CLIMATE CHANGE AND RENEWABLE ENERGY

Student Fact Sheet Page 1

About this Fact Sheet

- Climate change is considered to be one of the greatest threats facing the planet. In fact many important organisations say it is the greatest threat we face.
- There is also widespread agreement that humans are contributing to this climate change and to global warming by releasing greenhouse gases into the atmosphere. We call the releasing of these gases 'greenhouse emissions'.
- Industries that produce and use energy such as the electricity, oil and transport industries release over two thirds of the greenhouse gases into the atmosphere. Because of this it is very important that we shift to producing and using renewable energy world-wide.
- In this fact sheet we explore climate change and renewable energy solutions. We also look at New Zealand's emission levels, how we can reduce these levels, and what we can all do in our daily lives to help reduce greenhouse gas levels.

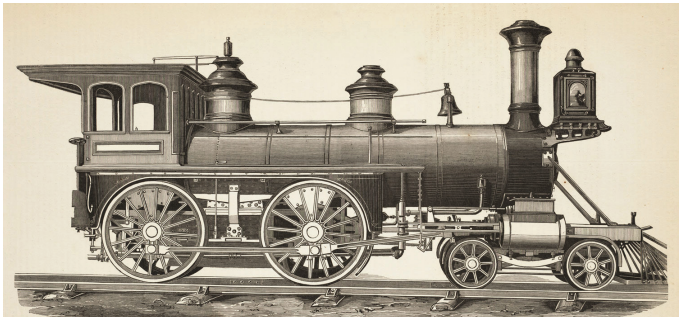
Introduction to Climate Change

- Climate change is not new and the Earth's climate has changed many times naturally during millions of years and can also change in just a few years.
- Climate changes are caused by the total amount of energy received from the sun that is kept in the Earth's atmosphere.These changes are spread around the world by winds and ocean currents.
- Over the last two million years the Earth's climate has changed naturally many times from ice ages to a much warmer climate.
- Natural changes in the Earth's climate are caused by:
  - small changes in the Earth's orbit around the sun and small changes in the tilt (axis) of the Earth
  - volcanic eruptions from volcanoes on land and under the sea
  - changes in the amount of energy we get from the sun including sunspots
- Humans also have an effect on climate change and global warming by:
  - releasing increased amounts of CO_2 and other greenhouse gases into the atmosphere
  - cutting down forests that absorb CO_2 and changing the ways we use the land
  - releasing soot particles into the atmosphere.
- In recent years we have seen an increase in temperatures around the Earth and weather patterns such as stronger and more frequent storms, floods and tornadoes occuring. As well as being caused by natural events it is now considered that human activities (by releasing increased amounts of CO_2) are contributing to climate change and global warming.

new zealand wind energy association

www.windenergy.org.nz

- The Industrial Revolution started about 1760. This was a time when people began to stop making things by hand and dozens of new inventions and machines were invented and used to 'make and do things'. Many of these machines were powered by coal and then petrol and oil. Later still the car and aeroplane were invented and this revolution has continued ever since.
- Before the Industrial Revolution our atmosphere had about 280 parts per million (ppm) of CO_2 in the atmosphere. This has increased ever since and today it has about 360-390 ppm of CO_2 which we consider is making our world warmer.
- As well as CO_2, another greenhouse gas that has a warming effect on the atmosphere is methane. Sheep and cattle produce methane naturally as they digest their food The large increase in the number of sheep and cattle farmed to feed the world's growing population with meat and dairy products, has meant more damaging methane is released into the atmosphere.



What we have discovered so far?

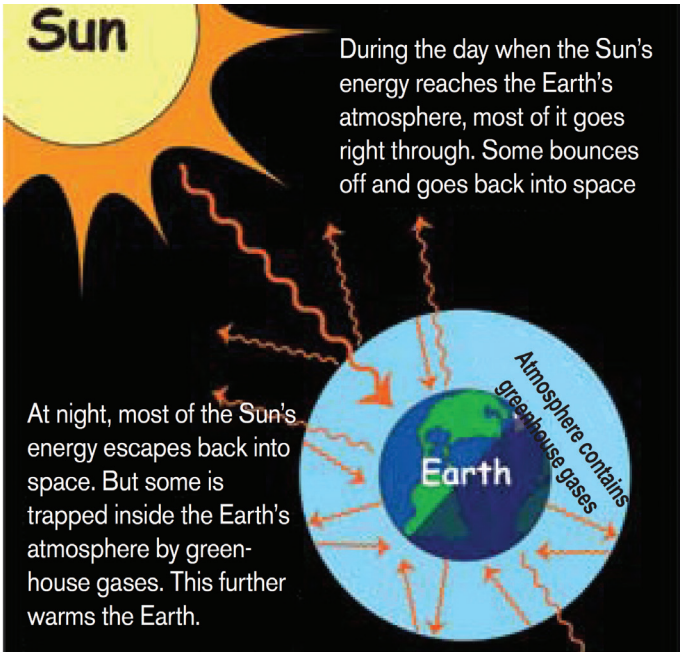
- The Greenhouse Effect has existed for millions of years and is a natural process. The Greenhouse Effect is caused by the interaction of the sun with greenhouse gases in the Earth's atmosphere. Without the natural greenhouse gas effect the Earth would be too cold for humans, plants and other animals to live.
- Since the Industrial Revolution, and particularly in the last 100 years, humans have been releasing increased amounts of greenhouse gases – particularly CO_2 into the atmosphere and have upset the natural balance of the Earth's atmosphere.The increased amount of greenhouse gases that cause heat to be trapped in the Earth's atmosphere has led to global warming.
- In the last 100 years the Earth's average temperature has increased by .75^0 C. This may not seem very much but if it continues to increase by 2^0 C as predicted by the Intergovernmental Panel on Climate Change (IPCC) it will have a huge effect on the the Earth's climate. The IPCC tells us that this climate change and with it, global warming is already causing:
  - greater strength of extreme weather events such as heat-waves, tropical cyclones, floods and major storms, droughts
  - more and larger forest fires
  - melting of glaciers and polar ice caps
  - rising sea levels (predicted to be between 18-59 cm by 2100)
  - increasing acidity in the ocean causing bleaching of coral reefs and damage to all life in the Earth's oceans.

CLIMATE CHANGE AND RENEWABLE ENERGY

Student Fact Sheet Page 2

How does the Greenhouse Effect work?

- The Greenhouse Effect is the name given to the warming of the surface of the Earth caused by greenhouse gases, the main two being CO_2 and methane, trapping heat in our atmosphere. When the rays of the sun hit the Earth they warm the ground and the oceans and some bounces back into space as heat. The greenhouse gases in the atmosphere traps some of this heat and redirects some of this heat back to the Earth and warms the atmosphere.
- The greenhouse gases help keep the Earth warm. If it wasn't for the greenhouse gases, all the heat would escape back into space and Earth would be too cold for life as we know it.
- If the amount of energy from the sun and the amount of greenhouse gases in the atmosphere stayed about the same then the average temperature on earth would remain stable. But this is no longer the case. The amount of greenhouse gases in the atmosphere have been increasing and this is making the Earth warmer than usual (global warming).



What is causing this warming?

- Although small changes in the Earth's orbit and axis can have an effect, by far the greatest cause of the build up of CO_2 and methane has been caused by human activities over the last 100 years. The build up of CO_2 is caused by the burning of fossil fuels such as oil, gas and coal and the destruction of many of the Earth's forests that absorb CO_2.
- The main natural source of methane is from wetlands but human activity is causing an increase of it in the atmosphere…

… from increased numbers of sheep, cattle and cows, more rice paddies, leaks from natural gas pipelines, and from the decay of rubbish in landfills.

new zealand wind energy association

www.windenergy.org.nz

Likely impacts of Global Warming

- The Intergovernmental Panel on Climate Change (IPPC) was set up in 1998 by the United Nations. The IPPC was set up to take action to reduce the effects of climate change.
- An IPCC statement about climate change says the following: '*There will always be uncertainty in understanding a system as complex as the world's climate. However there is now strong evidence that significant global warming is occurring. The evidence comes from direct measurements of rising surface air temperatures and sub-surface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can be attributed to human activities*'. (IPCC 2001). (2005, 11 international science academies)

- While we cannot be certain about the impacts of global warming, listed below are likely possibilities:
  - more severe droughts and/or floods in some areas and less severe droughts and/or floods in other areas
  - 3% -10% changes in rainfall during the heaviest events
  - some computer models suggest a possibility of more extreme events such as high rainfall and more severe storms such as tropical cyclones
  - an increase of global sea levels by 2100 ranging from 1.8 to 59 cm and this may be even greater
  - projection of an increase in global average surface temperature of between 1.8º C and 4º C by 2100
  - 5% -10% changes in stream flow across river basins
  - threats to human health through water shortages and more smog
  - a 5% -15% decrease in crops caused by extreme weather.
- There is still uncertainty about these predictions and there is less confidence in predictions for regions the size of New Zealand than for the entire planet.

CLIMATE CHANGE AND RENEWABLE ENERGY

Student Fact Sheet Page 3

Actions being taken to reduce the impact of Climate Change

- The Intergovernmental Panel on Climate Change (IPCC) was established in 1998 by the United Nations and thousands of scientists contribute to its work to reduce climate change.
- After much discussion and research the United Nations Framework Convention on Climate Change (UNFCCC) was formed in 1994. The aim of this Convention is to stabilise the amount of greenhouse gases in the Earth's atmosphere to a level that would prevent dangerous changes to our world's climate system.
- Another protocol (an agreement or set of rules), the Kyoto Protocol to reduce greenhouse gas emissions, was signed by New Zealand and 55 other countries. However the Paris Agreement signed in 2015 by 195 countries is the biggest breakthrough so far. The countries that signed have agreed to take actions to:
  - hold the increase in global temperature to well below 2^{o} C above pre-industrial levels and make great efforts to limit any increase in temperature to 1.5^{o} C. While different countries will have their own targets, this global agreement is an important step in bringing about a reduction in greenhouse gases – world-wide.
- Countries that signed the Paris Agreement seem to be focusing mostly on reducing the cutting down of forests and using more clean and renewable energy, rather than fossil fuels. A good example of this is that in 2015, $165 billion was spent by countries around the world in new renewable wind generation of electricity and the world-wide total wind energy generation is doubling every 3 years.
- Many countries are passing laws that place limits on motor vehicles' fossil fuel emissions and limits on emissions from power plants and factories. Most developed countries are also setting targets for producing more renewable energy for generating electricity. Some countries are even encouraging the use of renewable energy by offering rewards (incentives) for generating it and using it rather than using fossil fuels such as oil, gas and coal that release greenhouse gases into the atmosphere.

What is Renewable Energy and why is it so important?

- At present most of the world's energy is produced by using fossil fuels – coal, natural gas and oil. While using fossil fuels produces electricity which we need, it also comes with very harmful consequences for people and the Earth. These consequences include the vast majority of greenhouse gas emissions releasing dirty toxic air and chemicals that pollute our cities, causing health problems for people.

new zealand wind energy association

www.windenergy.org.nz

- Renewable energy does not use fossil fuels. Electricity sources that produce renewable energy include wind turbines, hydro and geothermal power stations, solar panels and and tidal generation.
- As the energy sector produces over two thirds of global greenhouse emissions, producing energy using renewable resources is the most important way we can reduce the impact of global warming.

New Zealand's Greenhouse Gas Emissions and how much do they need to reduce by?

- Even though New Zealand has one of the highest renewable electricity generation in the world (82%) we still produce over 81 million tonnes (Mt) of carbon emissions per year. Of this nearly half is from agriculture and the energy sector produces another 40% of total emissions.
- The main emissions in the energy sector are from transport – particularly road transport such as cars and trucks (14 Mt), followed by manufacturing (5 Mt) and electricity generation (5 Mt)
- This works out at over 17 tonnes per person which is slightly lower than Australia and USA but nearly twice as much per person as the UK and seven times more per person than India.
- When we signed the Paris Agreement we said we would reduce our emissions to 30% below our 2005 greenhouse gas emission levels by 2030. To get to this target we must reduce emissions by 25 million tonnes or around 34% – a big reduction.

Ways to reduce New Zealand's Emissions

- Our Government has identified 3 key areas to reduce emissions:
  - decreasing the quantity of fossil fuels used to produce process heat in the industrial sector
  - reducing transport emissions by improving vehicle efficiency and encouraging use of electric cars
  - increasing renewable electricity generation and improving electricity efficiency and use.

CLIMATE CHANGE AND RENEWABLE ENERGY

Student Fact Sheet Page 4

new zealand wind energy association

www.windenergy.org.nz

What can we all do to make a difference?

- Learning more and talking about climate change with friends and family will help make other people aware and understand the problem. It's hard trying to change something if you're part of the problem or you don't understand what it's about.
- Asking local politicians about the actions they are taking to address the effects of climate change and the progress made to reach the Paris Agreement reduction target. This is a positive step and lets them know that it is important to you.
- Changing behaviour to reduce energy usage may seem boring but unwanted lights and computers left on wastes a lot of energy and turning them off also saves money.
- Make your 'own climate' by dressing in warmer clothes in winter and only heating the room you are using will mean lower heating bills.
- Check with your parents that your home is well insulated and energy efficient.
- Why drive when you can walk? Walking, biking or catching the bus saves burning fossil fuel.
- If your parents are thinking of changing cars, suggest they consider an electric car which will be then powered by New Zealand's largely renewable electricity system. Electric cars are cheaper to run and way better for the environment.
- Reduce and reduce waste that goes to landfills which causes more pollution and releases methane - a powerful greenhouse gas.
- Remember the four R's – reduce what you buy to only what you need, reuse whatever you can, recycle and repair.

In Summary

- Climate change is real and the evidence and the impact of human activity has become stronger and stronger. We are seeing increased evidence of ice sheets in both the Arctic and Antarctic melting, sea levels and temperatures are rising and storms are getting stronger.
- The calls for action are stronger than ever. For example, surveys of the 'millenials', the generation aged 18 to 35, for the last two years has identified climate change as the most serious issue facing the world.
- The world is taking positive actions to reduce emissions with most countries investing heavily in moving energy production from fossil fuels such as coal, gas, and oil to renewable energy sources such as wind, solar, hydro, geothermal and tidal power.
- There are lots of things we can all do to reduce our individual carbon footprint.
- It is important that we share what we know with others and take positive actions to reduce greenhouse emissions to create a better future