Climate Change: Causes

Learning Outcomes:

- Understand the **causes** of climate change.
- Evaluate whether humans are responsible for climate change.

Where have you heard the words **climate change** or **global warming** before?

What do you think they mean?


Climate
change /
Global
warming

What is global warming?

A global change in **climate** due to human expansion of the "**greenhouse effect**", warming up the entire Earth.

https://climatekids.nasa.gov/climate-change-meaning/

Climate Change Evidence

Have you heard of any arguments against human caused global warming?

End

Maybe the Sun is to blame for global warming?

Energy output from the **Sun** has been measured since 1978 and over this time the data shows a very slight **drop** in **solar irradiance**.

Therefore the sun doesn't appear to be responsible for the warming trend.

Are we the cause?

In what ways do you think humans are contributing to global warming?

End

Human causes for climate change

Deforestation

The mass removal of trees for various reasons has a huge impact on the global climate.

Fossil Fuels

The burning of fossil fuels for transport, industry and power produces greenhouse gases, contributing to global warming.

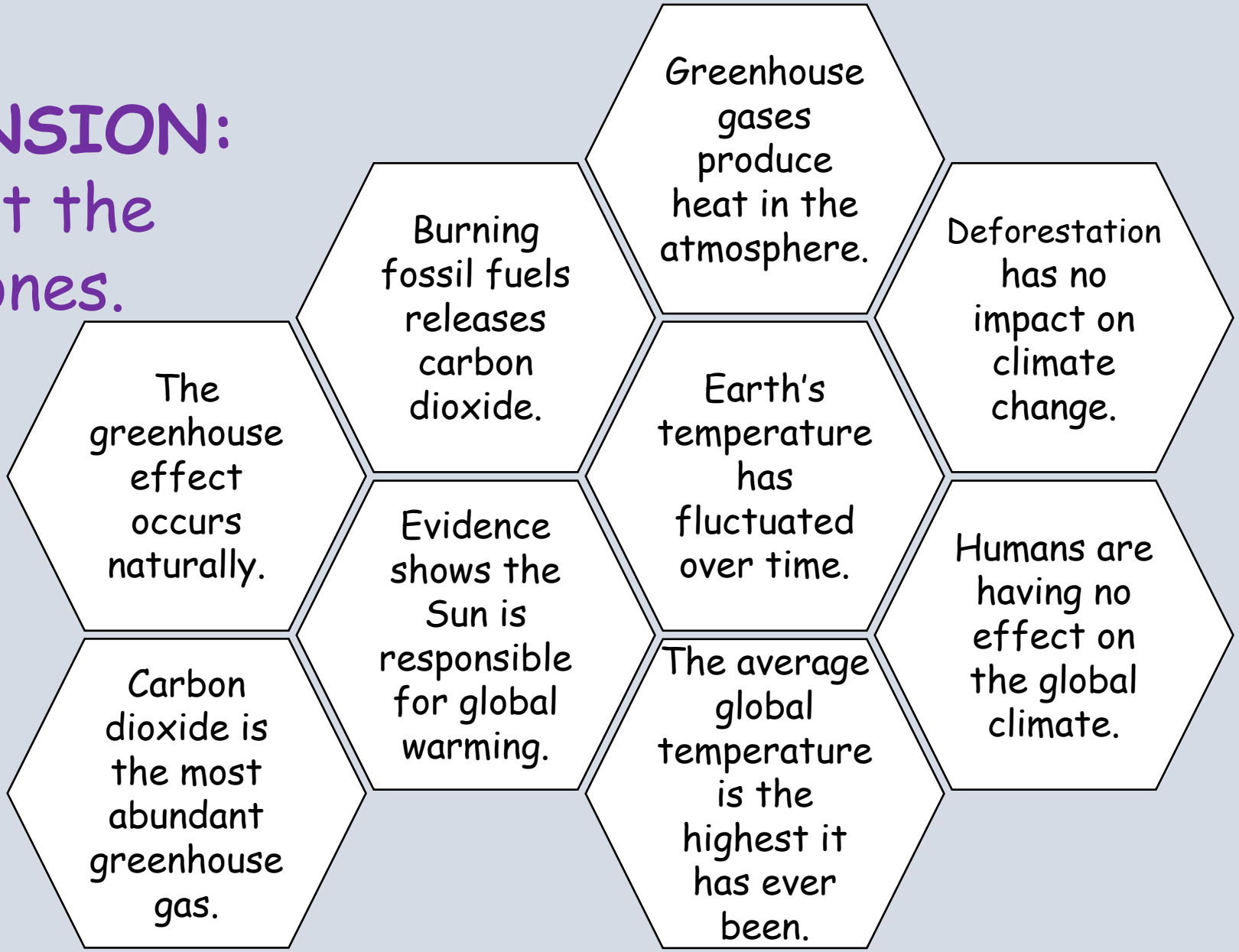
TASK:

Create a leaflet for the general public explaining what global warming is and how humans are contributing towards it.

EXTENSION: Produce a Frequently asked questions section, giving answers for commonly asked questions about climate change.

Decide whether the statements are **true** or **false**.

EXTENSION:
Correct the False ones.



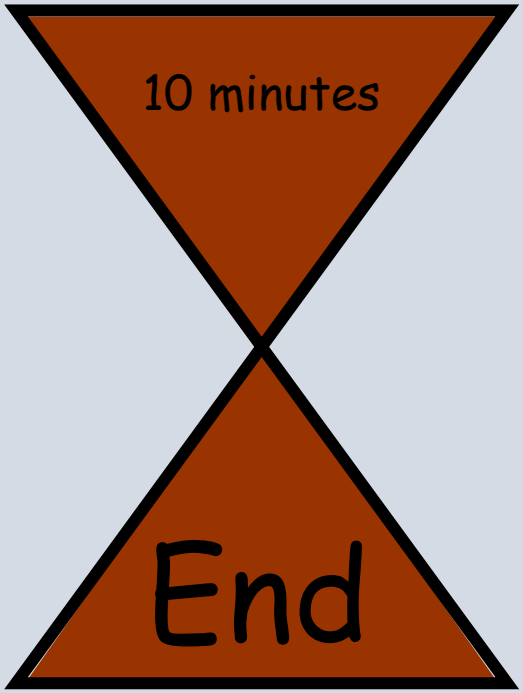
Climate Change: Effects

Learning Outcomes:

- Understand the **effects** of climate change.
- Evaluate the effects of climate change.

Climate Change Effects

Using the information sheets create a mind map with cause and effects of global warming.



EXTENSION: Summarise any other information you can find in your books.

As we go through the effects of global warming we will hear some arguments as to why they are the most damaging for the world.

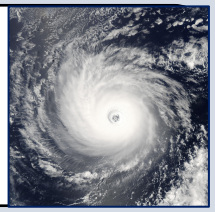
Sea Level Rises

Ocean Acidification

Warming Oceans

Shrinking Ice Sheets

Extreme Weather Events



Sea Level Rise

WHAT: Global sea level has risen by about 8 inches since reliable record keeping began in 1880.

It is projected to rise another 1 to 4 feet by 2100.

CAUSE: The result of added water from melting land ice and the expansion of seawater as it warms.

EFFECTS: Increase flooding in many regions.

Ocean Acidification

WHAT: The acidity of surface ocean waters have increased by about 30% since the start of the Industrial Revolution.

CAUSE: Humans emitting more carbon dioxide into the atmosphere and being absorbed in to oceans The amount absorbed by the upper layer of oceans is increasing by about 2 billion tons per year.

EFFECTS: Effects on marine life, in particular Coral reefs and makes it harder for marine life to absorb calcium carbonate, which they need to make their shells.

Warming Oceans

WHAT: The top 700 meters of the ocean has shown a warming of 0.302 degrees Fahrenheit since 1969.

CAUSE: The oceans have absorbed much of the increased heat caused by more greenhouse gases increasing the greenhouse effect of the Earth's atmosphere.

EFFECTS: Melting sea ice and rising sea levels. Effects all marine life as well- Algae cannot carry out photosynthesis in water that is too warm meaning that coral loses its colourful food source and becomes weak (coral bleaching). Other organisms at the bottom of food chains, such a plankton and krill, are seeing their populations affected by rising sea temperatures.

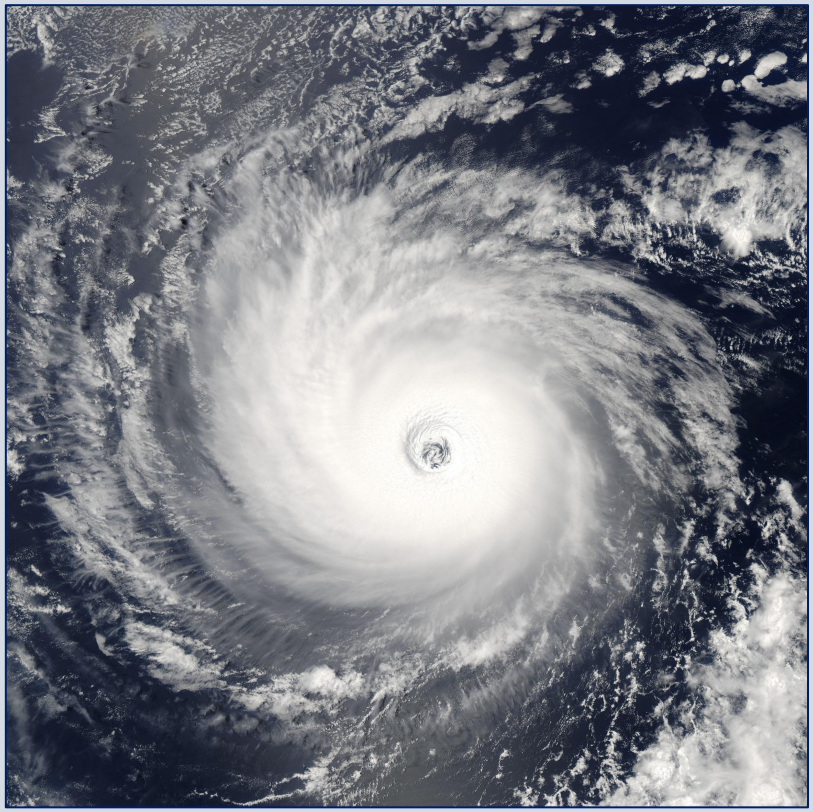
Shrinking Ice Sheets

WHAT: Greenland and Antarctic ice sheets have decreased in mass significantly. Greenland lost 150 to 250 cubic kilometres of ice between 2002 and 2006.

CAUSE: The result of an increased global temperature and ocean temperature causing the ice sheets to melt.

EFFECTS: Disappearing habitat for many organisms, such as polar bears. Also adds to the increasing sea levels and therefore flooding.

Extreme Weather Events



WHAT: Intensity, frequency and duration of North Atlantic hurricanes have all increased since early 1980's.
Changes in precipitation patters with some areas experiencing increased levels of rain whereas others are seeing increased droughts/ heat waves

CAUSE: Causes for the changes in hurricanes unknown, but storm intensity and rainfall rates are predicted to increase as climate change continues to warm the Earth.

EFFECTS: Social and economic impacts of hurricanes. Droughts will severely affect food production throughout the world.

Which of the effects of global warming do you think will most negatively affect the world?

Discuss in your groups, and then write down your own answer.

There are no wrong answers with this task!

The purpose of the task is to share opinions on which effects might be the worst and discuss ideas- **ALL** of them are very severe effects of global warming though which will have huge consequences for the world.

Climate change and global warming also threaten our **health**:

#ClimateChange

WHETHER YOU LIVE IN A...

CLIMATE CHANGE THREATENS YOUR HEALTH

Drought, floods and heat waves will increase.

Vector-borne diseases, like malaria and dengue virus will increase with more humidity and heat.

Basic necessities will be disrupted...

FOOD
Hunger and famine will increase as food production is destabilised by drought.

AIR
Pollution and pollen seasons will increase leading to more allergies and asthma.

WATER
Warmer waters and flooding will increase exposures to diseases in drinking and recreational waters.

Between **2030** and **2050** climate change is expected to cause

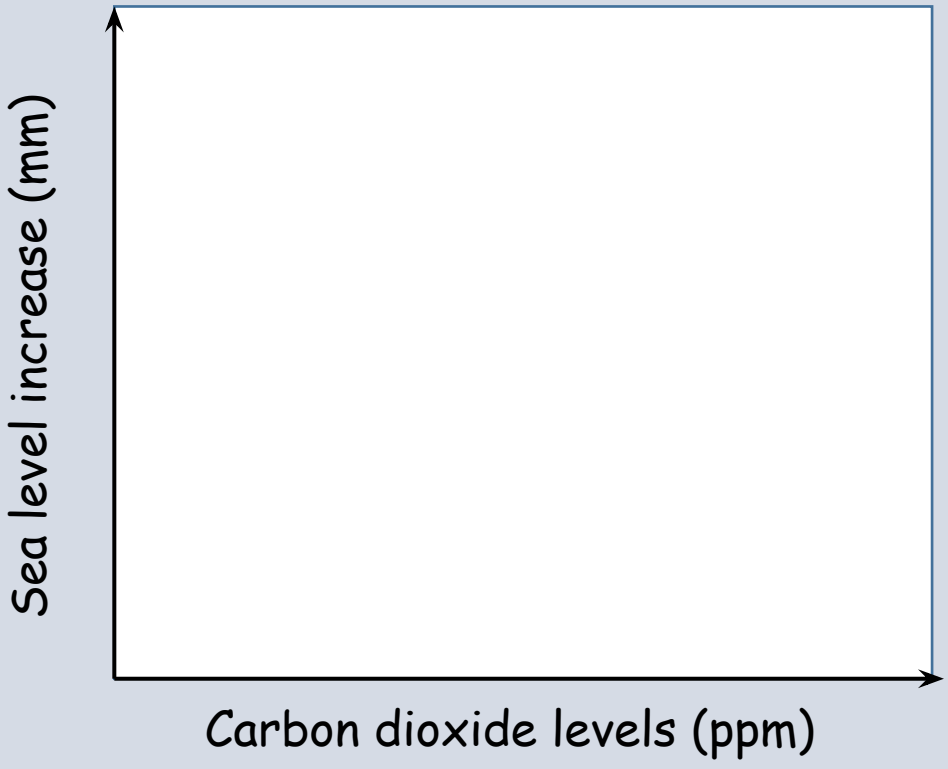
250 000 ADDITIONAL DEATHS PER YEAR

due to malaria, malnutrition, diarrhoea and heat stress.

World Health Organization

Looking at evidence

Using the data provided, plot a graph showing how sea level has changed with atmospheric carbon dioxide levels.

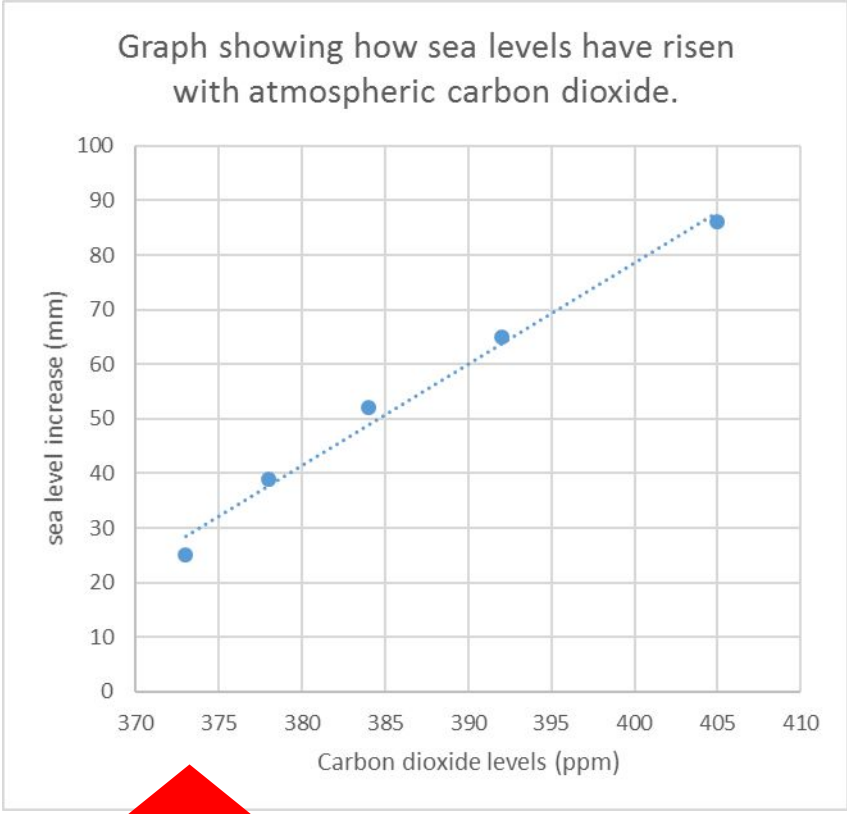


	Carbon dioxide levels (ppm)	Sea height change since 1993 (mm)
2000	373	25
2004	378	39
2008	384	52
2012	392	65
2016	405	86

Peer Assess

Swap graphs and mark each others work based upon:

- Data plotted correctly
- Axes labelled correctly
- Suitable and consistent scale drawn
- Line of best fit drawn
- Suitable title given
- Drawn neatly in pencil with a ruler



It should look something like this

/6

What effect will rising sea levels have?	Describe the trend of global temperature.	What is happening to coral reefs due to climate change?
How is the ocean becoming more acidic?	What type of extreme weather events might we see in our future?	How are humans contributing towards global warming?

Climate Change: Solutions

Learning Outcomes:

- Understand what we can do to combat climate change.
- Understand what governments and businesses can do to combat climate change.

In 2 sentences in your book, explain what global warming is and the effects that it has on the World.

EXTENSION: Is there anything we can do to combat these effects?

TRUE or FALSE

The greenhouse effect is a natural phenomenon that is being contributed to and made worse by humans.

TRUE or FALSE

The Earth has warmed by about 3°F since 1880.

TRUE or FALSE

There is nothing we can do to try to combat global warming and climate change.

TRUE or FALSE

Electricity produced from renewable energy resources has increased in recent years.

TRUE or FALSE

There is no legislation trying to get countries of the world to work together to combat global warming.

TRUE or FALSE

Changes by businesses and the government will have the greatest effect on combating global warming.

TRUE or FALSE

There are ways individuals can try to combat climate change on a smaller scale though.

Solutions: Government

What are the governments of the world doing in an attempt to control the rate of global warming and climate change?

End

An agreement within the **United Nations Framework Convention on Climate Change (UNFCCC)** dealing with greenhouse gas emissions mitigation, adaptation and finance.

Paris Agreement: Aims

1. Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.

2. Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.

3. Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

Paris Agreement: Aims

The Paris climate agreement: key points

The historic pact, approved by 195 countries, will take effect from 2020

Temperatures

2100

- *Keep warming* ***"well below 2 degrees Celsius".*** *Continue all efforts to limit the rise in temperatures* ***to 1.5 degrees Celsius"***

Finance

2020-2025

- *Rich countries must provide* ***100 billion dollars from*** *2020, as a "floor"*
- *Amount to be updated by 2025*

Differenciation

- *Developed countries* ***must continue to "take the lead"*** *in the reduction of greenhouse gases*
- *Developing nations are encouraged to "enhance their efforts" and move over time to cuts*

Emissions objectives

2050

- *Aim for greenhouse gases emissions to peak* ***"as soon as possible"***
- *From 2050:* **rapid reductions to achieve a balance between emissions** *from human activity and the amount that can be captured by "sinks"*

Paris Agreement: Aims

Burden-sharing

- **Developed countries** must provide financial resources to help developing countries
- Other countries are invited to provide support **on a voluntary basis**

Review mechanism

2023

- **A review every five years**
  First world review: **2023**
- Each review will inform countries in "updating and enhancing" their pledges

Climate damage

- Vulnerable countries have won recognition of the need for "averting, minimising and addressing" losses suffered due to climate change

AFP

However…

Targets set for each Country are <u>not</u> legally binding, with no penalties if not met.

The parties ARE legally bound to have their progress tracked by technical expert review to asses achievement towards targets.

Thus, both developed and developing nations must report every two years on their mitigation efforts, and all parties will be subject to both technical and peer review

Paris Agreement: Who Signed?

Paris Agreement: Who Didn't?

Nicaragua

They didn't think the agreement went far enough- particularly not punishing those who didn't follow it. Will continue to counter climate change on their own.

Syria

Was not expected to sign due to the ongoing Syrian Civil War.

USA

The USA originally signed 22nd April 2016. Under a new President though it was announced that they would withdraw from the agreement.
The earliest possible date for this to happen is 4th November 2020.

Paris Agreement

You have just been put in charge of your own nation!

The UN wants to know if you will sign the Paris Agreement.

Decide:

- If you will sign
- If you would argue to change anything
- How you might go about reducing greenhouse gas emissions

Come up with a name for your Country as well!

EXTENSION: Would your answer change depending on whether you are a developed or developing country?

Solutions: Businesses

How can businesses (including energy companies) reduce their greenhouse gas emissions?

End

Businesses

Reducing energy use

Reducing transport

Reducing packaging

Reduce deforestation

Use / produce energy efficient appliances

Plant trees

Invest in / switch to renewable energy

How many others did you come up with?

Renewable Energy

Energy from a source that is not depleted when used- it will not run out.

Solar- Energy from sunlight is captured in solar panels and converted into electricity.

Wind- Wind turns turbines and a generator generates electricity.

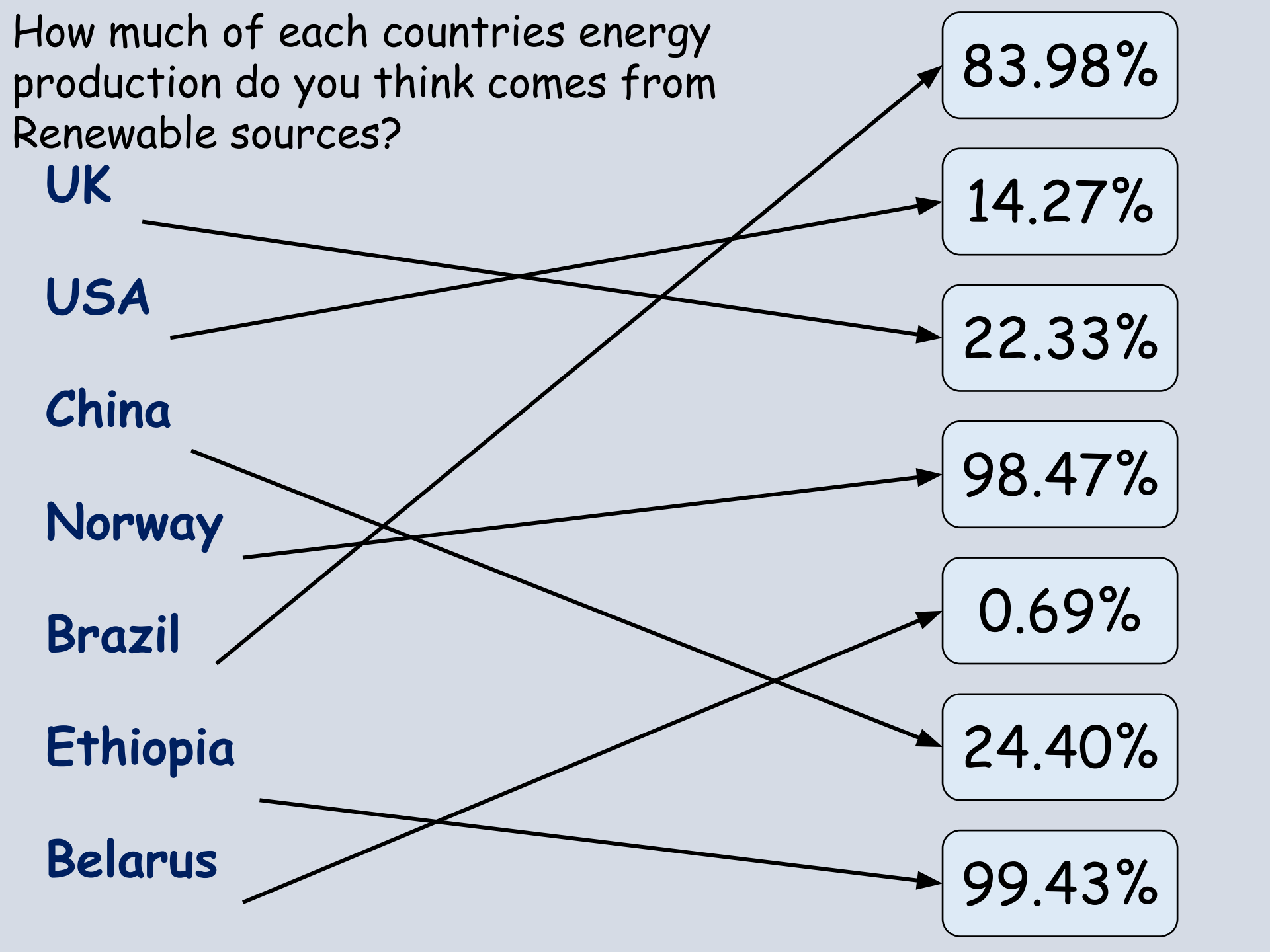
Tidal- Movement of the tides drives turbines.

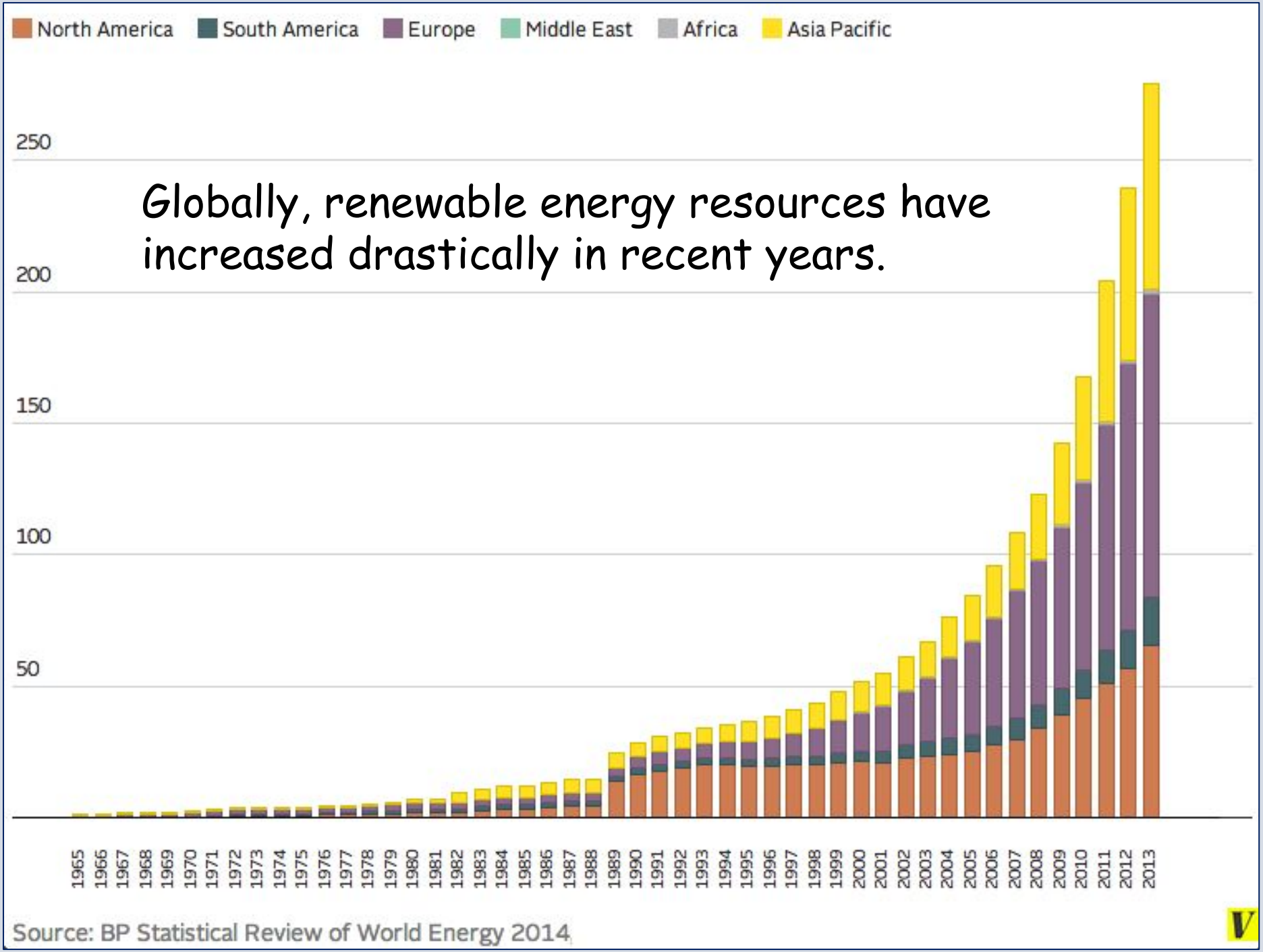
Wave- Movement of sea water in and out of a cavity on the shore compresses trapped air, driving a turbine

Geothermal- Cold water is pumped under ground and comes out as steam which can be used for heating or to power turbines.

Hydroelectric- Movement of water through rivers/lakes/dams drives turbines and generators.

How much of each countries energy production do you think comes from Renewable sources?




North America
South America
Europe
Middle East
Africa
Asia Pacific
250
200
150
100
50
Globally, renewable energy resources have increased drastically in recent years.
1965
1966
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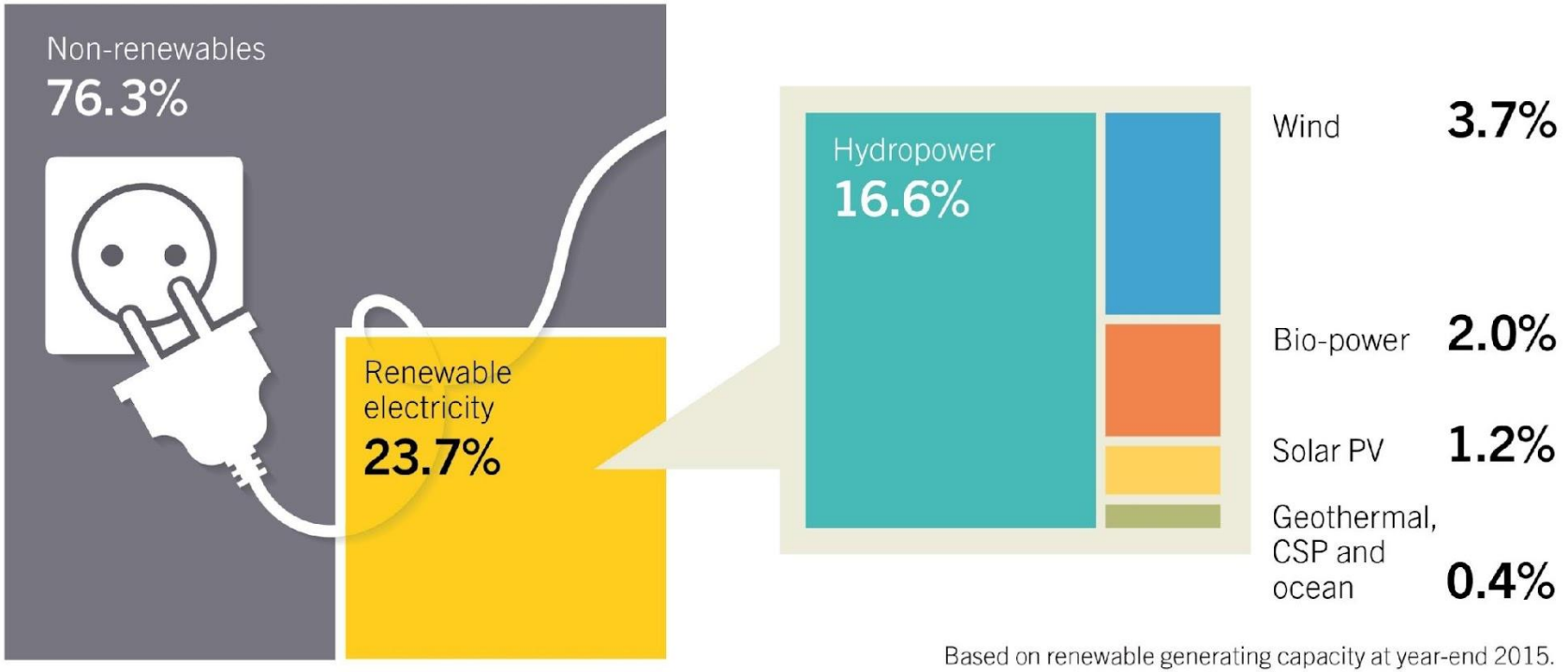
Source: BP Statistical Review of World Energy 2014

It is still nowhere near the level of non-renewable resources though.



REN21 *Renewables 2016 Global Status Report*

REN21 Renewable Energy Policy Network for the 21st Century

Many Countries throughout the world (including here in the UK) are investing lots of money on large scale renewable energy projects.

Lets look at some…


Largest floating solar plant - China


Largest
offshore wind
farm-
London array

Largest hydroelectric dam- Three Gorges Dam, China


Largest solar plant - Spain

100%?

Do you think it will ever be possible to generate 100% of our energy from renewable resources?

End

100%?

Some Countries / Cities in the world are already using 100% renewable energy resources!!!

Paraguay

Electricity sector is 100% hydroelectric. 90% of this is exported with the remaining 10% covering domestic demand.

Your Country

As the ruler of your own Country you have decided to move towards more renewable energy resources.

1. Draw a map of your Country

Will it be land-locked, an island, mountainous, etc…

2. Decide which renewable resources you will use and where they will be - label your map

EXTENSION:

3. Write a speech to convince investors to give you the money you need for all of this.

UN Meeting

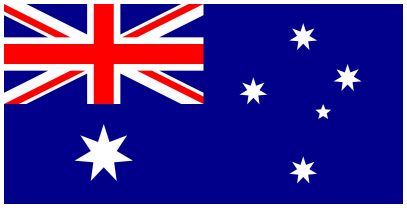
Think of some questions you could ask about their nations plans.

Lets hear about the wonderful work towards combating climate change going on in some of your nations.

HIGHER or LOWER

UK

22%



Australia

Higher or Lower?

LOWER

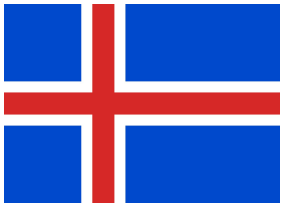
13%

Cuba

Higher of Lower?

LOWER

4%

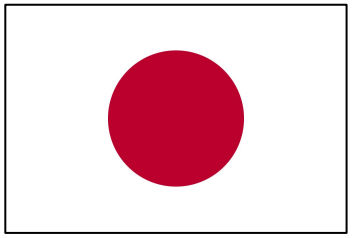


Iceland

Higher or Lower?

HIGHER

100%



Japan

Higher or Lower?

LOWER

15%

Italy

Higher or Lower?

HIGHER

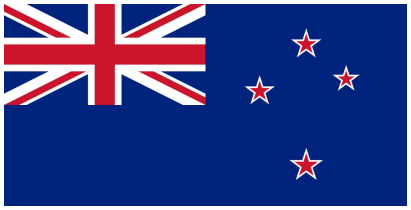
45%

North Korea

Higher or Lower?

HIGHER

71%



New Zealand

Higher or Lower?

HIGHER

73%

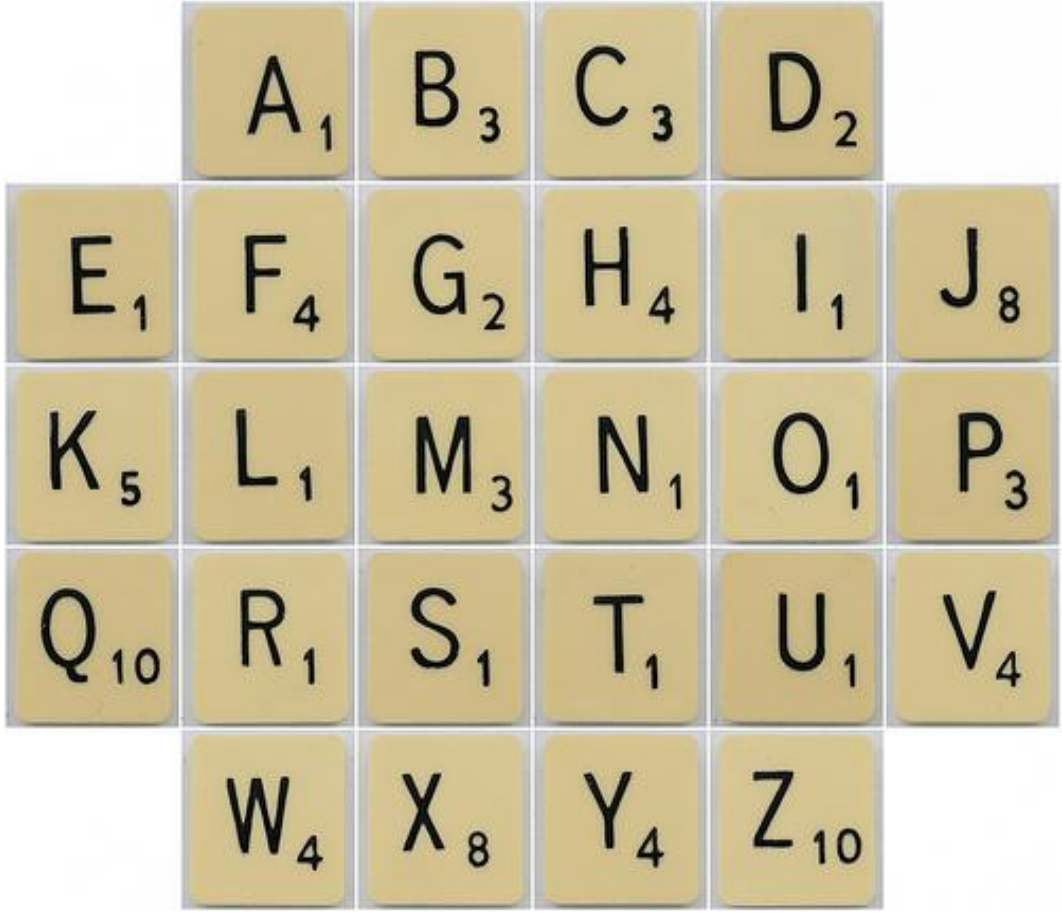
Climate Change: Solutions

Learning Outcomes:

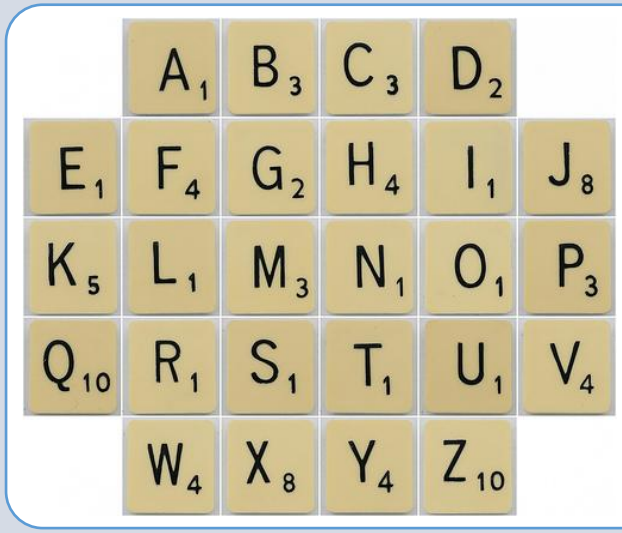
- Understand what individuals can do to combat climate change.
- Convince people to change help combat climate change.

Using the handout try to find the highest scoring keyword from our work on climate change that you can.

Prize for the highest scoring word!!!!



A 1 B 3 C 3 D 2
E 1 F 4 G 2 H 4 I 1 J 8
K 5 L 1 M 3 N 1 O 1 P 3
Q 10 R 1 S 1 T 1 U 1 V 4
W 4 X 8 Y 4 Z 10



My word is deforestation

(17 points)

can you beat me?

Keywords:

Solutions: Individuals

We have looked at how governments and businesses can combat climate change.

Do you think there is any way me and you can do our bit to help?

End

Solutions: Individuals

How many ways can you hear to combat climate change on an individual level?

The video mentioned these. **Did you get them all?**

- Buy local food
- Grow your own food
- Eat less meat/dairy
- Reduce food waste
- Fly less
- Carpooling
- Choose efficient car routes
- Maintain vehicles well
- Buy smaller / eco / hybrid / electric cars
- Travel by foot / bike / bus more
- Turn down heating
- Draught proofing

Using the pictures, try to work out some other ways we can reduce our carbon footprint and combat climate change:

We need to be more **energy efficient**:

- Turn off lights when not in use
- Switch to energy saving bulbs / appliances
- Turn off devices when not in use
- Wash clothes at lower temperatures
- Air dry clothes

REDUCE, REUSE, RECYCLE

What we consume and the packaging it comes in creates over a tonne of waste per household per year!

Landfills release large amounts of **methane** (CH_4) which contributes to **climate change.**

Here's how YOU can be part of the solution!

REFUSE

SAY NO TO PLASTIC BAGS!

Use cloth bags or a backpack when shopping. Aussies use up to **4 BILLION PLASTIC BAGS A YEAR**. They last from 20 - 1,000 years in the environment and are a major threat to wildlife.

14 TONNES OF GASES PER YEAR

The average Australian household produces around **14 tonnes of greenhouse gases** per year.

RECYCLE

ALWAYS RECYCLE PAPER & CARD

Recycling paper and cardboard containers reduces waste to landfill by up to **27%** and saves trees!

RECYCLE

AVOID NON-RECYCLABLES

Avoid packaging that won't go in your recycling bin, like styrofoam. Plastic packaging marked code 1, 2 or 3 can usually be recycled; several councils now also accept codes 4 - 7. **Check with your local council.**

REDUCE

MAKE THE MOVE TO CLEAN ENERGY

Switch to solar hot water – good for the environment, good for your bill. Be sure to ask your electricity provider about switching to a renewable energy plan or check out **Diamond Energy** and **PowerShop.**

REDUCE

REDUCE YOUR ENERGY USE

Cut your household emissions by up to **10%** by using energy saving lightbulbs and up to **50%** reduction by chosing energy-efficient whitegoods. **Good for the planet, good for your electricity bill.**

COMPOST

Get a compost bin or worm farm for food scraps. Means less landfill & great for your garden. **Contact your local council for more information.**

REUSE

DON'T THROW IT UPCYCLE IT!

Did you know that over 90% of plastics & metals in mobile phones and batteries can be reused in new products. Upcycle with **Mobile Muster** and **Clean Up Australia.**

CHOOSE

Opt for environmentally friendly & ethically made products. To learn how to shop smarter in Australia, visit **projectjust.com** and **ethical.org.au**

REUSE

REFILL YOUR OWN DRINK BOTTLE

Single-use plastic bottles generate an enormous amount of waste that is ending up in landfill, oceans and waterways. Refill your own stainless steel or BPA-free bottle and **save money** too!

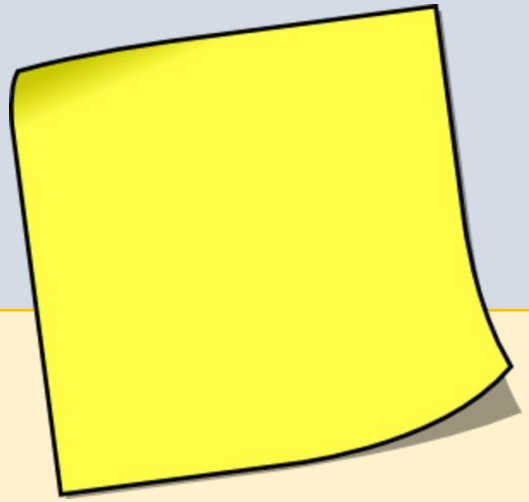
TASK:

It might help to explain the science behind climate change and the effects it will bring about.

In your groups, you need to come up with an advertising campaign (complete with posters, leaflets, etc.) to be displayed around the School to help people (both students and staff) combat climate change.

EXTENSION: How could you allow your advertising campaign to reach a greater audience?

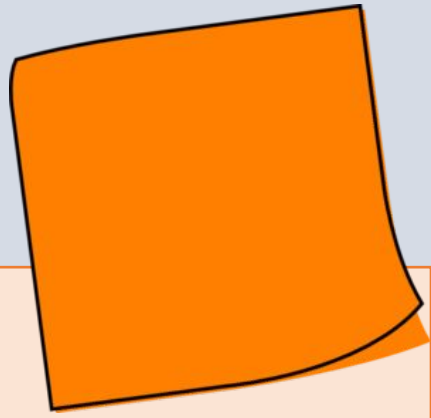
You have been given two post-it notes



On one…

Write down your most memorable fact about global warming / climate change.

And stick it on the left hand side of the room.



On the other…

Write down something you pledge to do to combat global warming / climate change.

And stick it on the right hand side of the room.

YOU are the future scientists / engineers / politicians / whatever you want to be and have the ability to change the world for the better!