

SOCIAL SCIENCE

GRADE 8

PROJECT 2

Effects of Climate Change In Papua New Guinea and Pacific Island Countries
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ACKNOWLEDGEMENT

We acknowledge the contributions of all Secondary Teachers who in one way or another have helped to develop this Course.

Our profound gratitude goes to the former Principal of FODE, Mr. Demas Tongogo for leading FODE team towards this great achievement. Special thanks to the Staff of the Social Science Department of FODE who played an active role in coordinating writing workshops, outsourcing lesson writing and editing processes, involving selected teachers of Central Province and NCD.

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DIANA TEIT AKIS
PRINCIPAL

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SECRETARY'S MESSAGE

Achieving a better future by individuals students, their families, communities or the nation as a whole, depends on the curriculum and the way it is delivered.

This course is a part of the new Flexible, Open and Distance Education curriculum. The learning outcomes are student-centred and allows for them to be demonstrated and assessed.

It maintains the rationale, goals, aims and principles of the National OBE Curriculum and identifies the knowledge, skills, attitudes and values that students should achieve.

This is a provision of Flexible, Open and Distance Education as an alternative pathway of formal education.

The Course promotes Papua New Guinea values and beliefs which are found in our constitution, Government policies and reports. It is developed in line with the National Education Plan (2005 – 2014) and addresses an increase in the number of school leavers which has been coupled with a limited access to secondary and higher educational institutions.

Flexible, Open and Distance Education is guided by the Department of Education's Mission which is fivefold;

- to facilitate and promote integral development of every individual
- to develop and encourage an education system which satisfies the requirements of Papua New Guinea and its people
- to establish, preserve, and improve standards of education throughout Papua New Guinea
- to make the benefits of such education available as widely as possible to all of the people
- to make education accessible to the physically, mentally and socially handicapped as well as to those who are educationally disadvantaged

The College is enhanced to provide alternative and comparable path ways for students and adults to complete their education, through one system, many path ways and same learning outcomes.

It is our vision that Papua New Guineans harness all appropriate and affordable technologies to pursue this program.

I commend all those teachers, curriculum writers and instructional designers, who have contributed so much in developing this course.



UKE KOMBRA, PhD
Secretary for Education

PROJECT INTRODUCTION



Welcome to Grade 8 Project 2 of the Social Science Course. This project is an extension of what you have studied in Grade 8 Strand 1. It will help you understand the causes and effects of Climate Change in Papua New Guinea and the Pacific.

The project is made up of five chapters. They are:

- 1. What is Climate Change**
- 2. Causes of Climate Change**
- 3. Effects of Climate Change**
- 4. What We Can Do to Reduce Global Warming and Climate Change**
- 5. Coping With Climate Change**

At the end of this project you should be able to:

- define climate change
- list the causes of climate change
- state the effects of climate change
- do educational awareness of climate change in your community and
- take simple measures at your level to reduce the negative effects of climate change.

When you finish studying the project, you will be required to complete Assignment No.6

Your completed Assignment booklet must be forwarded to your Provincial Centre for marking.

We hope you will enjoy learning about Global Warming and Climate Change.

Below are the steps to guide you in your course study.

STUDY GUIDE

- Step 1: Start with Chapter 1. Read through the notes and do the activities at the end of each chapter as you go along. Turn to the back of your project book to correct the answers of your learning activities.
- Step 2: When you have completed the first chapter, you then can move on to the next chapter. Continue until you complete the whole book.
- Step 3: If you make any mistakes, go back to the notes in your book and revise it well and try to understand why you gave an incorrect answer.
- Step 5: After completing your all the chapters, go to your Assessment Book and complete all topic tests in your Assignment Book 6.
- Step 7: Check your answers in the Assignment Book again, and when you are satisfied, submit your Assignment Book to your Provincial Centre for marking.

Study Schedule

Here is a sample study schedule that you can follow. It is just a guide to help you plan your work.

WEEKS	HEADING	ASSESSMENT NUMBER	ASSESSMENT TYPE	MARK
1-2	1	Assessment Task 1	Test	20 marks
3- 4	2	Assessment Task 2	Test	20 marks
5- 6	3	Assessment Task 3	Test	20 marks
7-8	4	Assessment Task 4	Test	20 marks
9-10	5	Assessment Task 5	Assignment	20 marks
THE COMPLETED ASSIGNMENT BOOK MUST BE SUBMITTED TO YOUR PROVINCIAL COODINATOR FOR MARKING.				TOTAL: 100 marks

All the best and enjoy your studies with FODE.

OVERVIEW

Climate Change is a global problem that has caused great concern since the early 1980s. It is not a new concept. There has been evidence of climate change for thousands of years, colder periods followed by warmer periods. There have also been natural changes in rainfall patterns.

However, there is growing evidence that the earth's climate is now becoming warmer because of human actions. There have been increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. Average global temperatures have increased by 0.74 degree celsius between 1906 and 2005. The first half of 2010 has already gone down in history as the hottest ever recorded. This is threatening the existence of life on earth. This trend may continue if we do nothing about it.

In Papua New Guinea, low-lying islands and coastal villages, cities and towns have been affected by rising sea levels and increasing wave activity. This has become a major issue now in Papua New Guinea.

The smaller Pacific island countries are already feeling the effects of global warming. For example, food and water shortages, rising cases of malaria, sea level rise and more frequent flooding and storms have been observed. Some people have already been forced to move from their homes and the number of displaced people is increasing. It is predicted that 75 million people in the Asia-Pacific region will be forced to relocate by 2050 if climate change continues. Not all will have the option of relocating within their own country, so it is important that developed neighboring countries like Australia and New Zealand start working with Pacific island governments to plan for this now.



Carteret Islanders in Bougainville: The first climate change refugees in the world

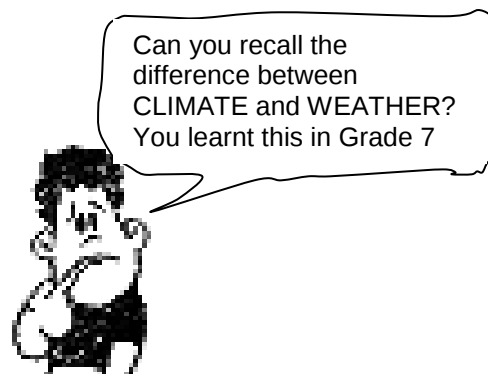


Fishermen paddle off Kennedy Island in the remote Western Province of the Solomon Islands

CHAPTER 1: WHAT IS CLIMATE CHANGE?

Before you look at climate change, let us first revise what you have learnt about weather and climate in Grade 7.

Weather comes from the earth's atmosphere and the sun's heat. The atmosphere is made up of a number of gases and when this air moves we call it *wind*. The sun heats up the air causing it to rise. This leaves a space behind for cooler air to flow into its space. The moving air carries clouds along with it. Clouds come from the air that is warm and full of water vapour. Water vapour is water in the form of gas. It gets into the air when the sun heats water in lakes, rivers, and oceans.



'Wewak is a hotter place to live in than Goroka'. 'It rains a lot around December in Port Moresby'. These statements are about climate. Can you recall the three main elements of climate you learnt in Grade 7 Strand 1? They are **temperature**, **rainfall** and **atmospheric / air pressure**.

You can see that, **weather** is the daily changes in the atmospheric conditions while **climate** is the average atmospheric conditions over a longer period of time in a given place.

What is Climate Change?

Climate Change is a change in global or regional climate patterns.

Depending on where you live, the weather is probably a little different every day. When we say the earth's climate is changing, we really mean that temperature, rainfall and air pressure patterns are not normal anymore. It may mean changing our statements to say, 'it no longer rains around December in Port Moresby'. You could say, 'nowadays, the rainfall season in Port Moresby starts in February instead of December'. Unlike weather that is reported daily, climate change happens slowly over a long period of time. Climate change has been happening for many years ago but at a slower rate, however today, scientists believe that it is happening at a faster rate as shown by the effects seen widely around the globe.

Now do the activity below. Check your answers at the end of the project book.

Activity 1

1. What is the difference between weather and climate?

2. What is climate change?

CHAPTER 2: CAUSES OF CLIMATE CHANGE

The earth and all that is in it, including living and non-living things are interdependent. This means that they depend on each other in order to make life possible on earth. They interact with each other through natural cycles such as water cycle, carbon cycle and nitrogen cycle to maintain the natural balance on earth so that life is sustained. Now, when one part of the environment is changed, it affects the other parts of the environment as well.

Let us look at an example. When forests are cleared, the following things may occur.

- Animals lose their homes
- Land is bare and is exposed to agents of erosion such as wind and rain. It loses its fertility and the place may become desert (desertification)
- Plant and animal species may become extinct
- The amount of carbon dioxide may increase as forests are major **carbon sink** (absorb carbon)
- The overall activities of the indigenous people in their environmental settings may be altered and the list goes on.

The example given above shows the dependency of both living and non-living things in the natural environment. The non-living things in the natural environment include the soil, the gases in the atmosphere, rocks, oceans and rivers.

With the information above in mind, we will now look at the causes of climate change.

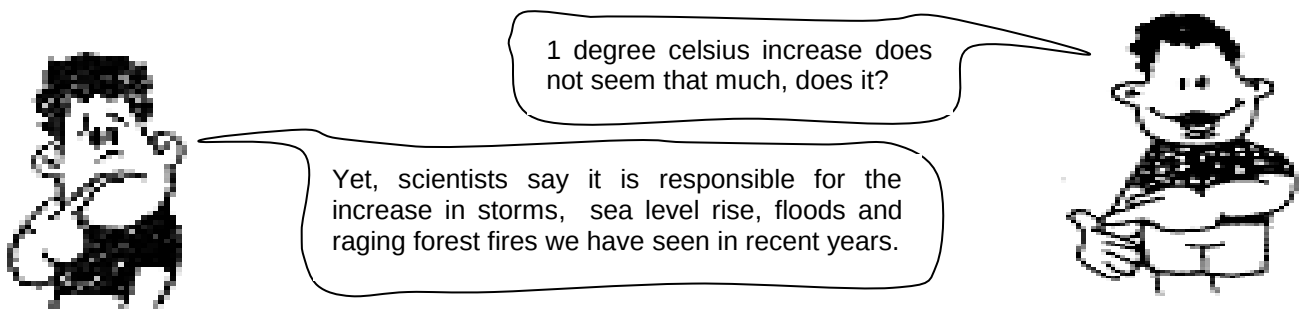
What are the Causes of Climate Change?

Scientists have discovered that humans are causing this warming. There are natural factors that can also cause climate change, for example, volcanic eruption, but they believe that this global issue of climate change is caused by man-made activities. That is why they describe it as *Human-Induced Climate Change* as identified from the natural climatic change that has been going on for thousands of years.

Warming is strongest at the Earth's Poles, the Arctic and the Antarctic, and will continue to be so. In recent years, winter air temperatures have been at a record 5 degree Celsius above normal in the Arctic. This is according to the U.S. National Oceanic and Atmospheric Administration. But changing wind patterns could mean that a warming Arctic, for example, leads to colder winters in continental Europe. Regional climates will change as well, but in very different ways. Some regions like parts of Northern Europe or West Africa will probably get wetter, while other regions like the Mediterranean or Central Africa will most likely receive less rainfall. But it is NOT just about HOW MUCH the Earth is warming, it is also about HOW FAST it is warming. There have always been natural climate changes – Ice Ages and the warm intermediate times between them – but those took place slowly over periods of 50,000 to 100,000 years.

Many plants and animals were able to adapt to these slowly changing climates. Even humans have changed their habitat according to the comings and goings of glaciers. Scientists believe that the warming visible in the last 30 years is not due to these natural changes. Since 1980, temperatures have risen faster than ever before, as far as scientists can tell us. Over the last 100 years, the average air temperature near the earth's surface

has risen by a little less than 1 degree celsius. Their data show that an increase of 1° celsius makes the Earth warmer now than it has been for at least a thousand years.



How do people's activities cause climate change?

To understand how people contribute to climate change, you will first look at the Greenhouse Effect and Global warming.

2.1: What is Greenhouse Effect?

The greenhouse effect is the capability of certain gases in the atmosphere in trapping heat given off from the Earth's surface therefore keeping the earth warm to sustain life on earth. These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapour, carbon dioxide and methane.

The idea of the greenhouse effect is illustrated below in the actual greenhouse.

A **greenhouse**, also called a **hothouse** is a heated building, usually with glass walls and a glass roof, in which tropical or delicate plants can grow at warm temperature.

Have a look at the diagrams on the next page. They are examples of greenhouses for growing certain plants.



Greenhouses at Volunteer Park Conservatory, Seattle, Washington

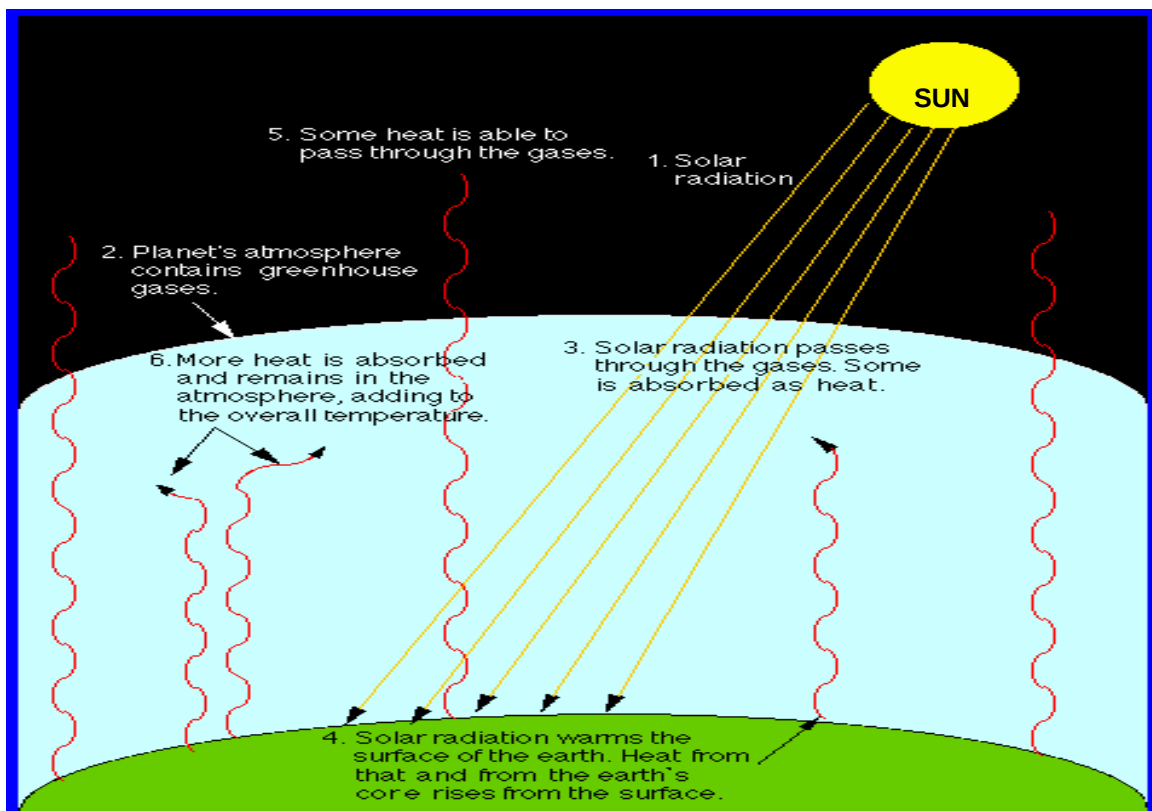
Firstly, the sunrays enter the glass roof and walls of a greenhouse. But once they heat up the ground, which, in turn, heats up the air inside the greenhouse, the glass panels trap that warm air and temperatures increase. Greenhouse gasses in the atmosphere therefore trap heat the way glass walls and ceilings in greenhouses trap heat. It stays warm inside a greenhouse even when it is cold outside. Our planet, however, has no glass walls. The only thing that comes close to acting as such is our atmosphere. Without the atmosphere, the earth surface would be about 15 degree celsius cooler than it is. But in here, processes are way more complicated than in a real greenhouse.

So, how does a greenhouse work?



Just like the glass of a greenhouse, the Earth's atmosphere keeps heat contained to a level that can sustain life on earth. The atmosphere consists of water vapor, nitrogen, oxygen, and the greenhouse gases, which include carbon dioxide, methane, and nitrous oxide. The general warming of the planet is being caused by an increase in the greenhouse gases which then trap increasing amounts of heat. Less of the heat that is emitted by the Earth is able to pass through the atmosphere when these gases are increased, and instead reflect back, warming the Earth's surface more than usual.

The diagram below shows how the earth is warmed by the greenhouse gases.



The Natural Greenhouse Effect

The sun is the earth's primary energy source, so hot that we can feel its heat from over 150 million kilometres away. Its rays enter our atmosphere and shower upon our planet. About one third of this solar energy is reflected back into the universe by glaciers, water

and other shiny surfaces. Two thirds, however, are absorbed by the earth, thus warming the land, oceans, and atmosphere. Much of this heat goes back out into space, but some of it is trapped by greenhouse gasses and stored in the atmosphere thus warming the earth's surface.

Do You Think the North and South Poles are cold?

If you went for a walk on Mars during the day, you will feel extremely hot as the average temperature will be about 37 degree celsius. But at night, temperature drops right down to a very low -123 degree celsius or so! Why does planet Mars cool off so much at night? It is because the sun's heat goes right back out into the outer space when the sun sets. This is because there is not much air or clouds to keep the warmth of the day in.

A Blanket around Our Earth

Down here on planet earth, about half of the sun's heat that reaches us is absorbed by the land and water. When the sun goes down, the absorbed heat is slowly released into the air. We also have an atmosphere that absorbs some of the sun's heat. This also helps keep the released surface heat from floating quickly off into the outer space.

The atmosphere is like a blanket that surrounds the planet earth. It also lets in just the right amount of the sun's heat (about 70%) and reflects the rest sending it back out into space.

As you know, oxygen is very important because it allows us to breathe. However, it is the water vapour in the atmosphere and a tiny amount of other gases that keep us from frying and freezing on planet earth.

An Atmosphere is a blanket of gas that surrounds a planet. The earth's atmosphere is mostly made up of Nitrogen, Oxygen and a small amount of Carbon Dioxide.

2.2 The Greenhouse Gasses

Let us take a closer look at the greenhouse gasses. These gases include:

- Water vapor
- Carbon dioxide
- Methane
- Nitrous oxide
- Ozone
- Chlorofluorocarbons (CFCs)

These gases are released into the atmosphere by burning **fossil fuels**. They trap additional heat in the earth's atmosphere.

What are Fossil Fuels?

Fossil fuel refers to decayed plant and animal matter that have been changed to crude oil, coal, natural gas or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years. These are flameable deposits which mean they can be burnt to release energy. They are buried deep in the earth's crust.

The burning of fossil fuels by humans is the largest source of emissions of carbon dioxide, which is one of the greenhouse gases that cause **Global Warming**.



Oil Disaster in the Gulf of Mexico, 2010



Factories that Burn Fossil Fuels contribute to Global Warming.

Fossil fuels are of great importance because they can be burnt to produce huge amounts of energy stored inside this resource. Examples are coal, oil and natural gas. They are all non-renewable forms of energy which means nature cannot replace them quickly enough. They are formed from plants and animals that lived up to 300 million years ago. We burn these fuels at the power stations to make electricity, and to power cars and other transport.

Now let us look at some of the greenhouse gases.

i) **Carbon dioxide**

Carbon dioxide (CO_2), is one of the most important greenhouse gasses. It is a heavy colourless gas that does not support any form of burning. It is formed naturally by burning processes and when plant and animal matter decay. Plants absorb carbon dioxide by photosynthesis process. Carbon dioxide makes up about 25 per cent of the natural greenhouse effect and is therefore a key player.

Here are some activities that put carbon dioxide into the atmosphere.

1. Forest fires or erupting volcanoes are natural sources of carbon dioxide.
2. Trees and plants also contain a lot of carbon. When they die and decompose (rot) half of the carbon contained in the trees and plants is released into the atmosphere as carbon dioxide.
3. The other half is absorbed by the soil. However, soils also slowly decay, especially when disturbed by fire and other processes. This releases more carbon dioxide into the atmosphere.
4. Humans, animals and insects consume plant materials that contain carbon. Much of the carbon in plants is eventually released into the atmosphere when humans, animals and insects breathe-out carbon dioxide.
5. Oceans contain and release huge amounts of carbon dioxide that bubble into the air from their surfaces.

Here is a list of activities that *remove* carbon dioxide from the atmosphere.

1. Plants and trees take in carbon dioxide when they turn the sun's energy into food (through photosynthesis).
2. Oceans also absorb large amounts of carbon dioxide into their surface waters. The carbon dioxide dissolves in the ocean like the bubble in a soft drink.
3. Phytoplanktons – a big name for little living things that float around in the ocean. They take up a large portion of the ocean's carbon dioxide through photosynthesis (though much of this is later released).

This removal of carbon dioxide from the atmosphere helps keep things in balance. Over the past 10,000 years, the balance between the annual atmospheric release and removal of large amounts of carbon dioxide has been remarkably stable on average.

ii) **Methane**

Methane (CH₄) is another of those greenhouse gasses that remains in the atmosphere for approximately 9 to 15 years. It is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide (CO₂) does over a 100 year period. Methane is released from a variety of natural and human sources.

Here are some of these sources of methane.

- Fossil Fuel Mining and Distribution:

Methane is always found wherever there are fossil fuels. It is released whenever fossil fuels are removed from the earth whether it is natural gas (which is mostly methane anyway), coal or oil. Methane is also during any type of handling and transportation through pipeline or truck delivery. By simply buying or using fossil fuel you contribute to the most important source of methane emissions worldwide.

- Livestock:

Farm animals like cows, sheep and goats are **ruminant animals**. During their normal digestion process they create large amounts of methane. This livestock also create methane emissions from their *manure. When cows, pigs and chickens are raised on a large scale, there are obviously large quantities of manure that get produced by these animals everyday so farms have to have a way to manage and treat all of this manure.

Livestock manure management is done by using large waste treatment systems and storage tanks. In these tanks the manure decomposes but because the tanks are closed there is no oxygen. When dead plant and animal matter decomposes without oxygen (anaerobically) great quantities of methane is produced.

Ruminant Animals like, cows and sheep, possess a four-chambered stomach housing micro-organisms that break down the cellulose from plant matter into a more digestible form.

- Landfills:

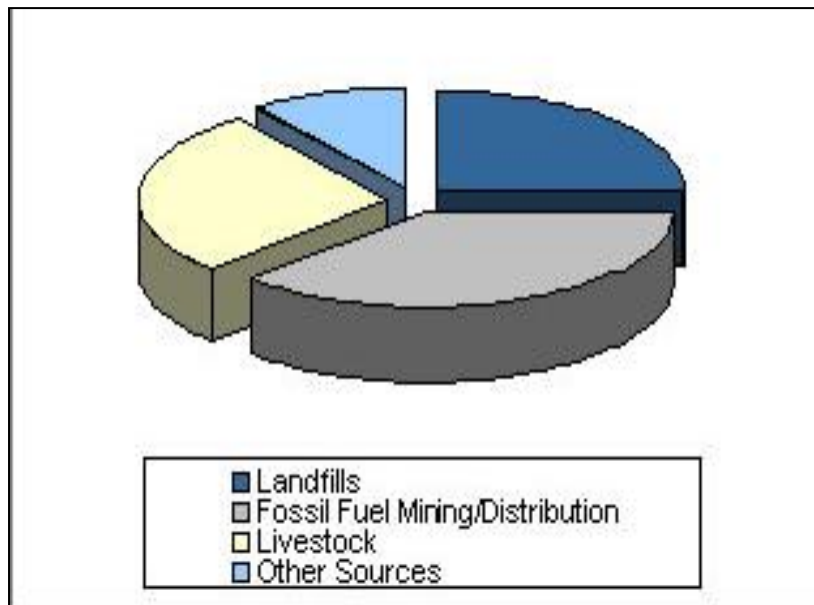
As with manure, landfills and open garbage dumps are full of dead plant and animal matter from our garbage (things like food scraps, newspapers, cut grass and leaves).

Every time new garbage comes in, it is piled over the old garbage that was already there. The dead plant and animal matter in our garbage gets trapped in conditions without oxygen (anaerobic) and because of these large amounts of methane is produced.

Landfill refers to the disposal of waste material or refuse by burying it in natural or excavated holes or depressions.

Take a look at the graph below. It shows the amount of methane that is released by different sources in the United States of America. You will see that Fossil Fuels Mining and Distribution is the biggest contributor of methane followed by Landfills.

SOURCES OF METHANE EMISSIONS IN USA



iii) Nitrous Oxide

Nitrous oxide is another powerful greenhouse gas that is released mainly by ploughing farm soils and burning fossil fuels. Nitrous oxide traps about 300 times more heat than does the same amount of carbon dioxide. The amount of nitrous oxide in the atmosphere has increased by 18 percent over pre-industrial levels. It contributes about a tenth as much as carbon dioxide to global warming.

iv) Chlorofluorocarbon

The **Chlorofluorocarbons** (CFC's) are man-made gasses. They are stable, colourless, non-toxic, non-flammable and non-reactive gasses. CFCs are easy and not costly to produce. They are used in products such as *aerosols and air conditioners.

They are chemicals that are made of elements such as chlorine, fluorine, and carbon. During the 1970s, scientists linked CFCs to the destruction of Earth's *ozone layer. They discovered a thinning of the ozone layer over the Antarctica which was believed to have

been caused by CFCs. The manufacture of CFCs has since been banned in most countries. CFCs occur in low amounts but have a strong warming effect. Too much of them will make the earth warmer and could cause disastrous changes on the planet.



Next, we will correct some common misunderstandings of concepts in GREENHOUSE EFFECT and GLOBAL WARMING.

Misconception is when people mis-interpret information and thus misunderstand the facts.

Misconception 1:

Many people think that greenhouse gasses 'reflect' heat back to the Earth. Greenhouse gasses do not 'reflect' heat. They retain or absorb heat that radiates off of the Earth's surface and re-radiate it back to Earth and to space. Most of the heat, in fact, returns back to space.

Students may also conclude that the gases absorb heat when sunlight first penetrates the atmosphere from the sun. This is NOT the case. Only the Ozone Layer in the Stratosphere absorbs ultra violet radiation and some heat energy.

It is the earth that first absorbs the visible radiation from the sun, which is then changed to heat energy. This heat radiates out to the atmosphere in the night, where the greenhouse gasses then absorb some of the heat.

Misconception 2:

Many people believe that the Greenhouse Effect is dangerous for life on Earth. However, if it were not for the Greenhouse Effect, the temperature on Earth would be too cold for human survival. The Greenhouse Effects actually helps to keep the earth warm at reasonable levels so that it is not too cold for all life forms.

Misconception 3:

A common misunderstanding that may confuse students is that clouds are water vapour. Given this misconception, they may think that clouds block sunlight and assume that the heat from the sun should be bounced back from the water molecule out to space.

Here are some facts you must remember.

- Many of the greenhouse gases are naturally occurring, causing natural global warming. Without naturally occurring greenhouse gases, the earth's surface temperature would average 33 degrees celsius cooler.
- The first person to predict the greenhouse effect was a Swedish Chemist named Svante Arrhenius. Over a hundred years ago, in 1896, he observed that when the Industrial Revolution began; more carbon dioxide was being released into the atmosphere. He believed that carbon dioxide levels would rise as industries grow. He was the first to understand that this increase meant a rise in the temperature of the earth. He was ignored at the time, because the results of his predictions were seen as too far into the future for the people of his time to believe.

- When we burn fossil fuels and manufacture other products, we release gases into the atmosphere, which are called **Greenhouse Gases**.
- Over the past 250 years, carbon dioxide levels have increased by 25 percent.
- Mass deforestation is decreasing the amount of plant life on the planet. Trees and plants are important to us because they remove carbon dioxide from the air and make oxygen in the process of photosynthesis. Industries will continue to pump carbon dioxide into the air and, with the decrease of vegetation, more carbon dioxide will remain in the atmosphere to cause problems like the Enhanced Greenhouse Effect.
- In the past 15 to 20 years, there has been an overall rise in earth's temperatures.



My gosh! What is happening now to these natural levels of atmospheric carbon dioxide?

Earth's Atmosphere is made up of these Gases:

- **Nitrogen: 78%**
- **Oxygen: 21%**
- **Carbon dioxide: 0.03%**



My friend, you have just learnt that these natural levels of carbon dioxide in the air are increasing due to the burning of fossil fuels by industries and even cars that burn fuel. Any change in this natural amount of carbon dioxide will have a big impact on the earth's temperature.

Therefore, **Global Warming** is the slow increase of the average air temperature on earth, which scientists believe is caused by burning of fossils. Sometimes people define it as warming caused by human activity. As the earth is getting hotter, disasters like hurricanes, droughts and floods are getting more frequent. It is now generally accepted that as our planet warms up, the natural climatic processes are affected. This increasing heat from global warming is affecting the normal climatic patterns. For instance, unpredictable heavy rainfalls, strong wind patterns such as hurricane and cyclones. These changes to the climate are now commonly known as **Climate Change**.

More burning will lead to more CARBON DIOXIDE released into the atmosphere. If there is more carbon dioxide in the atmosphere, more out-going heat energy will be trapped by them. This heat will not escape to the outer most layer of the atmosphere because they are trapped within the lower layers. When more heat is trapped, the earth surface warms up. This is referred to as GLOBAL WARMING.

Are climate change and global warming one and the same?



Basically, GLOBAL WARMING is the cause, while CLIMATE CHANGE is the effect.

How do Humans contribute to Global Warming?

- By burning fossil fuels such as gas, coal and oil. This includes gasoline for car engine which raises the level of carbon dioxide in the atmosphere.
- Some farming practices and land-use changes increase the levels of methane and nitrous oxide.
- Many factories produce long-lasting industrial gases that do not occur naturally yet contribute greatly to greenhouse effect (global warming). Examples of these are the Chlorofluorocarbons.
- Deforestation also contributes to global warming. Trees use carbon dioxide and give off oxygen in its place. This helps to create the best balance of gases in the atmosphere. As more trees are logged for timber or cut down to make way for farming, fewer trees are left to do this important function.
- Population growth is another factor in global warming. As more and more people use fossil fuels for heat, transportation and manufacturing, the level of greenhouse gases continues to increase. A bigger and growing population means increased demand for the use of natural resources. More areas of land are cleared for farming to feed the increasing population. By doing so, more greenhouse gases enter the atmosphere.

Energy is important to modern society as we know it. Over 85 percent of our energy needs are met by the burning of fossil fuels. Two major problems with fuels are they are non-renewable and when burnt they give off greenhouse gasses that are responsible for global warming. The developed countries of the northern hemisphere are believed to be major producers of greenhouse gasses. The *developing countries of the southern hemisphere believe that they are innocently suffering the effects of climate change that is largely caused by these developed and industrialised countries. They are demanding greater assistance from them to assist with addressing the effects of global warming and climate change.



Do you cook food with firewood? Oh well, the other name for firewood is **FUELWOOD**. Fuel wood is also a fossil fuel that is burnt to release carbon dioxide into the atmosphere.

That really means I have to switch to an environmentally friendly form of fuel to cook my food so that I do not contribute to greenhouse gas emissions.



Now do activity 2 below. Check your answers at the end of the project.

Activity 2

1. What is the main cause of the enhanced climate change?

2. What are greenhouse gases?

3. How are greenhouse gases produced and released into the atmosphere?

4. Name the two main natural features that absorb carbon dioxide from the atmosphere?

CHAPTER 3: EFFECTS OF CLIMATE CHANGE

So far, you learnt that climate change is caused by global warming. This warming is causing huge ice bergs in the South and North Poles to melt. The ice on the highest mountains of the world is also melting.



All these melt waters from these sources end up in the oceans, thus causing the sea level to rise. The low-lying islands in PNG and the Pacific Ocean are obviously at high risks of problems such as being drowned, beach erosion and salt water contamination of freshwater sources.

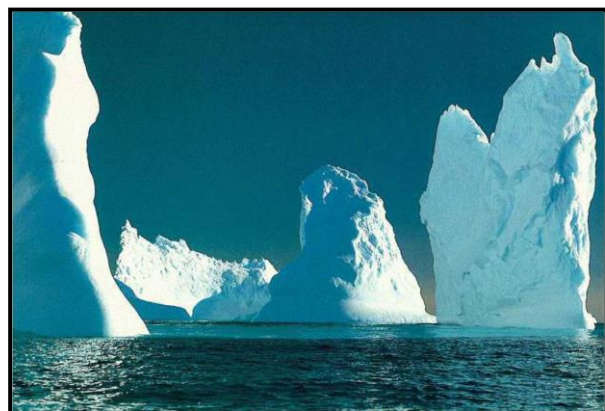
The Arctic is global warming's focus. It is a highly sensitive region, and it is being greatly affected by the changing climate. Most scientists view what is happening now in the Arctic as an early indication of worse things to come. Average temperatures in the Arctic region are rising twice as fast as they are elsewhere in the world. Arctic ice is getting thinner, melting and cracking. For example, the largest single block of ice in the Arctic, the Ward Hunt Ice Shelf, had been around for 3,000 years before it started cracking in 2000. Within two years it had split all the way through and is now breaking into pieces. The polar ice cap as a whole is shrinking.

Take a look at these amazing pictures (Image 1 and 2) of this Hunt Ice Shelf melting and cracking away.

IMAGE 1



IMAGE 2



The map below shows a satellite image of the Summer Arctic Sea Ice Boundary in 1979. Images from NASA satellites show that the area of permanent ice cover is becoming smaller, at a rate of 9 percent each decade. If this trend continues, summers in the Arctic could become ice-free by the end of the century.



Summer Arctic Sea Ice Boundary -1979

The loss of coastal areas, combined with a reduction in available fresh water could be very bad to the agricultural potential of many islands where coastal areas serve as the only area for cultivation. The rise in sea-level often accompanies natural hazardous events like cyclones and tidal waves. Although, tropical cyclones are an important natural feature of the South Pacific Islands, the number of tropical cyclones and their impact has increased in recent times. These have had very destructive effects on agriculture, housing and the whole of the living conditions of the many island groups which lie within the cyclone areas. This is threatening and damaging lands previously out of reach of the sea.



Typical Beach Erosion on the Islands-
Tuvalu



Eroding Shoreline has Stranded this Coconut
Tree on the Active Beach, Southern Coast of
Viti Levu, Fiji

One important and necessary condition for the formation of cyclones is the sea surface temperatures in excess of 27 degree celsius. Thus, any warming up of sea surface temperatures will contribute to increasing risks of cyclones. During the 1983, El Nino, the French Polynesia, an area not normally prone to cyclones was destroyed by six violent

cyclonic storms. Within the last few years, increasing cyclonic activities has been observed.

In most Pacific islands, the people, agricultural land, tourist resorts and infrastructure (including roads and airports) are concentrated in the coastal zones, and are thus especially affected by any rise in sea level. Determining how severe this problem is, or might be, by natural changes in sea level is not so easy.

The Pacific Islands Climate Change Assistance Programme (PICCAP) is a three-year SPREP (South Pacific Regional Environment Programme) activity funded by the Global Environment Facility (GEF). PICCAP began in 1997 to assist 10 Pacific Island countries that signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) with their reporting, training and capacity building under the convention.

Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Republic of Marshall Islands, Nauru, Samoa, Solomon Islands, Tuvalu, and Vanuatu have appointed Climate Change Country Teams and a Climate Change Country Co-ordinator to:

1. do inventory sources and sinks of greenhouse gases,
2. identify and evaluate mitigation options to reduce greenhouse gas emissions,
3. assess vulnerability to climate change,
4. develop adaptation options,
5. develop a national implementation strategy for mitigating and adapting to climate change over the long term.

Niue and PNG also have climate change programmes, but these are funded directly by GEF through the United Nations Environment Programme (UNEP) and UNDP (United Nations Development Programme) and are not included in PICCAP. A total of 23 participants from Cook Islands, FSM, Fiji, Kiribati, Republic of Marshall Islands, Nauru, Samoa, Solomon Islands, Tuvalu, Vanuatu and Niue attended a SPREP Regional Training Workshop on National Greenhouse Gas Inventory Methodology in 1998 for training in national inventories of greenhouse gas sources and sinks. Participants from 12 countries including Niue and PNG also participated in training on assessing climate change issues and adaptation requirements during a six-month training course at the International Global Change Institute (IGCI), University of Waikato, New Zealand in 1998.



2010 Forum Leaders' Meeting, Port Vila, Vanuatu



Pacific Island Forum Leaders at a Climate Conference in Alofi, Niue

Most Pacific island governments view climate change and sea-level rise and natural changes as priority issues, recognising that they have a big impact on the economic, environment, social, cultural and traditional sectors of these island countries. However, governments wish to know what they have to do to address the problem. Traditional cultural practices existed with conservation of the environment. Traditional knowledge has governed activities and survival of people in the region for a long time. However, these practices are now challenged by the effects of climate change.

Now do activity 3 below. Check your answers at the end of the project.

Activity 3

1. What is the main effect of global warming that is most evident in coastal regions of the Pacific?

2. In chapter two, we learned that all things are interdependent. When one part of the environment is changed, it affects the others as well. What other parts of the environment can be affected by the rising sea level?

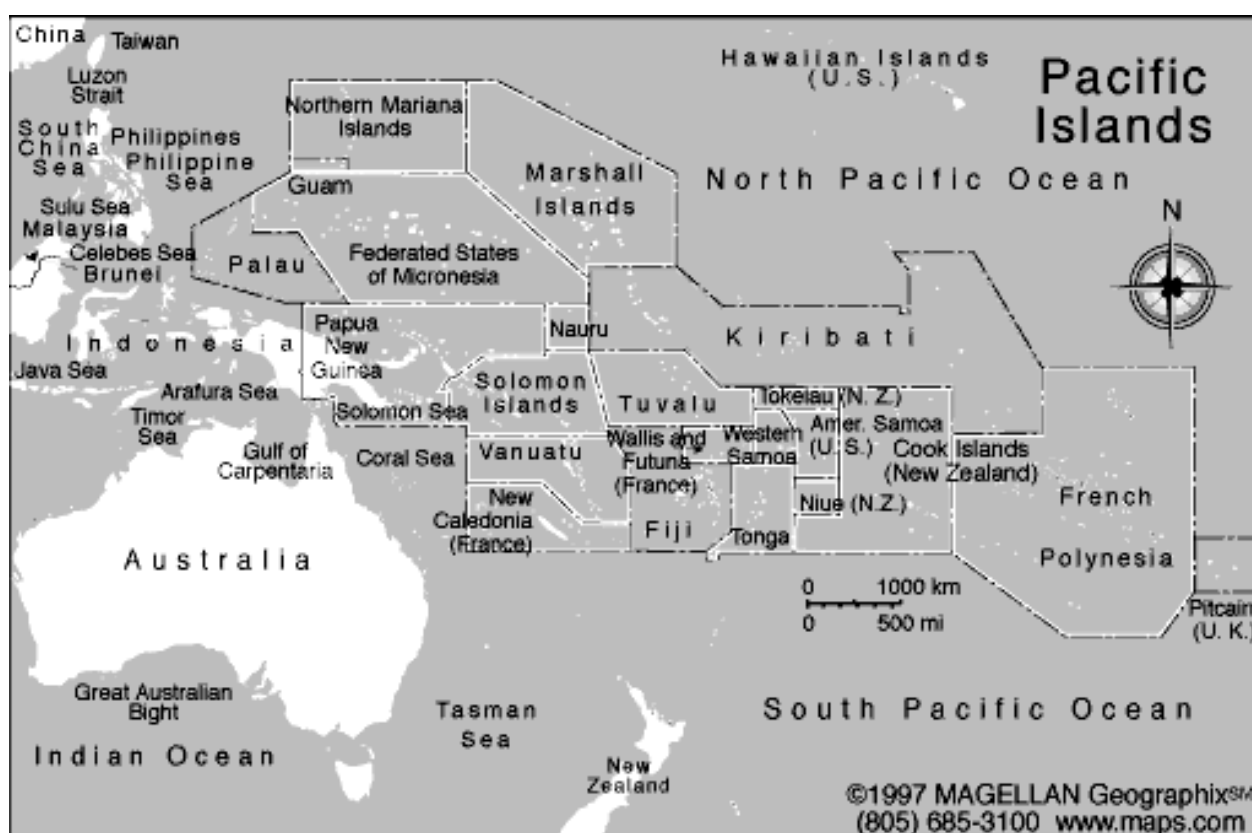
3. Can you think of an island in Papua Guinea New that has been badly affected by rising sea level and as a result, the inhabitants of the island were relocated.

CHAPTER 4: COPING WITH CLIMATE CHANGE IN THE PACIFIC

The Pacific Ocean, the largest in the world, covers almost one third of the earth's surface. Within the vast blue ocean are many thousands of tiny islands, the largest two being Viti Levu in Fiji and the Big Island in Hawaii, both being just over 10,000 square kilometres or about half the size of Israel. There are more than 25,000 islands in the western and central Pacific Ocean. The islands lie across millions of square kilometres of ocean. They appear to be just a few tiny dots in a large expanse of sea.

On the following map, the countries are labelled in black text. The white text indicates areas that are controlled by another country, which is included in brackets. You need to spend some time to study the map below.

THE PACIFIC ISLAND COUNTRIES



Climate Change ranks among the greatest challenges facing these small island countries in the South Pacific. Food security and access to fresh water are very serious issues in places such as Tarawa Atoll in Kiribati. Critical issues include rising sea levels, beach erosion, salt water contamination of fresh water supplies, frequent storms and cyclones, dead corals and the displacement of people as islands cease to sustain communities.

Effects of Sea Surface Warming on Corals

Global warming is expected to have serious effects on the Pacific Ocean. Most sea creatures live within narrow temperature levels and even short-term extreme temperature increase can have a big impact. One such impact is seen on corals.



First of all, let us define coral.

Corals really look like plants or rocks, but they are actually animals.



The coral reef looks like strangely shaped rocks sticking up from the ocean floor. Fish of all different shapes and varieties of colour swim near the reef. Coral reefs play an important role in ocean life. Many kinds of plants, fish, and other animals live on and around a coral reef. Even the reef itself is made mostly of tiny coral animals, both living and dead.

These coral animals do not move around. They are tiny creatures that live together in groups called **colonies**. One single coral animal is called a **polyp**. It has a body shaped like a tube. Its mouth is on the top of the tube. Little tentacles around the mouth help the coral polyp catch food that floats by. Coral animals eat very tiny sea creatures called **zooplankton**.

Take a look at this photograph. Can you spot the mouth and the little tentacles of this Orange Tube coral?



Orange Tube-Coral

The reef-building polyp makes a hard outer shell for itself from materials found in seawater. When the polyp dies, the shell is left behind. The shells from colonies of polyps build up over time to form a rock called *limestone*. This limestone becomes the inner part of the reef. The living coral animals form the top part of the reef. As each layer of polyps dies, their stony skeletons get added to the reef. A new layer then grows on top of the old. This is how a reef gets bigger.

Tiny single-celled *algae* called **zooxanthellae** live in coral polyps. The polyp and the algae make food for one another. The polyps could not live without the algae.

There are hundreds of different kinds of coral. Hard coral or stony coral is the kind of coral that builds reefs. These corals have hard outer skeletons. Other corals do not have hard outer skeletons and look like fans or flowers. Some kinds of coral look like the branches of a tree. Other kinds can sting you if you touch them.

Corals as we have just learnt are very important ecosystems in the oceans. They are now under threat of dying out due to warming of the sea surfaces from global warming.

In the past two decades, it was seen that short-term extreme high temperatures contributed to a fall of coral reefs throughout the tropics

Coral bleaching is a condition whereby coral colonies suddenly take on very bright colours, going from very brilliant blue to pink and fluorescent yellow. They appear to bloom while at the same time the tips of the branches start to turn totally white. In the space of few weeks this white colour extends to the whole structure causing the corals to die eventually.

Corals can grow successfully where the water is between 26 to 30 degree celsius. Above 30 degree celsius, they become separated from the **algae-zooanthellae* which are important partners of their existence.



Coral Colonies

Over the last few years in the South Pacific, there were clear observations of change in the colour of corals. This is believed to have been caused by warming of the sea surfaces. Corals die when they cannot cope with the high temperatures.

In November 1998, 350 reef managers, Biologists and government representatives attended the International Tropical Marine Ecosystems Management Symposium (meeting) in Townsville, Australia. They met to discuss ways to solve these problems. Scientists revealed that *Coral Bleaching* cases of 1997-1998 were the most geographically widespread ever recorded and probably the most severe in recorded history (Wilkinson, 1998, Robbins 1999).



Dead Corals on Bora Bora, Society Islands

In the Society Islands, scientists from IRD (Institute of Research for Development) Centre of Tahiti observed Coral Bleaching over 500 kilometres of barrier reef. Similar observations had been made during the warm periods of 1982-1983 *El Nino*. This was the time when sea surface temperatures in the central and eastern Pacific were 4 degrees celsius above normal. Other regions of the South Pacific were also affected.



Tuvalu Women Going about their Daily Activities

Let us look at Tuvalu. It is the fourth smallest country in the world by landmass, and consists of a chain of nine low-lying islands situated about 4,200 kilometres southwest of Hawaii. The majority of Tuvalu's population is ethnic Polynesian.

These peoples' day to day livelihood have been challenged by the effects of sea-level rise, frequent droughts, salt water contamination of freshwater sources and farm land.

These island governments and PNG have similar problems of climate change, sea-level rise and natural disasters as priority issues. They have, for a long time used traditional knowledge to do their activities. These traditional practices and knowledge is now challenged by these effects of climate change.

From Tuvalu we travel south to the Fiji islands. On Fiji's largest island, Viti Levu, a new coral gardening project is under way to help reduce coastal erosion and sand loss, which are considered to be major impacts of sea level rise. The project is a joint initiative of the local community, a national *NGO and a holiday resort. They have also started *artificial wetlands to manage waste water, planting mangrove trees to protect the reef, and replanting coral in deeper water to bring back the natural fish and animals that the people can use to eat. This is an example of how *mitigation and *adaptation strategies can protect the environment and the economy.

The Climate Change and South Pacific Forum (CCSPF) is a regional organisation that aims at addressing climate change issues. It recognised and *endorsed members' deep concerns regarding the impact of greenhouse gas emissions on rising sea levels and changing weather patterns on all Forum members, especially low lying island nations. This was recorded in the "Forum Leaders' Statement on Climate Change" issued at the 28th South Pacific Forum and the "Statement on Climate Change and Sea Level rise" issued by the 7th Economic Summit of Smaller Island States Leaders.



Here are some views expressed by people about the effects of Climate Change.



"I am concerned...I would like the future generation to be looking at things more closely and really thinking it through. What they do to their island now, even though they think it isn't going to do much... it might, and (Nauru) is just one small island...where are they going to go after that?"

-Limay Uera
Nauru Island



"There have been, in our oral traditions, indications of adaptation based on what is happening in the climate. I am sure that, as before, adaptations will be made to accommodate changes due to warming because we are always evolving."

-Jane Harchareck, Educator
Barrow, Alaska



"The kiosk will promote interest in atmospheric science among Northern Territory students and teachers. The Papua New Guineans in our community will appreciate the content from Manus Island".

-Kate Smith, Education Manager
Darwin, Australia

Challenges Facing Papua New Guinea

Let us have a closer look at home. Papua New Guinea is the biggest island country in the Pacific region in terms of land size and population. It, like many developing countries, faces significant environmental problems. The most pressing challenges since the mid-2000, is coping with climate change and its effects. PNG is party to international treaties concerning climate change, endangered species, marine dumping, ship pollution, tropical timber, and wetlands. It is expected to plan within these international expectations to meet targets it agreed to. However, you will realise that many factors contribute to the slow and ineffective processes to meet some of these commitments.

You need to spend some time to study the map of Papua New Guinea below. As you can see, Papua New Guinea occupies the eastern half of the island of New Guinea, called the mainland, and several hundred smaller islands. The western part of New Guinea forms the Indonesian province called West Papua (formerly Irian Jaya).

You will notice that there are many low-lying islands and much smaller atolls that make up the bigger islands. Take Manus and the Milne Bay Islands as examples. There are many smaller islands that make up these two islands. The coastline of mainland Papua New Guinea is mostly low-lying and is also prone to the effects of climate change.

MAP OF PNG



The effects of climate change have been widely talked about and reported in the Media lately. The hot dry extreme conditions that spread throughout the country in 2008 and 2009 are having big impact on crop yields. As you know, 85 percent of our people live in the rural areas and their livelihood depends on subsistence farming of food crops, hunting and fishing. Nowadays, it is even harder for them to predict rainfall and temperature patterns because normal patterns have changed a lot. These changes are affecting planting, growing and harvesting seasons. This in turn affects the supply of food and water. People's routines and ability to cope with the associated effects is also affected.

Subsistence and cash crops and animal farms are expected to make best use of available water resources and cope with increasing temperatures and frequent drought that are unpredictable.



Pictured Here are Community Leaders from Manus Island Discussing Climate Change Impacts on Pacific Islands. Adults and Children from Surrounding Villages Gather to Listen.

Climate Change and its effects are affecting many sectors of the community, and the reality is that, people are not well prepared for it. Majority of people do not understand what Climate Change is due to lack of access to information. However, climate education and awareness is progressing well in some parts of the country that are affected by effects of climate change, as you can see in this photograph.

Increase in Sea-Level

Do you live near the coast or an island? Try chatting with an older person about his/her observations of sea level rise or beach erosion. Take a walk around the shores to hear their stories of the changes they have observed over the years. You probably might have your own experiences of sea level rise, beach erosion or even frequent occurrences of cyclones and drought.

If you are not a coastal or islands person, then you can find time to talk to an older person in your community about their observations of rainfall and temperatures patterns. Have they seen any irregularity in the rainy and dry seasons?

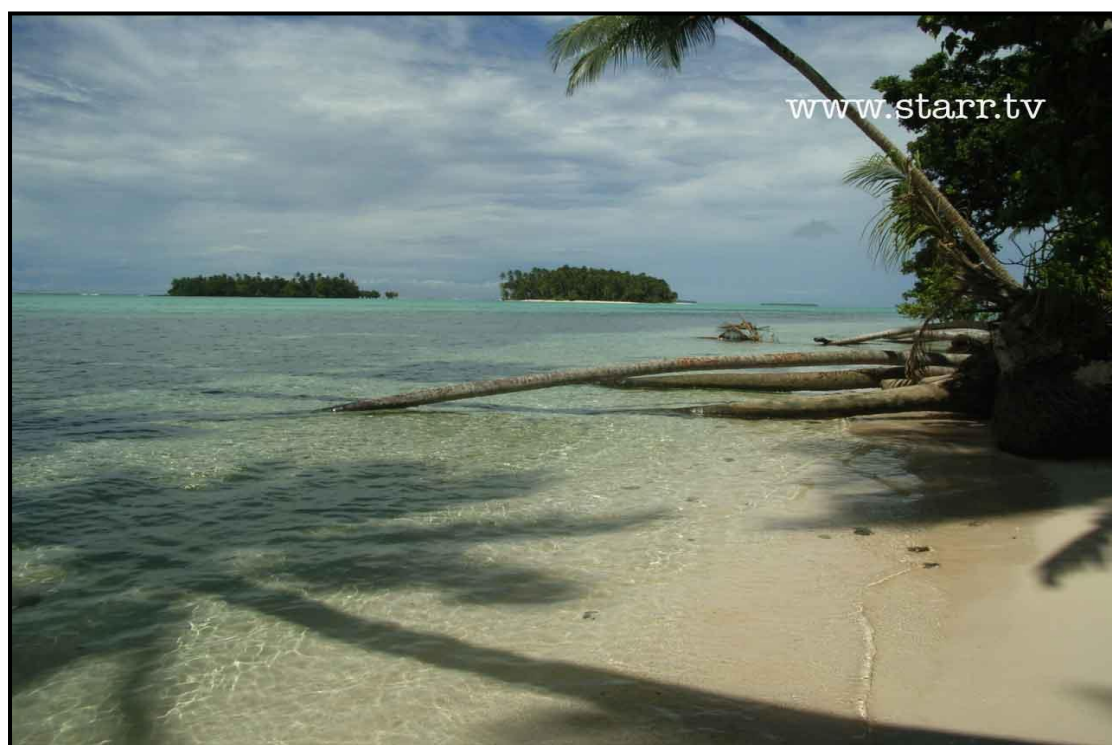
You would have noticed some changes yourself if you have lived there your entire life.



In places such as Madang and Manus provinces, there were unusual experiences of daily rise of the sea level between 2007 and 2010. It was reported in our daily newspaper (the Post Courier), that the people of the Madang and Manus provinces experienced sea level rise that occupied their food gardens and coconut trees. They complained to their provincial government to do something to address such natural problems. People fearing for their lives have moved inland or evacuated to bigger islands to live.

The Case of Carteret Islands in Bougainville

The Carteret Islands have been the international focus as effects of sea level rise continue to severely affect their livelihoods. Some islands have been completely lost due to severe beach erosion. Their food gardens and fresh water sources have been contaminated with salt water. Natural habitats for wildlife that serves as food sources have been affected by warming effects and frequent droughts. For example, corals are breeding grounds for fish. Fish in turn is an important food for coastal and island people. There are records of dead corals due to the warming effect thus threatening the people's livelihood.



The Scenic Views of Carteret Islands Affected by Sea Level Rise

Our government has a big task to relocate the Carteret islanders to higher grounds, preferably on bigger islands. These Carteret Islanders were relocated to mainland Bougainville and have been recorded as the first *Climate Change Refugees in the world. They are many smaller islands in PNG facing similar situation.

The 2,500 Carteret islanders, who have lived a carefree life of fishing and small-scale agriculture, are now affected by coastal erosion, destruction of sea walls and flooding by salt water. This means that most of the vegetable gardens and swamp taro can no longer sustain their livelihood as the soils are now infertile. Emergency food supplies are running low, and relocation increasingly looks like the only option.

After several unsuccessful attempts to move the islanders over the past few years, the authorities have identified a plantation on Bougainville as a future resettlement site and anticipate bringing families from the Carterets and other threatened atolls. The government is also planning continuing services for families and individuals who remain on the atolls and is putting in place a contingency plan in anticipation of future severe climate events. Many islanders are worried about losing their culture and traditions and are uncertain as to how they will be received by the new community. Such uncertainties show the difficult choices faced by island communities under threat from rising seas. Relocation is now seen as the last resort.



Intrusion of Salt Water into Garden Land and Fresh Water Sources at Carteret Islands

An ATOLL is a ring-shaped coral reef and small island that encloses a lagoon and is surrounded by open sea.

Have a look at the photograph of an atoll below. Notice how it can be easily be drowned if the sea level rises.

Although people displaced by climate change are not classified as refugees under the 1951 Refugee Convention, the United Nations High Commissioner for Refugees (UNHCR) Regional Representative Richard Towle's experience has shown that they are clearly people who face great challenges and whose rights and protection needs have to be addressed. Indeed, many communities do not like the "*climate refugee*" label saying it gives a false sense of hopelessness. They prefer assistance that will help them to cope and adapt to this climate change effects so that they stay in their homes. They believe relocation is the last resort.



An Atoll in the Pacific



Severe Beach Erosion on Carteret Islands

Some of these islands have natural scenic landscapes and features that attract tourists but are now affected by sea level rise and beach erosion. There may also be increased costs of repair and maintenance of infrastructures such as roads that come under attack by sea level rise and coastal erosion. Increases in flooding, storm surges, heat waves, cyclones and bushfires is posing greater risks to the coastal and island communities. The country is facing greater challenges in coping with these effects of climate change.

Now do the activity below. Check your answers at the end of the project.



Activity 4

1. Now look at the cartoon of the two polar bears on page 28. Where do you think the polar bears live? You are correct, if you said the icy North Pole. They are strong swimmers and eat many types of marine animals such as seals.

What is the main message you can pick from the cartoon?

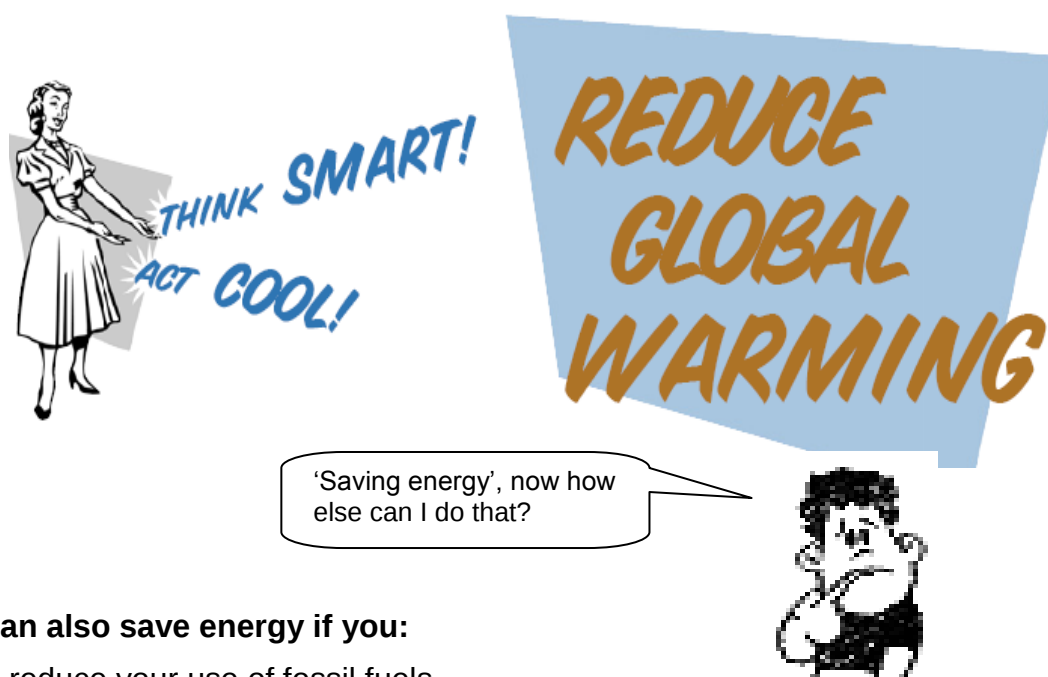
- 2 Do you live in an urban or rural community? Discuss one evidence of the effects of climate change that is seen or experienced by the people in your community. Explain how they are coping with these effects.

CHAPTER 5: WHAT WE CAN DO TO REDUCE GLOBAL WARMING AND CLIMATE CHANGE

When you burn fossil fuels such as oil, coal and natural gas to produce electricity and power your vehicles, you create greenhouse gasses that cause global warming.

You may not be burning fossil fuels but have you burnt dry grass and papers around your home? It really does not matter what you burn carelessly, you are contributing to greenhouse gasses. Instead of burning those grasses, you could compile them for your backyard garden compost. The more we burn, the faster we stir up the global climate change. Thus, the most important thing we can do is save energy. For example, you can switch off your toilet and bedroom lights after use so to save energy.

Your small act of saving energy will make a big difference when put together with all others who are saving energy in small ways across the globe. Technologies exist today to make cars that run cleaner and burn less gas, produce electricity from wind and sun. People are already building refrigerators, air conditioners and whole buildings that use less power. As individuals, each of us can take steps to save energy and fight global warming.



You can also save energy if you:

1. reduce your use of fossil fuels
2. protect native forests as “carbon storehouses”
3. help plant native trees in urban and deforested areas

The following are the benefits of planting native trees.

1. They help stop global warming by reducing greenhouse gases when they remove carbon dioxide from the air through the photosynthesis process
2. They reduce soil erosion and water pollution
3. They provide habitat or home for native wildlife
4. They improve human health by producing oxygen and improving air quality

5. They reduce home energy needs by providing shade in summer and a *windbreak* during strong winds

Here are some facts about the benefits provided by planting one tree

1. It absorbs over a ton of harmful greenhouse gases over its lifetime (U.S. Environmental Protection Agency)
2. Produces enough oxygen for four people every day (Tree Canada Foundation)
3. Provides the equivalent cooling effect of ten room-size air conditioners operating 20 hours a day (U.S. Department of Agriculture)
4. Provides an estimated \$273 of environmental benefits in every year of its life (American Forests)

Now, study some more action steps below. They are simple guide to help you reduce global warming in your everyday living.

ACTION STEPS

From the easy to the large scale, there are numerous actions you can take to reduce your energy consumption and fight global warming. By taking any of the following actions, you are helping to clean up our atmosphere.



Actions to reduce carbon dioxide

- Use a push mower instead of a power mower
- Clean or replace air-conditioning filters as advised
- Run your dishes only when it is full using the energy saving setting
- Buy products packaged in reusable or recyclable containers
- Install low-flow shower heads in order to use less hot water
- Replace your current washing machine with low-energy, low-water-use machine. Better still hand-wash your laundry
- Keep your water-heater thermostat no higher than 120 degree Fahrenheit
- Do not overheat or overcool rooms. Turn thermostat up when it is hot and down when it is cold
- Replace standard light bulbs with energy efficient fluorescent bulbs
- Wash laundry in warm or cold water, not hot
- Install a solar thermal system to provide hot water
- Recycle all your home's waste newsprint, cardboard, glass and metal
- Reduce your garbage by 25%
- Leave your car at home two days a week (walk, bike, take public transport)
- Insulate walls and ceilings
- Get rid of old, energy inefficient appliances and replaces with newer energy-efficient Models

- Plant trees around your home; paint the roof of a light color in a hot climate and a dark color in a cold climate
- Replace your most frequently used car with a fuel efficient car (related at 32 mpg more)
- When replacing windows, install energy efficient models

5.1 REDUCTION in EMISSION from DEFORESTATION and DEGRADATION (REDD) INITIATIVE in PNG

Papua New Guinea, one of United Nations REDD pilot countries has welcomed the UN REDD initiative as an important step to help reduce carbon dioxide emissions at a global scale. REDD aims to reduce the alarming rates of tropical rainforest destruction by paying forest communities not to cut them down and to actively protect them. The idea is that, developed countries or companies would pay for forest protection and earn *carbon credits* that could count towards their greenhouse emissions obligations. Up to 20 percent of global carbon dioxide emissions are estimated to come from deforestation.



Forests are important 'carbon sinks' as they absorb huge amounts of carbon dioxide from the air to make their food. They also give off carbon dioxide when they decay.

What is a Carbon Credit?

Carbon Credits are like certificates that represent a reduction (decrease) of greenhouse gases in the atmosphere. Projects that prevent the generation of greenhouse gases or remove greenhouse gases from the atmosphere earn these credits, which can in turn then be "sold" to other businesses and individuals to make up for the emissions they generate. One carbon credit is the equivalent to a saving of one tonne of carbon dioxide (CO₂).

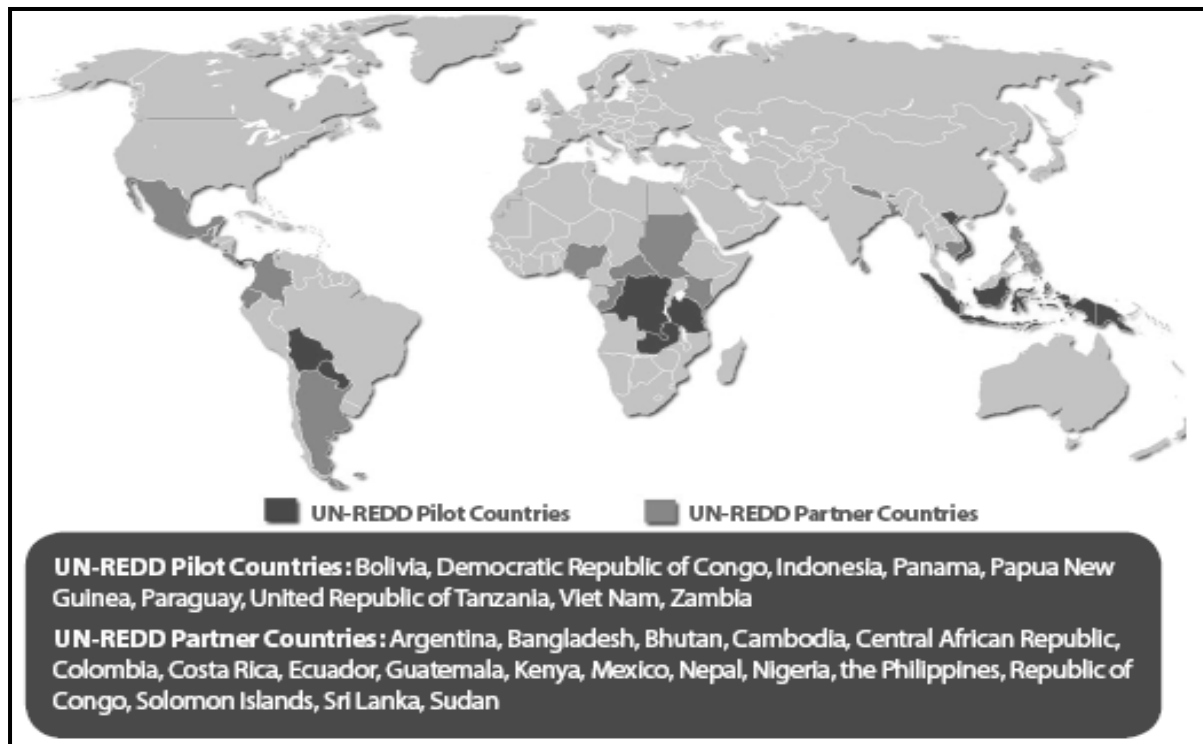
The UN-REDD Programme is the United Nations joint initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries. The Programme was launched in September 2008 to assist developing countries prepare and implement national REDD strategies.

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an attempt to encourage developing forested countries to protect, better manage and wisely use their forest resources. In doing so, they contribute to the global fight against Climate Change. It rests on the effort to create a money value for the carbon stored in standing forests. In the long term, payments for confirmed emission reductions and removals, either market or fund based, helps encourage REDD countries to further invest in low-carbon development and a healthier tomorrow.

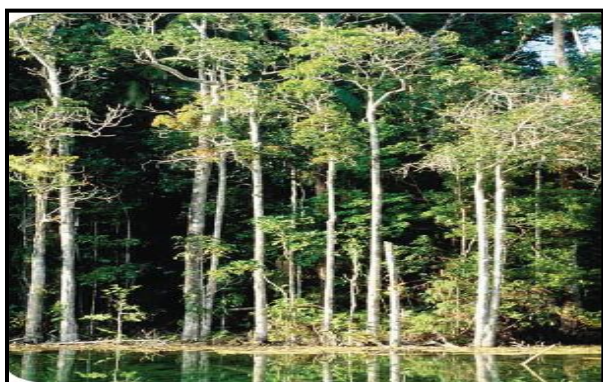
In accordance with United Nations REDD expectations, PNG established the **Office of Climate Change and Environmental Sustainability (OCCES)** in 2008. The government has then been working on developing policies and measures that would guide how forest resource owners can make money by working closely with the PNG Forest Service and other sectors. This office is responsible for climate change issues, environmental

sustainability and adaptability. It is the coordinating office for the United Nations REDD initiative in PNG.

As you can see on the map below, PNG is one of the UN-REDD pilot countries.



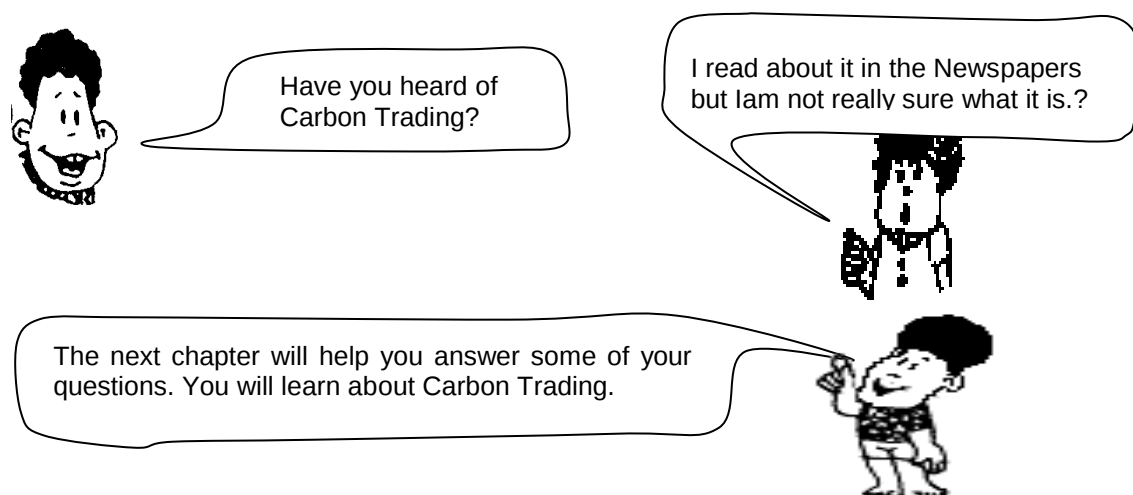
In April 2009, the activities of the Office of Climate Change and Environmental Sustainability (OCCES) brought international criticism due to a *scandal over sale of carbon credits certificates. It was believed that carbon credits were printed and sold to an Australian company 'Carbon Planet'. The scandal caused by these certificates led to the suspension of the then Director of OCCES and his eventual referral to the *Public Accounts Committee. The Secretary for Department of Environment and Conservation (DEC) was then appointed to act as the Executive Director. The office is now re-named **Office of Climate Change and Development**.



Virgin forests in PNG

Healthy, well managed forests are essential to the survival of our societies. They are home to millions of species of plants, animals and insects; and protect soils and watersheds from erosion. They act as carbon stores/sinks, absorbing greenhouse gasses and preventing their release into the atmosphere.

When you and I maintain and look after the forest ecosystems we can help reduce the effects of climate change.



Carbon Trading

Basically, Carbon Trading is a REDD initiative where the traditional landowners will basically be paid for conserving (to preserve or look after) their forests. Carbon trade is an exercise that encourages people to preserve their forests in order to reduce carbon dioxide emissions (to send out or give off) that contributes to global warming and climate change. Many people have heard about carbon trading and have a fair idea on what enormous financial benefits it could bring to our people. They have also been a lot of talk in the media about allegation (*a claim that someone has done something wrong*) of corrupt deals in carbon trading in PNG. So it is best you educate yourself and your community including land and resource owners about how Carbon Trading takes place.

Before every forest resource owners jump on the opportunity of reaping the rewards through carbon trading, it would be important to take into account some very basic helpful summary check list. You will see this checklist at the end of this book in **Appendix 1**. This must not be seen as a procedure but something that will help to safe guard an individual or a group of resource owners when planning to go into carbon trading activities.

The risk is that, carbon trading schemes will be subject to the dangers of **Transfer Pricing**, where corporations and government actors receive bribes as payments for selling PNG's natural resources. In this case, carbon are sold at lower than market prices, filling their pockets while further exploiting local people and PNG taxpayers. There has been a long history of transfer pricing in the forestry sector in PNG and this should not be repeated with carbon trading.

TRANSFER PRICING refers to the setting, analysis, documentation, and adjustment of charges made between related parties who deal with Carbon Trading.

There are still many questions that need to be answered before REDD initiatives are implemented (carried out) in PNG. Carbon trading agreements cannot be legally signed in PNG, until the government has put in place an appropriate carbon trade policy to obtain carbon credits. It is important for this to be in place before any carbon sales starts.

Here are some important questions that need to be answered before Carbon Trading takes place in PNG.

- How will the REDD mechanisms link to existing national development plans?
- How can forest owners and our village people participate in the design, monitoring and evaluation of national REDD programme?
- How will REDD be funded, and how will PNG government ensure that benefits are distributed equitably among all those who manage the forests?
- Finally, how will the amount of carbon stored be monitored?

Good governance needed to be promoted by bringing transparency into the creation of carbon-related policy. All development partners and donors need to work together in a true spirit of partnership and transparency to make REDD work for PNG and its people. All parties must discuss these issues particularly; forest owners need to be well informed of the procedures and processes.

Deforestation also has severe negative impacts on forest biodiversity, availability of wood, soil and water resources and local livelihoods. Reduced deforestation and forest degradation may be important in climate change mitigation and adaptation and bring sustainable development benefits. Increases in atmospheric carbon dioxide could be slowed down if people see a financial motivation to preserve their forests as in the case of selling carbon credits.

The people and landowners of PNG obviously want to preserve their forests for future generations. Carbon trading, although a very foreign concept offers them a non-destructive way to both preserve their traditional lifestyle and at the same time earn a living that can improve their lives and the development of the entire country. It is important, that the people's rights be safeguarded first with proper rules and regulations such as a policy regarding carbon trading.

Now do activity 5 below. Check your answers at the end of the Project.

Activity 5

1. List three things you can do at your level to reduce global warming.

i) _____

ii) _____

iii) _____

2. What does the initial REDD stand for?

3. Explain Carbon Trading.

Summary

- The overwhelming majority of scientists agree that our globe, the planet earth is undergoing major climatic change. They also agree that the level of carbon dioxide in the atmosphere is rising significantly.
 - We can see from satellite images and research that the ice caps are melting faster, our sea levels are rising, and weather patterns are changing. We are experiencing more water shortages and we will see hurricanes, typhoons and cyclones increasing in intensity and frequency. The deserts will expand and the world will ultimately have difficulty growing enough food. Without doubt, we have to change the way we live to adapt to these challenges.
 - The earth has gone through many natural climatic cycles during its long history. The scary part is we are causing changes to happen at an unbelievable rate, much faster than normal. Burning fossil fuels pours out greenhouse gases at a life threatening rate and causing global warming.
 - We are all personally responsible for releasing carbon dioxide into the atmosphere by burning fossil fuels for transportation (driving and flying) and home energy (electricity, heating, and cooling). This leads to global warming, which is destroying Earth's biodiversity and native ecosystems.
 - Effects of climate change are affecting all sectors of PNG and the Pacific Island Countries. This is threatening the very existence of humanity. The most pressing and common ones facing PNG and the Pacific Island Countries are sea level rise, beach or coastal erosion, increase in cyclones and storms, and droughts. Everyone needs to be working together to address these climate change effects. This would mean resource sharing, political will, appropriate policies and properly and highly trained personnel amongst other considerations.
-

ANSWERS TO ACTIVITIES

Activity 1

1. Weather is the daily condition of the atmosphere while climate is the condition of the atmosphere over a long period of time.
2. Climate Change is a change in global or regional climate patterns.

Activity 2

1. Human activities have been identified as the main cause of enhanced climate change.
2. Greenhouse gases are gases that trap heat given off from the earth's surface.
3. Greenhouse gases are produced by burning fossil fuels.

Activity 3

1. Rising sea level
2. Soil, fresh water, plants, animals and the people.
3. Carteret Island in Bougainville

Activity 4

1. The cartoon is illustrating the fact that that ice at the poles is melting faster, causing sea level to rise. The polar bears represent the endangered animals at the poles. Their homes and food sources are threatened due to the warming effects.
2. *The answer below is just a model or possible answer.*

The main effect of climate change is raising sea level. This then leads to sinking of small islands, increased salt in the soil which then affects the growth of plants, starvation, increase malaria cases up in the high and extinction of endangered plant and animal species as they could not adapt to the changing environment

People are coping with the effects by:

- Building sea walls
- Migrating to new settlement sites
- Changing farming methods
- Changing from destructive to safe hunting and fishing methods
- Using energy efficient machines
- Using safe and renewable sources of energy

Activity 5

1. *(Any of the actions or measures stated in chapter 4 can be correct.)*
2. REDUCTION in EMISSION from DEFORESTATION and DEGRADATION (REDD)
3. Carbon Trading is a REDD initiative where the traditional landowners will basically be paid for conserving (to preserve or look after) their forests. Carbon trade is an exercise that encourages people to preserve their forests in order to reduce carbon dioxide emissions (to send out or give off) that contributes to global warming and climate change.

THIS IS THE END OF PROJECT 2: CASE STUDY OF CHINA. YOU MAY NOW START ON ASSIGNMENT 5 WHICH IS BASED ON THIS PROJECT. ONCE YOU COMPLETE THE ASSIGNMENT, FORWARD YOUR ASSIGNMENT BOOKLET TO YOUR PROVINCIAL CENTRE FOR MARKING.

Glossary

Word	Meaning
Adapt	To get used to certain conditions and adjust oneself to suit into the conditions
Aerosols	A mixture of solid or liquid particles in a gaseous state.
Algae	This is a diverse group of simple, plant-like organisms. They use the energy of sunlight to make their own food, in the process of photosynthesis .
Artificial	Simply means man-made and un-natural
Carbon	A non-metallic element that exists in two main forms, diamond and graphite, and has the ability to form large numbers of organic compounds such as coal and petroleum (oil).
Conservation	To protect, preserve or maintain something so that it is not destroyed or lost completely
Coal	Coal is a black rock. It produces energy when it burns. Coal deposits are found in many parts of the world. Taking these deposits from the ground is called <i>coal mining</i> . Coal is mostly made up of the element carbon. When carbon burns, it releases a large amount of energy as heat. That is what makes coal such a useful fuel.
Coral degradation	A decline in the quality or performance of corals. They lose their colour due to stress from excessive heat and as result they die.
Cost-effective	Economically worthwhile in terms of what is achieved for the amount of money spent
Decompose	To break down organic matter from a complex to a simpler form, mainly through the action of fungi and bacteria, or be broken down in this way
Deforestation	Mass removal of large areas of forests /trees
Developed countries	These countries basically have high standards of living. Their features are the very opposite of the developing countries
Developing countries	These are countries with generally low standards of living such as low levels of productivity, high rates of population growth and dependants, high and rising levels of unemployment and underemployment, dependence on agriculture and export of primary products and international relations etc.
Digestion	The breaking down of foodstuffs in the body into a form that can be absorbed and used or excreted
Emission	To give out or give off something. It also means to release something
Endorse	To support or approve
Glacier	A slow, moving river of ice. Most commonly found in the arctic and Antarctic areas
Greenhouse Effect (Enhanced greenhouse effect)	The result of the sun's heat being trapped by greenhouse gasses within the lower layers of the atmosphere rather than escaping out into the outer space. This causes a significant increase in the earth's temperature thus warming up the earth surface.
Greenhouse Gasses	These are also called heat-trapping gases because they trap outgoing heat energy from the earth surface. In doing so, the earth maintains the warmth needed to sustain life. Example of these gases are carbon dioxide, methane, nitrous oxide and chlorofluorocarbons
Human-Induced Climate Change	The changes in temperature, rainfall and air pressure patterns due to increased global warming caused by increase in greenhouse gasses, resulting mostly from human or man's actions or activities.

Industrial Revolution	This was a period from the 18th to the 19th century where major changes in agriculture, manufacturing, mining, transportation, and technology had a big effect on the socioeconomic and cultural conditions of the times. It began in the United Kingdom, and then spread throughout Europe, North America, and eventually the world.
Intergovernmental Panel on Climate Change (IPCC)	The IPCC is a scientific body set up by the United Nations Environment Program and World Meteorological Organization to inform the work of the UN climate convention (UNFCCC). It assesses the climate-related research of thousands of scientists worldwide, drawing together overriding conclusions in assessment reports released every or six years.
Landfill	This is the disposal of waste material by burying it. It also refers to waste material buried in this way.
Livestock	It refers to animals that are raised for food or other products, or kept for use, especially farm animals such as meat and dairy cattle, pigs, and poultry.
Manure	Animal excrement, often mixed with straw, used as fertilizer for soil
Mitigation	To make something less harsh, severe, or violent
Natural Gas	This is a colourless, highly flammable gaseous hydrocarbon consisting of methane and ethane. It is a type of petroleum that commonly occurs together with crude oil. Natural gas is often found dissolved in oil within the earth's crust.
NGO	Non Government Organisation
Non-renewable	That which cannot be renewed or replaced quickly enough by natural processes
Non-toxic	Harmless or not poisonous
Ozone Layer	Ozone is both a natural and human-made greenhouse gas. Ozone in the upper atmosphere (Stratosphere) is known as the <i>ozone layer</i> and shields life on earth from the sun's harmful ultraviolet radiation. This ozone is formed by the action of ultraviolet light from the sun on molecules of ordinary oxygen. Some chemical compounds are known to destroy ozone molecules in the upper atmosphere. This can break down, or deplete, the ozone layer. Depletion of the ozone layer actually causes a slight cooling, offsetting a small part of the warming from greenhouse gases.
Photosynthesis	Is the process by which green plants make their food by turning carbon dioxide and water into carbohydrates and oxygen, using light energy trapped by chlorophyll of the green plants
Precipitation	Water that is deposited on the earth surface from the atmosphere often in the form of rain, hail, snow or dew
Projection	Is to forecast or predict something based on the present trends, often with facts and figures
Radiate	This means to give out something.
Scandal	Something causing public outrage like a situation or event that causes public outrage or censure
Stable	Constant or steady
Sustain	To make something continue to exist
Voluntary	Doing something out from one's own willingness and not necessarily being paid.

Appendix 1: Checklist for Carbon Trading Activities in PNG

Items To Be Checked

- 1 Social Mapping
- 2 Registered ILG
- 3 ILG constitution
- 4 Profile (arises from the ILG Constitution)
- 5 Land use planning
- 6 Registered interest with the Office of Climate Change and Environment Sustainability (OCCES)
- 7 Consult Department of Environment and Conservation (DEC) to do Bio-diversity assessment
- 8 Identifying of Project Activity as REDD or CDM Projects
- 9 Have a genuine credible carbon consultant, recognized by OCCES to carry out forest appraisal to determine carbon content

1. Social Mapping

This involves the distribution of people between groups, people between resources, resources between people, power between people and products between people

2. Registered Incorporated Land Groups (ILG)

Registered ILG stands for Incorporated Land Group. It refers to the land title issued and gazette by the government which groups people into the land as theirs. This is marked with map coordinates held at the Department of Lands and Physical Planning. Registered ILG are issued land title certificates. The ILG certificate is obtained through the Department of Lands and Physical Planning.

3. ILG Constitution

ILG Constitution refers to the set of laws or rules/guidelines and activities that protects the interest of the registered ILG incumbent to engage themselves in the project between the government, carbon consultant and the people who are registered under the ILG. The constitution safe guards and protects the activities of the people, groups and resources identified in the social mapping and ILG.

4. Profile

A profile is the summary of the group that comprises of people as recognized and being registered as part of the ILG. A profile should include a general account of the ILG and its activities and its interest to part take in carbon trade and its spin off activities.

5. Land-use Planning

This is the planning of how the land is going to be used. Whether you should have all the land use for carbon trading or manage some land for gardening and other agriculture activities such as coffee, tea, vanilla, cocoa settlement and such.

6. Register Interest with OCCES

The Office of Climate Change and Environment Sustainability is the Government Department responsible for all matters related to Carbon Trading projects. It was suspended in early 2010 due to allegations of corrupt deals. It was re-established and re-named as Office of Climate Change and Development in the same year. It is currently under the management of Environment and Conservation. It works closely with PNG National Forest Authority (PNGNFA) and the Department of Environment and Conservation (DEC) as well as other government department and NGOs. This office will also advice you whether the forest you are using to trade carbon falls under the Reduced Emissions from Deforestation and Degradation (REDD), Clean Development Mechanism (CDM) or Voluntary Carbon Agreements (VCA) which is an option where PNG does not want to take.

7. Consult Department of Environment Conservation (Environment Impact Assessment & Green House)

This Government Department is responsible for all bio-diversity assessment. The assessment covers endangered species, critically endangered species, and species count of both flora and fauna. They administer key legislations and perform their functions which also include environmental policy development, administration of PNG's international environmental convention agreements with respect to environment.

There are also private environmental consultants where their services can be use. Again consult with DEC and IPA for their history and legitimacy of their operation.

8. Identifying of Project Activity as REDD or CDM Projects

Through the OCCES, DEC and PNGNFA you are able to confirm whether your project activity on your land is a REDD or CDM project. The only two government department responsible to identify your project is the OCCES and the PNG National Forest Authority Research Institute.

9. Genuine Carbon Consultant

This consultant should be responsible for assessing the carbon content from the above and below ground bio-mass in the different sinks. They should be able to do calculations of the amount of carbon stored in the different sinks. They must be recognized by the OCCES and have close consultations with DEC and the PNGNFA and other governmental departments and NGOs. As a precaution to know whether the company is a legitimate business entity in PNG, they must be registered with Investment Promotion Authority (IPA).

If you have all this in place and have a valuer to value your land including all the appraisals and assessments of bio-diversity and carbon content of sinks, and then you will truly

appreciate how much your land is worth. For instance, during a biological assessment, a new species of plant is found that could lead to new medical drug to cure breast cancer etc or even a rare/endangered species of animal. Put an economical value to that!

This check-list is to protect our people from being exploited by doubtful so call carbon dealers in agreements and in signing any agreement that is not recognized by the government through OCCES. The dealing should be legitimate and have a foundation with all plans that would help in MTDS etc.

Appendix 2: Top 50 Things To Do To Stop Global Warming

Global Warming is a dramatically urgent and serious problem. We don't need to wait for governments to find a solution for this problem: each individual can bring an important help adopting a more responsible lifestyle: starting from little, everyday things. It's the only reasonable way to save our planet, before it is too late.

Here is a list of 50 simple things that everyone can do in order to fight against and reduce the Global Warming phenomenon: some of these ideas are at no cost, some other require a little effort or investment but can help you save a lot of money, in the middle-long term!

1. **Replace a regular incandescent light bulb with a compact fluorescent light bulb (cfl)**
CFLs use 60% less energy than a regular bulb. This simple switch will save about 300 pounds of carbon dioxide a year.
2. **Install a programmable thermostat**
Programmable thermostats will automatically lower the heat or air conditioning at night and raise them again in the morning. They can save you \$100 a year on your energy bill.
3. **Move your thermostat down 2° in winter and up 2° in summer**
Almost half of the energy we use in our homes goes to heating and cooling. You could save about 2,000 pounds of carbon dioxide a year with this simple adjustment.
4. **Clean or replace filters on your furnace and air conditioner**
Cleaning a dirty air filter can save 350 pounds of carbon dioxide a year.
5. **Choose energy efficient appliances when making new purchases**
Look for the Energy Star label on new appliances to choose the most energy efficient products available.
6. **Do not leave appliances on standby**
Use the "on/off" function on the machine itself. A TV set that's switched on for 3 hours a day (the average time Europeans spend watching TV) and in standby mode during the remaining 21 hours uses about 40% of its energy in standby mode.
7. **Wrap your water heater in an insulation blanket**
You'll save 1,000 pounds of carbon dioxide a year with this simple action. You can save another 550 pounds per year by setting the thermostat no higher than 50°C.
8. **Move your fridge and freezer**
Placing them next to the cooker or boiler consumes much more energy than if they were standing on their own. For example, if you put them in a hot cellar room where the room temperature is 30-35°C, energy use is almost double and causes an extra 160kg of CO₂ emissions for fridges per year and 320kg for freezers.
9. **Defrost old fridges and freezers regularly**
Even better is to replace them with newer models, which all have automatic defrost cycles and are generally up to two times more energy-efficient than their predecessors.
10. **Don't let heat escape from your house over a long period**
When airing your house, open the windows for only a few minutes. If you leave a small opening all day long, the energy needed to keep it warm inside during six cold months (10°C or less outside temperature) would result in almost 1 ton of CO₂ emissions.
11. **Replace your old single-glazed windows with double-glazing**
This requires a bit of upfront investment, but will halve the energy lost through windows and pay off in the long term. If you go for the best the market has to offer

(wooden-framed double-glazed units with low-emission glass and filled with argon gas), you can even save more than 70% of the energy lost.

12. Get a home energy audit

Many utilities offer free home energy audits to find where your home is poorly insulated or energy inefficient. You can save up to 30% off your energy bill and 1,000 pounds of carbon dioxide a year. Energy Star can help you find an energy specialist.

13. Cover your pots while cooking

Doing so can save a lot of the energy needed for preparing the dish. Even better are pressure cookers and steamers: they can save around 70%!

14. Use the washing machine or dishwasher only when they are full

If you need to use it when it is half full, then use the half-load or economy setting. There is also no need to set the temperatures high. Nowadays detergents are so efficient that they get your clothes and dishes clean at low temperatures.

15. Take a shower instead of a bath

A shower takes up to four times less energy than a bath. To maximise the energy saving, avoid power showers and use low-flow showerheads, which are cheap and provide the same comfort.

16. Use less hot water

It takes a lot of energy to heat water. You can use less hot water by installing a low flow showerhead (350 pounds of carbon dioxide saved per year) and washing your clothes in cold or warm water (500 pounds saved per year) instead of hot.

17. Use a clothesline instead of a dryer whenever possible

You can save 700 pounds of carbon dioxide when you air dry your clothes for 6 months out of the year.

18. Insulate and weatherize your home

Properly insulating your walls and ceilings can save 25% of your home heating bill and 2,000 pounds of carbon dioxide a year. Caulking and weather-stripping can save another 1,700 pounds per year. Energy Efficient has more information on how to better insulate your home.

19. Be sure you're recycling at home

You can save 2,400 pounds of carbon dioxide a year by recycling half of the waste your household generates.

20. Recycle your organic waste

Around 3% of the greenhouse gas emissions through the methane is released by decomposing bio-degradable waste. By recycling organic waste or composting it if you have a garden, you can help eliminate this problem! Just make sure that you compost it properly, so it decomposes with sufficient oxygen, otherwise your compost will cause methane emissions and smell foul.

21. Buy intelligently

One bottle of 1.5l requires less energy and produces less waste than three bottles of

Top 50 Things To Do To Stop Global Warming

0.5l. As well, buy recycled paper products: it takes less 70 to 90% less energy to make recycled paper and it prevents the loss of forests worldwide.

22. Choose products that come with little packaging and buy refills when you can

You will also cut down on waste production and energy use... another help against global warming.

23. Reuse your shopping bag

When shopping, it saves energy and waste to use a reusable bag instead of accepting a disposable one in each shop. Waste not only discharges CO₂ and methane into the atmosphere, it can also pollute the air, groundwater and soil.

24. Reduce waste

Most products we buy cause greenhouse gas emissions in one or another way, e.g. during production and distribution. By taking your lunch in a reusable lunch box instead of a disposable one, you save the energy needed to produce new lunch boxes.

25. Plant a tree

A single tree will absorb one ton of carbon dioxide over its lifetime. Shade provided by trees can also reduce your air conditioning bill by 10 to 15%. The Arbor Day Foundation has information on planting and provides trees you can plant with membership.

26. Switch to green power

In many areas, you can switch to energy generated by clean, renewable sources such as wind and solar. In some of these, you can even get refunds by government if you choose to switch to a clean energy producer, and you can also earn money by selling the energy you produce and don't use for yourself.

27. Buy locally grown and produced foods

The average meal in the United States travels 1,200 miles from the farm to your plate. Buying locally will save fuel and keep money in your community.

28. Buy fresh foods instead of frozen

Frozen food uses 10 times more energy to produce.

29. Seek out and support local farmers markets

They reduce the amount of energy required to grow and transport the food to you by one fifth. Seek farmer's markets in your area, and go for them.

30. Buy organic foods as much as possible

Organic soils capture and store carbon dioxide at much higher levels than soils from conventional farms. If we grew all of our corn and soybeans organically, we'd remove 580 billion pounds of carbon dioxide from the atmosphere!

31. Eat less meat

Methane is the second most significant greenhouse gas and cows are one of the greatest methane emitters. Their grassy diet and multiple stomachs cause them to produce methane, which they exhale with every breath.

Top 50 Things To Do To Stop Global Warming

32. Reduce the number of miles you drive by walking, biking, carpooling or taking mass transit wherever possible

Avoiding just 10 miles of driving every week would eliminate about 500 pounds of carbon dioxide emissions a year! Look for transit options in your area.

33. Start a carpool with your coworkers or classmates

Sharing a ride with someone just 2 days a week will reduce your carbon dioxide emissions by 1,590 pounds a year. eRideShare.com runs a free service connecting north american commuters and travelers.

34. Don't leave an empty roof rack on your car

This can increase fuel consumption and CO₂ emissions by up to 10% due to wind resistance and the extra weight - removing it is a better idea.

35. Keep your car tuned up

Regular maintenance helps improve fuel efficiency and reduces emissions. When just 1% of car owners properly maintain their cars, nearly a billion pounds of carbon dioxide are kept out of the atmosphere.

36. Drive carefully and do not waste fuel

You can reduce CO₂ emissions by readjusting your driving style. Choose proper gears, do not abuse the gas pedal, use the engine brake instead of the pedal brake when possible and turn off your engine when your vehicle is motionless for more than one minute. By readjusting your driving style you can save money on both fuel and car maintenance.

37. Check your tires weekly to make sure they're properly inflated

Proper tire inflation can improve gas mileage by more than 3%. Since every gallon of gasoline saved keeps 20 pounds of carbon dioxide out of the atmosphere, every increase in fuel efficiency makes a difference!

38. When it is time for a new car, choose a more fuel efficient vehicle

You can save 3,000 pounds of carbon dioxide every year if your new car gets only 3 miles per gallon more than your current one. You can get up to 60 miles per gallon with a hybrid! You can find information on fuel efficiency on FuelEconomy and on GreenCars websites.

39. Try car sharing

Need a car but don't want to buy one? Community car sharing organizations provide access to a car and your membership fee covers gas, maintenance and insurance. Many companies – such as Flexcar - offer low emission or hybrid cars too! Also, see ZipCar.

40. Try telecommuting from home

Telecommuting can help you drastically reduce the number of miles you drive every week. For more information, check out the Telework Coalition.

41. Fly less

Air travel produces large amounts of emissions so reducing how much you fly by even one or two trips a year can reduce your emissions significantly. You can also offset your air travel carbon emissions by investing in renewable energy projects.

Top 50 Things To Do To Stop Global Warming

42. Encourage your school or business to reduce emissions

You can extend your positive influence on global warming well beyond your home by actively encouraging other to take action.

43. Join the virtual march

The Stop Global Warming Virtual March is a non-political effort to bring people concerned about global warming together in one place. Add your voice to the hundreds of thousands of other people urging action on this issue.

44. Encourage the switch to renewable energy

Successfully combating global warming requires a national transition to renewable energy sources such as solar, wind and biomass. These technologies are ready to be deployed more widely but there are regulatory barriers impeding them. U.S. citizens, take action to break down those barriers with Vote Solar.

45. Protect and conserve forest worldwide

Forests play a critical role in global warming: they store carbon. When forests are burned or cut down, their stored carbon is released into the atmosphere - deforestation now accounts for about 20% of carbon dioxide emissions each year. Conservation International has more information on saving forests from global warming.

46. Consider the impact of your investments

If you invest your money, you should consider the impact that your investments and savings will have on global warming. Check out SocialInvest and Ceres to learn more about how to ensure your money is being invested in companies, products and projects that address issues related to climate change.

47. Make your city cool

Cities and states around the country have taken action to stop global warming by passing innovative transportation and energy saving legislation. If you're in the U.S., join the cool cities list.

48. Tell Congress to act

The McCain Lieberman Climate Stewardship and Innovation Act would set a firm limit on carbon dioxide emissions and then use free market incentives to lower costs, promote efficiency and spur innovation. Tell your representative to support it.

49. Make sure your voice is heard!

Americans must have a stronger commitment from their government in order to stop global warming and implement solutions and such a commitment won't come without a dramatic increase in citizen lobbying for new laws with teeth. Get the facts about U.S. politicians and candidates at Project Vote Smart and The League of Conservation Voters. Make sure your voice is heard by voting!

50. Share this list!

Send this page via e-mail to your friends! Spread this list worldwide and help people doing their part: the more people you will manage to enlighten, the greater YOUR help to save the planet will be (but please take action on first person too)!

If you like, you are free to republish, adapt or translate the list and post it in your blog, website or forum: we only ask you to give us credit with a link to the original source.

Original source: <http://globalwarming-facts.info/50-tips.html>

Appendix 3: Things You Can Do At Home, Work and Community

THINGS YOU CAN DO AT HOME

MAKE A PLAN Visit energystar.gov and use EPA's online tools to help you assess your home and make it more energy-efficient. Whether you do it yourself or hire a professional, recommendations from ENERGY STAR can reduce your utility bills by up to 30 percent, make you more comfortable, and protect our environment.

CHANGE A LIGHT Replace existing lighting with ENERGY STAR qualified compact fluorescent light (CFL) bulbs, lamps, ceiling fans, and fixtures. Also look for the ENERGY STAR on decorative light strings for festive occasions.

MAKE SAVING ENERGY ENTERTAINING Make sure your next TV has earned the ENERGY STAR. Look for ENERGY STAR qualified components, including DVD players, sound systems, and set-top boxes.

SEAL AND INSULATE Use caulk, spray foam, and weather stripping to seal your home's outer walls, ceilings, windows, doors, and floors. Add insulation to your attic to help keep your home cool in the summer and warm in the winter. Also seal leaks and repair disconnections in your home's duct system to improve efficiency.

HEAT AND COOL EFFICIENTLY Change your air filter at least once every 3 months, have your heating and cooling systems tuned-up by a professional annually, and install and properly use a programmable thermostat. When replacing heating or cooling equipment, choose models that have earned the ENERGY STAR and ask your contractor if they follow the ENERGY STAR Quality Installation guidelines.

ALWAYS LOOK FOR THE STAR Choose products that have earned the ENERGY STAR label. While offering all the features you want, these products also meet strict guidelines to help you save money and protect our environment. Products with the ENERGY STAR label are available in more than 60 product categories – and even new homes can earn the ENERGY STAR.

GO WHOLE-HOUSE Find out if Home Performance with ENERGY STAR is available in your area. Through this program, specially-trained contractors will evaluate your home using state-of-the-art equipment and provide recommendations to improve your home's energy efficiency and comfort. They can also help you get the work done right!

THINGS YOU CAN DO AT WORK

GIVE IT A REST Use the ENERGY STAR power management settings on your computer and monitor so they power down when not in use. Also use a power strip as a central “turn off” point to completely disconnect equipment from the power supply. Don’t forget to make these changes in your home office, too.

UNPLUG IT Unplug electronics such as cell phones and laptops once they are charged. Adapters plugged into outlets use energy even when they are not charging.

LIGHT UP YOUR WORK LIFE Replace the light bulb in your desk lamp with an ENERGY STAR qualified bulb, which will last up to 10 times longer and uses 75 percent less energy. Turn off the lights when you leave, especially at the end of the day.

LET IT FLOW Keep air vents clear of paper, files, and office supplies. It takes as much as 25 percent more energy to deliver air into the workspace if vents are blocked.

TEAM UP Create a Green Team with your co-workers, help build support for energy efficiency in your workplace, and reduce office waste.

TALK TO THE BOSS Encourage your employer to use ENERGY STAR tools to assess and improve your organization’s energy use. Your building could earn EPA’s ENERGY STAR for superior energy efficiency.

SET UP YOUR OFFICE FOR SAVINGS Look for the ENERGY STAR when shopping for office equipment at home and at work, including computers, monitors, fax machines, printers, and more.

THINGS YOU CAN DO IN YOUR COMMUNITY

TAKE THE PLEDGE Join the growing community in the fight against global warming by taking the ENERGY STAR Pledge. Visit energystar.gov/changetheworld to share your commitment.

INCLUDE YOUR FAMILY Encourage your parents, siblings, and spouse to shop at local retailers and grocery stores that have earned the ENERGY STAR. Tell your family and friends to stay at an ENERGY STAR labeled hotel the next time they travel. Go to energystar.gov/buildings for a full list.

SPREAD THE WORD Encourage local community groups and clubs to join the Change the World, Start with ENERGY STAR campaign. Ask your friends and neighbors to take simple energy-saving steps with you.

BE A LEADER Contact your local government officials and ask them to reduce their energy use by partnering with ENERGY STAR. Help your homeowners association organize an Earth Day event centered around ways to save energy. Visit energystar.gov/leaders.

TEACH FUTURE ENERGY-SAVERS Get involved in a local school or community organization to teach kids about how they can help protect the environment by saving energy. Encourage your child's school to join ENERGY STAR.

RECYCLE IT If you are purchasing new ENERGY STAR qualified electronics or appliances, talk to your retailer or local authorities about how to recycle old items.

ADD IT UP Find out what your household's carbon footprint is with EPA's greenhouse gas emissions calculator. Visit epa.gov/climatechange.

YOU HAVE COME TO THE END OF PROJECT 2. NOW TURN TO YOUR ASSIGNMENT BOOKLET AND COMPLETE ALL THE TOPIC TESTS IN THE BOOK. CROSS CHECK YOUR ANSWERS AND WHEN YOU ARE SATISFIED, SEND YOUR ASSIGNMENT TO YOUR PROVINCIAL COORDINATOR FOR MARKING.

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