

CLIMATE CHANGE AND RENEWABLE ENERGY

Teacher Lesson Plan Page 1

Science, Technology and Social Sciences – based explorations to enable students to: understand the concept and causes of climate change and global warming; identify the dangers it poses to our planet; the actions we must all take to lessen the impact of global warming and the major part that renewable energy can play in mitigating the impact of climate change.



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Teacher Notes

- This unit contains student discussion/research sections and poses questions to be answered by students. These are based on the **Student Fact Sheet** that accompanies this lesson. Download Student Fact Sheet at: www.windenergy.org.nz/resources/for-teachers
- The Student Fact Sheet can be used for group and/or individual student research and also used for shared class reading and discussion.
- Links to websites and videos are provided for additional research and extension activities.

Tuning in to Changes on Earth

- Challenge groups to discuss and report back the reason why we have both day and night every 24 hours. Introduce the word 'axis' as an imaginary stick or dowel that goes through the Earth from the bottom to the top. Do students know that once every 24 hours the Earth spins once right around its axis? In a darkened room with a lamp as the sun, slowly spin a world globe around its axis so students can see that it will be night when New Zealand is not facing the sun. Play the video at: www.youtube.com/watch?v=I0OCX3pBcJg
Additional lesson ideas for night and day at: www.starters.co.nz/download/get/day-and-night/62.html
- Why do the students think it is nearly always warmer during the day than at night? What provides this warmth? Discuss.
- Introduce the idea that we have four changes of seasons during the year. Have students speculate on why these seasons change during the year. Why is it winter in the Northern Hemisphere when it is summer in New Zealand and Australia? Discuss explanations given in the following videos. www.youtube.com/watch?v=KUU7lyfR34o
www.youtube.com/watch?v=Udvlep63cXk

Discovering reasons for Climate Change

- Do the students know that climate change is not new and the Earth's climate has changed many times during millions of years? Read/discuss the 'Introduction to Climate Change' section of Student Fact Sheet Pg1 to discover the following:
 - what happens when the total energy from the sun changes?
 - how are these changes spread around the world?
 - what causes natural changes in the Earth's climate?
 - how have humans also had an effect on the Earth's climate and global warming?



Indicative Curriculum Links and Learning Outcomes

Science: Planet Earth/Physical & Material World. Students will:

- gain an understanding of the natural variability of the Earth's climate and why we need the natural greenhouse effect.
- discover what humans have done to upset the natural balance of the atmosphere and causes of current and future global warming.
- understand how the greenhouse effect works and identify likely impacts of future climate change and global warming.

Social Sciences: Place and Environment. Students will:

- identify the actions being taken, now, and in the future, if we are to reduce the impact of climate change on the Earth's environment.
- understand the reasons why we must embrace renewable energy sources to reduce greenhouse gases in our atmosphere, how we compare with other countries, and how signing the Paris Agreement will help reduce our emission and improve the environment.

Technology: Practice and Knowledge Students will:

- be able to identify the renewable technologies we can adopt to decrease our greenhouse gas emissions and the positive effects for the environment that these technologies will make.

Most suitable for levels 2-4+ Links to English, Arts, Health

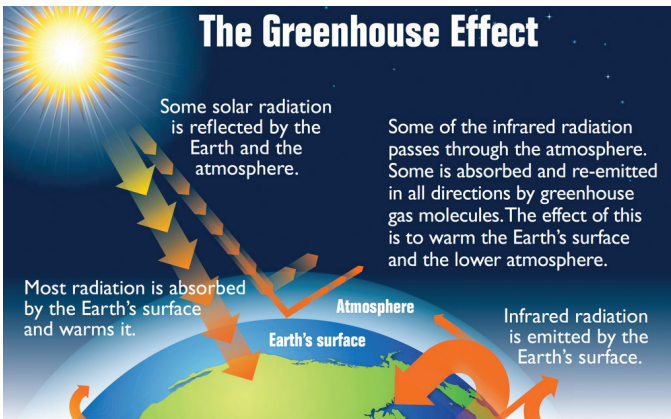
- what changes have we seen in the Earth's temperature and weather patterns in recent years?
- what human activities are believed to have caused this?
- since the start of the Industrial Revolution in 1760, how has the amount of CO₂ changed and what effect do we believe this is having on the Earth's climate?
- what other greenhouse gas has a significant effect on warming the atmosphere and how is it produced?
- Play/discuss the National Geographic 'Introduction to Global Warming' at: www.youtube.com/watch?v=oJAbATJCugs
Discuss, summarize and list the main ideas of the video.

What have we discovered so far?

- Have students focus on and discuss the following from the 'What have we discovered so far' section of Student Fact Sheet, Page 1.
 - the causes of the natural greenhouse effect on the Earth
 - the consequences for life on Earth if we didn't have the natural greenhouse gas effect
 - what humans have done to upset the natural balance of the Earth's atmosphere
 - the temperature rise in the last 100 years and the amount of temperature rise predicted that will have a huge effect on our climate
 - what the IPCC tells us is already happening because of increased greenhouse gases released by humans causing global warming.

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How does the Greenhouse Effect work?

- Remind students that the greenhouse effect is the name given to the warming of the Earth by greenhouse gases trapping some of the sunlight (heat from the sun) in the atmosphere and redirecting some of this warmth back to the Earth to warm it and to warm the atmosphere.
- Play and discuss the following greenhouse effect videos at:
www.youtube.com/watch?v=CxUK2TizQ4g
www.youtube.com/watch?v=BPJJM_hCFj0
- Using group or class shared reading techniques, have students read the 'How does the greenhouse effect work?' and 'What is causing this warming?' sections of the Fact Sheet Pg 2 and find answers to the following:
 - what would happen to life on Earth without the greenhouse gas effect?
 - what is the effect of increased greenhouse gases on the temperature of the Earth?
 - how and what human activities have contributed to this global warming over the last 100 years?

Likely impacts of Climate Change/Global Warming

- Play the following video by Dr David Wratt*, one of New Zealand's leading climate change scientists at:
<https://vimeo.com/147783165> What does he say about the causes of climate change? Has climate changed in the past? How has it changed? What is causing the Earth's climate to change even more and to warm up? What changes does he say we can expect in the future?
- Using group or class shared reading, focus on the 'Likely impacts of Global Warming' section on Student Fact Sheet 2. Have students focus on and discuss the following:
 - what the IPCC is and why was it formed by the United Nations?
 - why it is not possible to be absolutely certain about climate change and understanding the world's climate
 - what strong evidence is there that 'significant global warming' is occurring?
 - list and discuss the likely impacts of global warming
 - have students suggest the effects this will have on people
- Of the predicted impacts, which do the students think would be the most likely to affect New Zealanders? Why?
Play the second Dr David Wratt video at:
<https://vimeo.com/147783163> to find out what changes we can expect in New Zealand's weather from climate change and global warming in New Zealand in the next 100 years. Compare this with the expected ...

* The full series of Dr David Wratt videos are found at: www.niwa.co.nz/news/new-video-series-on-climate-change-featuring-dr-david-wratt



... world's climate changes predicted by the IPCC.

- Play the third Dr Davis Wratt video at: <https://vimeo.com/147783162>

to find out how sea level rise could affect us in New Zealand in the next 100 years.

Actions being taken to reduce the impact of Climate Change

- Have students use the above section of the Fact Sheet (Pg 3) to discover the following:
 - what were the aims of the UNFCCC and why was it set up?
 - how many countries signed the Paris Agreement in 2016 and what actions have they agreed to take to reduce greenhouse gases – world-wide
 - what are most countries that signed the Paris Agreement doing and focussing on to reduce greenhouse gases?
 - why is focussing on using renewable energy sources good for our planet?
 - how are these 195 countries trying to limit the amount of fossil fuel emissions being released into the atmosphere?
- Play <https://vimeo.com/147783166> to find out ways we can reduce the amount of fossil fuels we use in New Zealand.

What is Clean Energy and why it's so important?

- Remind students that most of the world's energy is at present produced by using fossil fuels. Challenge students to identify and name these fossil fuels, eg coal, natural gas and oil products (diesel, petrol ...)
- Have students read this section of the Fact Sheet (Pg 3). Can the students say why it is necessary to change from using these fuels to using renewable energy and consequences of continuing to use fuels that produce greenhouse gas emissions? What percentage of the world's energy is produced today by fuels that produce greenhouse gases (67% approx)?
- What are examples of renewable resources that can be used to produce energy without releasing greenhouse gases?

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

- Do students know that New Zealand has one of the highest levels of renewable electricity generation in the world (82%)? Do students think it is necessary for us to use any more renewable energy? Use the above section of the Fact Sheet (Pg 3) to discover:
 - the % of electricity generation in New Zealand produced by renewable energy.
 - how many tonnes of carbon emissions NZ produces per year, who produces (what sectors) these, and how much each in % terms?
 - who produces most carbon emissions in the energy sector and how much does each sector produce?
 - how many tonnes per person does New Zealand produce compared with USA, Australia, UK and India?

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- by signing the Paris Agreement, by how much have we said we will reduce our tonnes of carbon emissions by 2030 below our 2005 greenhouse emissions? Is this a small or a large amount?
- Challenge students to think of any ways we will be able to reduce our carbon emissions by 25 million tonnes (34%)? Discuss this in groups and have students report back any solutions.



Ways to reduce New Zealand's Emissions

- Read this section of the Fact Sheet (Pg 3) to identify the 3 key areas in which we must reduce our emissions to reach the Paris Agreement target.
- Have groups brainstorm and report back practical ways we can: reduce emissions and heat from industries; reduce transport emissions; promote use of electric cars; increase generation of renewable electricity; and use electricity more efficiently.

What can we all do to make a difference?

- Pose the following question to the class: 'what can we all do as individuals and/or as a group to make a difference to cut down on greenhouse gas emissions and make a difference to the dangers of climate change and global warming?' As a class or in groups, have students brainstorm and list:
 - positive actions they can take to help reduce greenhouse gas emissions
 - positive actions to take with others to help get out important messages of reducing greenhouse gas emissions.
- Play the Dr David Wratt video at: <https://vimeo.com/147783169> and have students compare their ideas with his suggestions.
- Have the class read and discuss the 'What can we all do to make a difference' section of the Fact Sheet (Pg 4). Challenge students to think of

practical ways they can get these important messages out and change people's behaviour about producing and releasing greenhouse gases into the atmosphere, eg 'Check with your parents that your home is well insulated and energy efficient.' This message can be communicated to parents by exploring with them the 'Simple ways to lower energy bills' section of the EECA Energywise website at:

www.energywise.govt.nz/at-home/simple-ways-to-lower-energy-bills

- As a homework exercise, have students play through the video with parents and older family members. Have students report back to the class:
 - the measures their family has already taken to become energy efficient at home
 - the measures they are going to take to become more energy efficient.

Getting the messages out

- As a class, brainstorm ways that they can communicate the important energy efficiency and reduction of greenhouse gases to other students at school, their families and to the local and wider community. Ideas could include:
 - preparing and acting out mini-dramas on energy efficiency at school assemblies and to other classes.
 - running a 'reducing greenhouse emissions day' at school that includes:
 - students sharing what they have learnt about greenhouse gases and global warming*
 - asking local council representatives to talk about energy efficiency measures they are taking and encouraging in the local community*
 - inviting a representative from the local power company to talk about electrical efficiency in the home.*
 - groups planning and shooting videos to get the main messages from the Fact Sheet out to the community – upload these on to the local class/school website and Youtube.
 - paint/draw bright and 'funky' posters of energy efficiency and greenhouse gas reduction slogans/messages to display at local shopping malls, Information Centres and supermarkets.
 - write letters to local papers to highlight the greenhouse gas emission problem and the simple measures people can take to help.
 - prepare a multi-choice climate change/global warming quiz for parents and family members to raise awareness of the problem. Include measures we can all take to reduce emissions as part of the quiz.



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Clean, Renewable Energy Produced by the Wind

Find out more at: www.windenergy.org.nz