average temperatures.

**Climate** - the average of the weather conditions in an area over a long period of time.

**Drought** - a long period of very low rainfall leading to shortage of water.

**Electricity** - the flow of electrical power or charge. It is a secondary energy source as we get it from the conversion of other sources of energy e.g. coal, natural gas, oil and natural sources.

**Energy** - usable power that comes from heat, electricity etc.

**Evaporation** - when the sun heats up water in rivers or lakes or the ocean and turns it into vapour.

**Fossil fuel** - a fuel (such as coal, oil, or natural gas) formed in the earth from plant or animal remains from millions of years ago.

**Fuel** - a material (such as coal, oil, or gas) that is burned to produce heat or power.

**Global warming** - a raising of average global temperatures that is thought to be a result of increased levels of certain gases e.g. carbon dioxide and methane in the atmosphere.

**Greenhouse effect** - the warming of Earth's surface and the air above it. It is caused by gases in the atmosphere that trap heat energy from the earth's surface..

**Hurricane** - an extremely large, powerful and destructive storm with very strong winds and usually accompanied by rain, thunder, and lightning.

**Methane** - Methane is a greenhouse gas with a global warming potential of 22 (meaning that it has 22 times the warming ability of carbon dioxide).

**Non-renewable energy** - made from natural resources that cannot be replaced after they are used, so they will run out one day e.g. fossil fuels.

**Renewable energy** - energy made by harnessing energy found in nature, like wind, water and sunshine . They will not run out.

**Solar energy** - energy from the sun is converted into thermal or electrical energy.

**Weather** - the daily state of the atmosphere in any given place (in regard to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness).

**Wind energy** - the power of the wind is used to create electricity.

## WHAT ARE WE DOING TO OUR WORLD?

### SUGGESTED STARTER ACTIVITY

Find out what the children know about climate change. Have they heard about it on the television? Do they know the effects it is having around the world? Do they know what we are doing to cause climate change? Are they doing anything at home or school to help prevent climate change? Record their ideas in a mindmap on the board and keep a note of any misconceptions that need addressing.

### TEACHING INPUT

#### What is Climate?

**Slides 4 & 5:** Climate is different to weather. **Weather** describes the day-to-day conditions in a place and it can change very quickly - one day it can be dry and sunny and the next day it may rain. **Climate** describes the average weather conditions in an entire region for a very long time - 30 years or more.

#### What is Climate Change?

**Climate change** is a large-scale, long-term shift in the planet's weather patterns and average temperatures. It's very important that we keep an eye on how the Earth's climate is changing as many things that are important in our lives could be changed forever by climate change.

#### How is Our Climate Changing?

**Slide 6:** The Earth's climate is definitely changing - it is heating up. There have been peaks and troughs in temperature over the years, but there is now a steady and unremitting trend in the records which show that the Earth has warmed by an average of 1°C since the 1850s. This might not sound like very much, but it has very big implications for the people and animals on our planet. Rising temperatures don't just mean we'll get nicer weather. As climate is changing, our weather is becoming more extreme and unpredictable.

#### What Effects is Climate Change Having?

**Slide 7:** We can already see the impacts of climate change. It is having an effect on millions of people around the world and it's happening far faster than many people thought possible.

## 1. More Frequent and Powerful Storms and Floods

**Slide 8:** Higher temperatures mean more water is **evaporating** from the oceans. This means there is more moisture in the air, leading to more frequent and more powerful rainfall and storm events around the world.

**Slide 9:** In 2018 Hurricane Michael battered north-west Florida in the US. It brought 155 mph winds and caused storm surges of up to 10ft along the coast. It flooded beach towns, destroyed homes and killed 43 people. But Hurricane Michael was only one of many storm events in the US that year. The US was hit by a total of 15 named storms, 8 **hurricanes**, and 2 major hurricanes in 2018, which caused a total of over 50 billion dollars in damages.

**Slide 10:** In 2015, Storm Desmond broke the UK's 24-hour rainfall record, with over 341 mm of rain falling in Cumbria on 5 December. This caused severe disruption including landslides, blocked roads, collapsed bridges and loss of power. Thousands of homes were flooded and many people had to be evacuated.

**Slide 11:** In southern England there were severe floods during the winter of 2013-14 when the region experienced the wettest weather for 250 years. Storms brought heavy rainfall which caused widespread flooding of villages, farmland and roads. Some villages on the Somerset Levels were completely cut off for over a month.

More recently, Storms Ciara and Dennis occurred in February 2020. The rainfall they brought with them led to the wettest February since records began (in 1766 for England and Wales with 169.6 millimetres beating the previous record from 1833)

## 2. More Drought

**Slides 12-13:** Whilst global warming is causing heavier rainfall events in some parts of the world, in others it is increasing the risk of **drought**. Climate change has been shown to be a key factor in the Horn of Africa drought of 2011 which covered areas of Ethiopia, Somalia and Kenya. In some places it was the worst drought for 60 years. Lack of rain meant cows died, crops couldn't grow and there wasn't enough water for drinking or cooking. 3.5 million people in Kenya needed emergency assistance.

## 3. More Hunger

**Slides 14-15 :** 1 person in 8 around the world goes to bed hungry - that's 900 million people that are short of food. Climate change is the single biggest

threat to the fight against hunger. Changes in temperature and rainfall patterns make it very difficult for farmers to know when best to sow, cultivate and harvest their crops. When crops fail, people go hungry. Extreme events, such as storms and floods, destroy crops. They also damage systems for transporting and distributing food. Very unfairly it is often the people in the poorest regions, who contribute least to climate change, that suffer the most. It is estimated that the number of people at risk of hunger by 2050 could increase by 10-20% more than would be expected without climate change.

#### 4. Melting Glaciers, Sea Ice and Ice Sheets

**Slides 16-17:** Earth's ice, frozen for millennia, is melting. Glaciers all over the world are melting and the rate of their retreat has increased in recent decades. Arctic sea ice has been declining since the late 1970s. The Greenland and Antarctic ice sheets, which between them store the majority of the world's freshwater, are both shrinking at an accelerating rate. This water ends up in the oceans and affects people around the planet as sea level rises.

#### 5. Rising Sea Levels

**Slide 18:** A warming climate leads to rising sea levels in two ways:

1. As air temperature increases, the sea absorbs more heat from the atmosphere and becomes hotter; this causes it to expand and sea level rises.
2. In addition, higher temperatures cause enormous glaciers and ice sheets to melt in polar areas such as Greenland and Antarctica. This water ends up in the oceans, contributing to rising sea levels.

Sea level has risen by 20cm in the last 100 years and the rate of sea level rise has increased in recent decades. This causes flooding of coastal and low-lying areas and with this comes the destruction of homes, schools, crops and habitats. Hundreds of thousands of people have lost their homes in the coastal areas of Asia.

**Slide 19:** In Louisiana, US, land is being lost at the rate of a football field every 45 minutes - homes lost and entire communities relocated due to climate change.

**Slide 20:** Many of the world's cities are located in coastal areas and almost a quarter of the world's population live near the coast, so this is a huge concern. Photo shows the flooded streets of New Orleans (USA) in the aftermath of Hurricane Katrina (2005) .

## 6. Animals Losing Habitats & Struggling to Adapt to Climate Change

**Slide 21:** Climate change is already seriously affecting our planet's wildlife, especially in polar areas. Experts believe that Arctic sea ice is melting at a shocking rate of 9% per decade. Polar bears need sea ice to hunt, raise their young and rest; but their icy natural habitat is melting. Polar bears are now listed as a threatened species in the US due to the ongoing and potential loss of their sea ice habitat.

It is not only animals in the polar regions that are under threat. In rainforest regions, apes like orangutans are under threat as more droughts cause bushfires. Rising sea levels threaten sea turtles who rely on nesting beaches to lay their eggs.

**Slide 22:** Animals are struggling to adapt to rapidly changing conditions and this results in extinction of species which is irreversible. Even creatures that are specifically adapted to heat are unable to survive e.g. bats in Cairns, Australia. Their usual cooling methods are no longer enough for the temperatures experienced.

## SUGGESTED ACTIVITIES

### Research Tasks

Find out how climate change could affect you and your children in the future.

Choose an Arctic animal e.g. polar bear that is threatened by climate change. Find out why warmer oceans and melting sea ice is putting the survival of this animal at risk. Is anything being done to help them?

## 2. HOW ARE HUMANS CAUSING CLIMATE CHANGE?

### SUGGESTED STARTER ACTIVITY

Ask the children to think about how we rely on electricity in our everyday lives:

- What did they eat/drink for breakfast?
- What did they need to get ready for school?
- How is electricity being used in their classroom at this moment?
- How do we rely on electricity to communicate with each other?
- How does electricity make our lives easier?
- Does electricity improve our leisure time?
- What would it be like if there was no electricity?

### TEACHER INPUT

After forty years of research, the evidence shows that the warming of our Earth is caused by human activities, in particular the use of fossil fuels. By burning fossil fuels, humans are increasing the amount of **greenhouse gases** in the Earth's atmosphere and contributing to a change that is causing it to heat up - this is called **global warming**.

### What Are Fossil Fuels?

**Fossil fuels** are formed from the remains of ancient plants and animals, buried deep inside the Earth for millions of years. Over a long, long time, heat and pressure has turned these remains into the fossil fuels that we call coal, oil and natural gas. Today, fossil fuels are mined and burned to release the energy stored inside them.

### Why Do We Burn Fossil Fuels?

**Slides 24-26 :** During the 1800s the Industrial Revolution spread throughout Britain, before spreading to other parts of Europe and the US. Victorian engineers developed bigger, faster and more powerful machines that could run whole factories. It meant that lots of products could be made in the same place at the same time and it changed everything. This new industry depended on steam power and steam depended on coal.

**Slides 27-28:** Over the past 150 years, industrialised countries have been burning large amounts of fossil fuels. Today approximately 50% of the UK's electricity is generated from fossil fuels (a record low). But coal, oil and gas are also used to provide heating; and to power cars, trains and aeroplanes.

## What is the Problem With Fossil Fuels?

**Slides 29-32:** When fossil fuels are burned, carbon dioxide is released into the atmosphere as a waste product. It then acts as an invisible blanket, trapping heat and warming the Earth - this is called the **greenhouse effect**. The more fossil fuels that are burned, the thicker the blanket becomes and the more heat that is trapped. Records show that global temperatures have been rising more rapidly since the time we started burning fossil fuels in large quantities.

A more detailed explanation of the greenhouse effect can be found on YPTE's video which can be downloaded using this link:

<http://yppte.org.uk/videos/the-greenhouse-effect>

## What Is Our Carbon Footprint?

**Slide 33:** This is a way of describing the amount of carbon dioxide released into the atmosphere as a result of the activities of an individual person. Every person on the planet has a carbon footprint but some people and some countries have much larger carbon footprints than others.

## Are Fossil Fuels the Only Problem?

**Slide 34:** Burning fossil fuels is a huge cause of climate change but it's not the only one. Dairy farming is another contributor. When cows eat, **methane** gas builds up in their digestive systems and is released in the form of a fart! Methane is a powerful greenhouse gas and contributes to global warming.

**Slide 35:** **Deforestation** is another contributor. Forests absorb huge amounts of carbon dioxide from the air - they store a third of our emissions in fact. They also release oxygen back into the atmosphere, so they are natural climate regulators on a global scale.

But humans are cutting down huge areas of forest for wood and to make way for farmland, roads and oil mines. One of the main drivers is palm oil which is found in many of the products we use. Also, when trees are burned carbon dioxide is released. Trees are being cut down and burnt at such a rate it is thought that a third of emissions are now caused by deforestation.

*You will find lots of resources here covering global warming and climate change:*

<http://yppte.org.uk/downloads/conservation-education-21-wildlife-and-climate-change>



<http://yppte.org.uk/downloads/conservation-education-29-climate-change-update>

## SUGGESTED ACTIVITIES

### **Activity: Greenhouse Effect (see below)**

This practical activity will help the children understand how the greenhouse effect works.

### **Audit: Do You Rely on Fossil Fuels?**

Ask the children to list everything they do on a normal day e.g. having a shower, eating breakfast, driving to school. Then ask them to tick all those activities that they think use fossil fuel energy. A volunteer reads out their list and the rest of the class put up their hands if they think an activity uses fossil fuels. They should try to explain why: e.g. shower uses hot water heated by gas or electricity.

### **Think About What You Eat**

Think about how the food we eat contributes to climate change e.g. a loaf of bread: farming and harvesting the grain; transporting it, making the packaging, transporting the bread to shops; lighting and heating the supermarkets where it is sold.

### **Imaginative Writing: A Day Without Electricity**

Imagine a world without electricity. Ask the children to write a diary entry describing their day and how different it would be to a normal day. How dependent have we become on electricity?

**No Electricity Day:** Organise a day for school to run without electricity! How will the children and staff need to adapt? Review your day afterwards.

### **Written Task: Letter to the Past**

Ask the children to write a letter to the leading industrialists at the start of the Industrial Revolution. They should warn them about the dangers caused by burning fossil fuels and tell them how it is affecting our World in the 21st century.

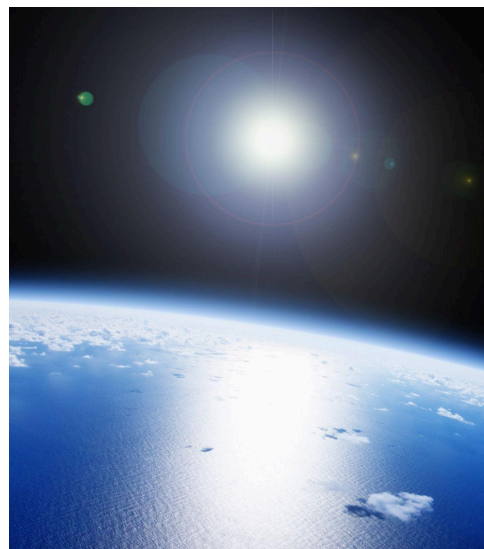
# Greenhouse Effect Activity

## You will need

- 2 Thermometers
- A clear container such as a jar
- A sunny area, either outside or inside
- A watch or clock
- A pen and paper to record your findings

## Instructions

1. Put the thermometers in direct sunlight for 5 minutes so that they can heat up.
2. On a piece of paper, draw two columns - one labelled "Thermometer A" and one labelled "Thermometer B".
3. After the 5 minutes is up, read and record the time and thermometer temperatures on your record sheet.
4. Now place one of the thermometers in the jar or container and seal it, making sure that any lid does not create a shadow over either thermometer. (The easiest way to do this is to place the jar upside-down over the thermometer on a flat, level surface).
5. Record the temperature of each thermometer every minute for ten minutes.
6. Look at your findings and discuss why and how the container affected the temperature of the thermometer. How did the temperature inside the container change compared to outside the container?



## Explanation

The thermometer not in the container is exposed to air that is constantly changing temperature, as warm air mixes with passing cooler air. But the air inside the container is trapped and can't mix with the cooler surrounding air - it just gets warmer as the sunlight heats it up. A greenhouse works in a similar way, as heat that has come from the sun is trapped and cannot escape back through the glass.

Although the greenhouse effect that is taking place in the Earth's atmosphere is more complicated, the basic idea is the same - greenhouse gases in the atmosphere act like the glass in a greenhouse and stop heat from escaping.

### 3. WHAT CAN WE DO TO STOP CLIMATE CHANGE?

#### SUGGESTED STARTER ACTIVITY

Discuss any measures that the children are taking at home and at school to combat climate change e.g. saving energy to reduce the use of fossil fuels, recycling to reduce waste, growing their own food or eating less meat.

#### TEACHER INPUT

##### What Will Happen If We Do Nothing?

Scientists warned us 30 years ago that our activities would cause climate change and much of what is happening was predicted. But not enough people listened or were willing to change their lifestyle, so the policies needed to achieve change were never adopted. As a result, greenhouse gases have continued to rise and the climate changes which scientists predicted are already happening.

**Slide 37:** We simply cannot afford to do nothing. Modelling systems predict that temperature increases will hit 1.5°C between 2040 and 2050 and by the end of the century our planet could be 3-6°C hotter. Producing food will become increasingly difficult due to frequent drought, storms and heatwaves. Access to clean drinking water will be a serious problem for many. By the end of the century sea levels could have risen by 80 cm to 1.4 metres, so large areas of land would be underwater. (Photo used is for dramatic effect).

**Slide 38:** The future looks alarming but it is not too late to do something about it. What we do now will profoundly affect the next few thousand years. We all contribute to the problem so it is everyone's responsibility to help fix it.

#### 1. Raise Awareness

**Slide 39:** Encourage the children to share what they have learned about climate change with others e.g. hold school assemblies, make posters, start an eco club, write an article for a local newspaper, speak on local radio.

Children at a Manchester school won a climate change poster competition. They used the wording, "We are the future, the tomorrow. But our

tomorrow is being cut short by the actions of our elders today". These are powerful words which will make people think about climate change.

**Slide 40:** Greta Thunberg is a Swedish school girl who campaigns for something to be done about climate change. As a young girl she became very worried about the consequences of climate change and upset that adults were not doing enough about it. At the age of 15 she began protesting outside the Swedish parliament for immediate action to combat climate change. She attracted media coverage and has done a great deal to help spread the word that something needs to be done. She also initiated a school strike for climate movement and on 15 March 2019, an estimated 1.4 million students in 112 countries around the world joined her call by striking and protesting.

So although the children are not yet the adults who make the decisions, their voice can still be heard and their actions can make a real difference. If they are inspired by Greta's actions, they could also campaign against climate change by putting pressure on decision makers and businesses to help reduce emissions. They could invite local MPs or business leaders into the school or write to their local MP to ask the government to do more to combat climate change.

## 2. Reduce Your Energy Use

### Electricity

**Slides 41-46:** Ask the children to think about their average day - how many items do they use that need electricity to make them work? Are there some things they could manage without? Could they be more careful about switching things off when they're not using them? Small changes by everyone can together make a big difference.

Small changes could include switching to energy-saving light bulbs, turning off electrical appliances when not in use and switching off gadgets at the mains (this can cut electricity use in the home by up to 10%).

### Travel

**Slides 47-48:** Transport is responsible for 25% of global carbon dioxide emissions. Could they walk or cycle to school instead of driving? Or share lifts with a friend? Could their family consider holidays in the UK instead of flying somewhere? Planes use huge amounts of fossil fuels and make a significant contribution to emissions.

### 3. Reduce, Reuse and Recycle to Limit Waste

If possible, ask the children to carry out a waste audit at home and in school. Plan ways to reduce, reuse and recycle waste wherever possible.

#### Reusing and Recycling

**Slides 50-51:** Most things we might throw away can be reused or recycled. This saves energy and the use of fossil fuels, as less new products need to be made. Many schools now recycle their paper, pens and batteries. Encourage the children to play a part in having an organised recycling system at home and that everyone knows what can be recycled and where they should put it.

#### Food

**Slides 52-53:** Encourage the children to think about the food they buy and eat and how much energy has to go into getting it to them. It's been estimated that a massive 13% of greenhouse emissions come from the production and transportation of food. Take a loaf of bread for example: farming the ingredients; transporting them in trucks, planes or ships; making the packaging; transporting the loaves to shops and supermarkets; and lighting and heating the supermarkets where they are sold. Food makes up a quarter of the carbon footprint in the UK and it's something we can all help make a difference with.

**Slides 54-55:** We should aim to eat everything we buy. Can the children be clever at using up leftovers to make delicious meals?

**Slide 56:** We should try to avoid air-freighted food by buying local produce that hasn't had to travel far. Even better, can the children grow their own fruit and vegetables?

**Slide 57:** We should reduce meat and dairy consumption where we can. Remind the children that that cows produce methane which is an extremely powerful greenhouse gas.

### 4. Support Renewable Energies

**Slides 58-59:** To reduce the negative impacts of using fossil fuels, particularly climate change, people are thinking of new and better ways to make electricity using natural resources such as the sun, wind and water.

As they harness natural forces which will never run out, they are called **renewable energies**. They are also clean energies as they do not produce harmful pollution and are referred to as zero-carbon.

YPTE's video provides a comprehensive guide to renewable energies. It can also be downloaded with the following link:  
<http://yppte.org.uk/videos/renewable-energy>

**Slide 60:** The power of the wind can be used to create electricity. A wind turbine is a tall structure that has large blades attached to a generator and is used to produce electricity. In the UK we are building some of the biggest offshore wind turbines in the world; one revolution can power a house for a day.

**Slide 61:** Energy from the sun can be converted into thermal or electrical energy - this is called solar power. A solar panel is a large, flat piece of equipment that uses the sun's light or heat to create electricity or hot water.

**Slide 62:** It is possible to generate electricity for schools and homes by using small solar panels or wind turbines. There are now many energy providers that use 100% renewable energy. Could the children ask their parents whether the energy they use at home is green?

## Our Future

**Slides 63-64:** What happens next is up to us all. Everyone of us has the power to make small changes in our day to day life, that together will help make a big change.

## SUGGESTED ACTIVITIES

### Activity Sheet: Solar Power (see below)

This simple activity demonstrates how solar heating panels work.

### Worksheet: Energy Efficiency Quiz (see below)

This quiz checks understanding of how we can reduce energy use.

### Personal Pledge

Ask the children to come up with their own pledge to help reduce climate change. This should be realistic and not overly ambitious. The aim should be to decide on a few changes that they can make in their lives e.g. to

ensure they switch off lights and appliances when not in use; to try to use leftover food to create new recipes; to make their parents aware of climate change and encourage them to recycle more at home; to make a poster about climate change to display around the school; to write to a local MP.

### **We value your feedback!**

Let us know what you thought of this lesson plan by completing this Google Form

<https://forms.gle/cGAwi9AWXfSZgrYa9>. **Thank you!**

# Solar Power Activity

The children will have learnt that solar panels can collect light and heat energy from the sun. The heat energy can be used to heat water for washing and heating. CD boxes can be used as mini solar heating panels to show how they work:

## What You Will Need

Three empty CD cases

Black paper

White paper

## Instructions

1. Cut two pieces of black paper and one piece of white paper to fit inside the front of each CD case.
2. Close one of the black CD cases and the white one. Leave the other black CD case open.
3. Leave all three CD cases face-up in a sunny place, such as a windowsill, for one hour. Try to do this on a sunny day if possible. But if it is not sunny, you could leave the CD cases under a reading lamp instead (but be careful not to put the CD cases too close to the lamp or they will melt).
4. After one hour, ask the children to feel the paper in each CD case. Which is the warmest? Can they explain why?



## Explanation

This experiment gives an idea of how solar heating panels work. Simple solar heating panels are essentially shallow metal boxes filled with tubes and coated with thick black glass. Water in the tubes heats up when the sun shines on the collector and the hot water is passed to the hot water tank inside the home using a heat exchanger.

The closed CD case with the black paper should feel the warmest. It is closest in design to a simple solar collector and it works because black surfaces absorb heat very well, rather than reflecting it, and the clear plastic cover acts as a mini greenhouse, by preventing the heat from escaping.

## Extension Task

The children could then investigate locations for solar panels and decide where the best place would be to put them at their school.



# Energy Efficiency Quiz

Shade in either the true or false box to answer the questions on energy saving:

Turning the lights off when you are not in the room will save energy.

True

False

Leaving the windows open will save energy when heating a building

True

False

Switching to efficient light bulbs will not save energy

True

False

Only boiling as much water as you need will save energy

True

False

Defrosting your freezer regularly will help save energy

True

False

Taking a bath instead of a shower will save energy

True

False

Using draft stoppers will not help save energy

True

False

Double glazing windows in your home or school will help save energy

True

False

Using a phone charger will help save energy

True

False

Leaving the lids off of saucepans will help save energy

True

False