DEPARTMENT OF ENVIRONMENTAL AFFAIRS

Environmental Quality and Protection

Chief Directorate: Air Quality Management and Climate Change

PUBLICATION SERIES A: BOOK 9

CLIMATE CHANGE AND INTERNATIONAL AGREEMENTS

Shamini Naidu
CSIR, P O Box 17001, Congella 401

ACRONYMS

CFCs	Chlorofluorocarbons
CH_4	Methane
CO_2	Carbon Dioxide
GDP	Gross Domestic Product
Gg	Gigagrams
GHG	Greenhouse Gases
GWP	Global Warming Potential
HADCM2	Hadley Climate Model
HFCs	Hydrofluorocarbons
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
MDGs	Millennium Development Goals
N_2O	Nitrous Oxide
NEMA	National Environmental Management Act
NePAD	New Partnership for Africa's Development
NER	National Electricity Regulator
O_2	Oxygen
O_3	Ozone
SADC	Southern African Development Community
WMO	World Meteorological Organization
WSSD	World Summit on Sustainable Development
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Human-induced climate change can be defined as the serious disruption of the world's weather and climate patterns with impacts such as extreme weather events, rainfall variability and potentially sea level rise (DEAT, 2004a). Climate change is a natural phenomenon, however, there is increasing concern about the impact of human-induced climate change. The reason for concern is because these climatic changes are occurring at an unprecedented rate and humans, wildlife and agriculture are unable to adapt (Barrow, 1995).

The impacts associated with human-induced climate change will ultimately modify South Africa's economy, such that the health, livelihood and social structure of its populations, infrastructure and natural systems will be threatened. The likely effects of human-induced climate change include increased flooding and storm damage, increased erosion of shorelines, decreased marine and coastal biodiversity, and contamination of drinking and irrigation water with saline water (IPCC, 2001a). Infrastructure damage is also likely to be effected by sea level rise particularly in coastal areas. These consequences have the potential to inhibit progress towards sustainable development.

This booklet aims to provide the reader with an introduction to the basics of climate change theory as well as the policies, legislation and international agreements that have been formulated to respond to these impacts.

1.1 The greenhouse effect and climate change

The process that underpins climate change is the greenhouse effect. The greenhouse effect is a natural process that maintains an average temperature on Earth. Without the greenhouse effect, the Earth's average temperature would be about -18° C.

This process occurs when the Suns energy passes through the earth's atmosphere. Some of this radiation is reflected by water vapour, gases and dust whilst most of the radiation reaches the earth's surface. About 70% of this radiation is re-radiated as longer wavelength radiation back to space (Barrow, 1995). However, when this occurs some of this radiation is absorbed or trapped by certain gases in the atmosphere causing a blanket effect that warms the warms the earth's surface (Figure 1).

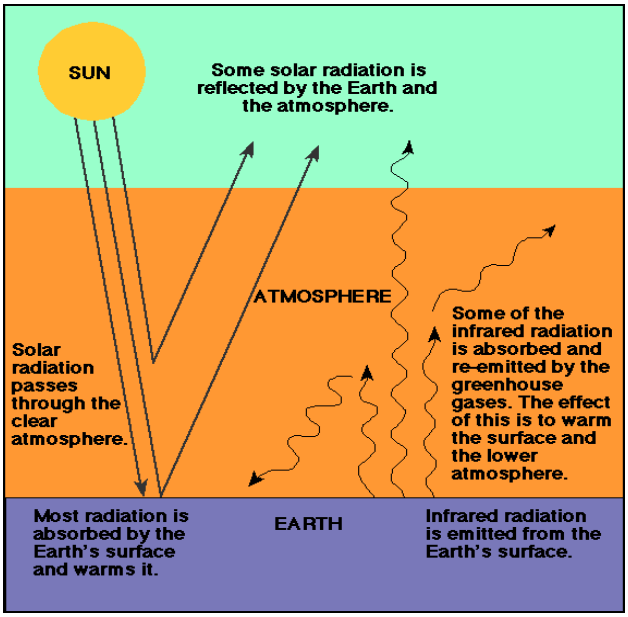

Figure 1: The greenhouse effect

Many gases exhibit these properties of being able to absorb radiation and these gases are termed greenhouse gases (GHGs). Some of these gases occur naturally in nature such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) whilst others are human made including chlorofluorocarbons (CFCs) (IPCC, 2001a). A list of the main GHGs are presented in Table 1 below.

Table 1: Main Greenhouse Gases & Their Abbreviations (IPCC, 2001a)

Chemical species	**Formula**
Carbon Dioxide	CO_2
Methane	CH_4
Nitrous Oxide	N_2O
Ozone	O_3
Chlorofluorocarbons	CFCs
Hydrofluorocarbons	HFCs

Before the Industrial Revolution, the concentrations of GHGs were relatively constant however, over the years the concentrations of these gases have increased. This has resulted in the increased absorption and emission of infrared radiation causing more energy to be stored within the earth's atmosphere causing an increase in the temperatures on Earth (IPCC, 2001b). This is termed the 'enhanced greenhouse effect' and is essentially the result of an imbalance between incoming solar radiation and outgoing radiation emitted by the climate. This imbalance is driving major changes in the climatic system.

It is important to note that different GHGs are able to warm the atmosphere at different rates i.e. each gas has a different global warming potential (GWP). Global warming potentials are a measure of the relative radiative effect of a

given substance compared to CO_2 over a chosen time horizon (IPCC, 2001a). The respective GWPs of the three main GHGs are presented in Table 2.

Table 2: Global warming potentials of the three main GHGs (IPCC, 2001a)

Gas	Lifetime	GWP (20 Yrs)
Carbon Dioxide		1
Methane	12.0	21
Nitrous Oxide	114	310

Furthermore, GHGs have a long residence time in the atmosphere (Table 3). This implies that GHGs can last for decades, centuries or even millennia in the atmosphere before natural processes can remove the quantities emitted (IPCC, 2001).

Table 3: Residence times of GHGs

Gas	Residence time in atmosphere (Yrs)
Carbon Dioxide	Approx 200-450
Methane	12
Nitrous Oxide	120
Chlorofluorocarbons	102

Therefore, if all emissions were stopped, global warming would still continue due to the lasting effect of GHGs in the atmosphere (IPCC, 2001).

There are a number of sources and sinks of GHGs. Sources are processes that generate GHGs and sinks are processes that remove GHGs. The main source of CO_2 emissions is the combustion of carbon-based fuels (Hopwood & Cohen, 2004). Coal, oil and natural gas are termed fossil fuels and contain carbon. These fuels, when burned, combine with oxygen (O_2) to form CO_2. The clearing and burning of forests have also contributed to an increase CO_2 in the atmosphere. This is because forests and wooded areas are natural carbon sinks and when burned, they add more carbon to the atmosphere. In 1996 it was reported that, CO_2 world emissions had increased by 2.8%, whilst the United States reported a 3.3% increase (Hopwood & Cohen, 2004).

Nitrous oxide is added to the atmosphere through the use of nitrogen-based fertilisers and motor vehicles as well as disposing of human and animal waste (Hopwood & Cohen, 2004). Globally, N_2O emissions have increased by 15% since 1750. Before industrialisation, the concentration of N_2O was 270 parts per billion (ppb) however, today it has increased to 314 ppb (IPCC, 2001a).

Methane is produced anthropogenically by activities such as exploitation of natural gas, biomass burning and coal mining. The concentration of CH_4 prior to industrialisation was 700 ppb but it has now increased to 1745 ppb (IPCC, 2001a).

Halocarbons are ozone-depleting compounds and have decreased slowly due to regulations imposed by the Montreal Protocol (IPCC, 2001a). For the majority of these compounds human activities are the sole source.

1.2 Causes of climate change

According to the Intergovernmental Panel on Climate Change (IPCC), Third Assessment Reports (2001), there is stronger evidence that most of the observed climatic changes over the last 50 years are attributable to human activities because of the combustion of fossil fuels for energy (IPCC, 2001b). Energy is central to the current global economy and provides the fuel for growth. It is also an essential requirement for economic and social development (World Business Council for Sustainable Development, 2003). Energy use in all countries of the world is largely based upon coal, oil, natural gas (i.e. fossil fuel resources), nuclear fission, hydropower, biomass and to a smaller extent on solar and wind power (Winteringham, 1991). Burning fossil fuels, however, release a number of gases such as CO_2, N_2O and CH_4 which are causing the current unprecedented warming in the climate.

A number of sectors of the economy contribute to the release of GHGs. These are as follows:

- Electricity production is responsible for about one-third of the world's primary energy consumption and releases a number of pollutants. Presently, there are billions of people who do not have access to electricity and in addressing this disparity it is likely that the problem of climate change will increase (Goldemberg, 1999);

- The transportation sector is responsible for about half the world's oil consumption through the use of motor vehicles. In the last century there was a radical increase in the number of motor vehicles. Motor vehicles release a number of gases that are responsible for the warming of the planet (Goldemberg, 1999);

- Buildings (commercial and residential) also consume an appreciable amount of energy for heating, cooling, lighting and in the use of appliances (Goldemberg, 1999); and

- Industry consumes about 35 to 45% of all energy used in developed countries and a larger proportion in most developing countries (IPCC, 2001). Some industries use more energy than others. These are termed energy intensive industries and are responsible for approximately 20% of global air pollution and emission sources. They include the industries of pulp and paper; chemicals; primary metals (aluminium); and petroleum.

It is also becoming evident that the substantial increase in global energy consumption in the coming decades will be driven by the developing world. Strong economic growth in many developing countries is already leading to sharp increases in per capita energy consumption. Consumption will continue

to rise, driven by a projected expansion in the world's population that will occur in developing regions during the 21st century. Therefore, it is likely that by 2025, developing countries CO_2 emissions (Figure 2) will greatly exceed developed countries emissions (IEA, 2004).

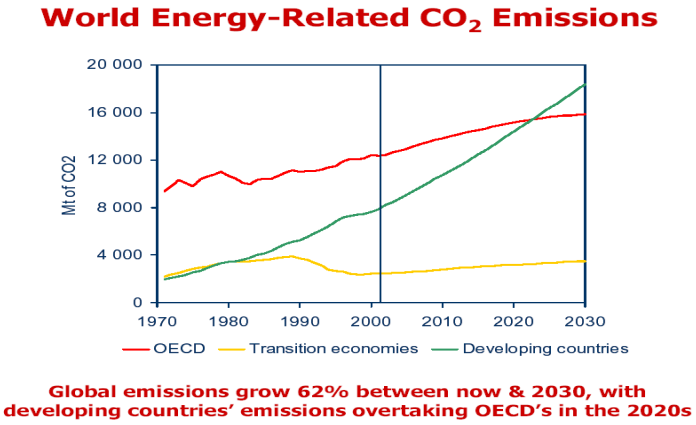

Figure 2: World CO_2 emissions (IEA, 2004)

1.3 Why worry about climate change?

There are a number of risks associated with human-induced climate change as many ecological systems are extremely sensitive to temperature and rainfall variability (IPCC, 2001b). Water availability is likely to be a significant issue, as temperature and evaporation rates increase and changes in the distribution of rainfall occur. These trends may impact the amount of water that reservoirs are able to store. Changes in temperature and rainfall are also likely to affect vegetation distribution (IPCC, 2001b). Migration of animal species to areas of more suitable climate is therefore likely to increase (CSIR, 2005).

Climate induced temperature changes can result in adjustments in ocean circulation, ice coverage and sea level. Increases in sea level, due to the melting of the ice sheets, will result in extreme levels of storm waves and surges. This could potentially affect infrastructure, human settlements and ultimately result in an increase in insurance claims and economic losses in the affected areas (Working Group on Climate Change & Development. 2004).

A number of health-related problems are also likely to occur. For example, malaria and cholera are likely to increase, particularly in areas where rainfall intensity increases and flooding occurs. Higher temperatures could also result in increased incidents of heat stress (IPCC, 2001b). These problems are further exacerbated by overcrowding, poverty and poor sanitation, which are widespread in a number of developing and developed countries (IPCC, 2001b).

Agricultural productivity is also likely to be affected, especially in drought-prone areas with a resulting impact on food production (IPCC, 2001b). This is

particularly important for the poorest members of society who are directly dependant on the land for survival.

Developing countries and poor communities already face significant challenges coping with existing climatic variability and extremes in the weather. These factors are disrupting economic growth and the provision of basic services (DFID, 2004). It is likely that climate change will have negative impacts on poverty and will make the process of eradicating poverty more difficult due to (CSIR, 2005):

- Negative effects on economic growth: The rate and pattern of which is critical to eradicating poverty, since growth generates the livelihood opportunities poor people need to elevate themselves out of poverty;
- Direct effects on people's livelihoods and the assets they depend on to make a living; and
- Increases in the level of risk to which countries and people already vulnerable to shocks are likely to be exposed to.

The IPCC (2001a) predicts that Africa will be the continent most adversely affected by the effects of climate change. This is because of other stresses that the continent experiences, such as widespread poverty, recurrent droughts, inequitable land distribution, dependence on rain-fed agriculture, wars and conflicts, limited technological development, a high disease burden and rapid population growth rate. The combinations of poverty, climate change, political governance, conflict and HIV/AIDS is likely to produce a "bleek" scenario for the African continent. These interactions have the potential to achieve sustainable development (Vogel, 2005).

This is reiterated in the Southern African Millennium Ecosystem Assessment (SAfMA) report which highlights the reliance of African people on ecosystems for their food, water and shelter. Thus, it is likely that the deterioration of these ecosystems to provide such services will result in serious impacts on human well-being (CSIR, 2004). As such, climate change poses the largest threat to ecosystems and human well-being (CSIR, 2005).

2 OBSERVED CHANGES IN THE CLIMATE SYSTEM

Scientific consensus on the issues of climate change is now clearly expressed in the reports of the Intergovernmental Panel of Climate Change (IPCC). This panel was created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) with the purpose of evaluating the state of climate science (IPCC, 2001a)). The main aim of the panel was to create a basis for informed policy action focusing on peer-reviewed and published scientific literature. Evidence obtained from measuring air temperatures, ocean temperatures and global sea level indicates that changes are occurring.

Several changes in the climate system have already been observed, primarily increases in temperature, extreme weather events (e.g. flooding and drought),

sea level rise, and rainfall variability. These observed changes are discussed in more detail in the sections that follow.

2.1.1 Changes in temperature

The global average surface temperature has increased by 0.6 °C since the late 19th century (Figure 3). In southern Africa it is predicted that warming will be greatest in the northern regions, with the arid regions being most vulnerable (IPCC, 2001a).

In South Africa modelling studies indicate temperature increases for the entire country. The highest increases (up to 4°C) are expected over the north-central parts of the country. The highest projected mean annual temperature increases range between 2.5° and 3°C, whilst for the coastal regions predicted are slightly lower (Turpie, *et al.,* 2002).

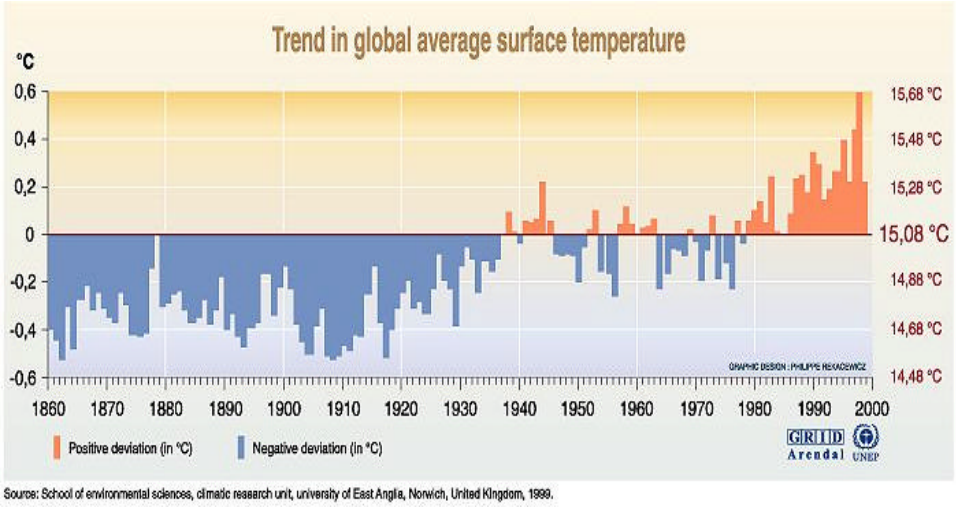

Figure 3: Changes in temperature (Scholes, 2005)

2.1.2 Changes in precipitation and atmospheric moisture

Increasing global surface temperatures are very likely to lead to changes in precipitation and atmospheric moisture. Worldwide, precipitation has increased by 0.5-1% over the mid-high latitudes (IPCC, 2001a). These changes are not geographically consistent, with increased rainfall in some areas and reduced rainfall in others, ultimately resulting in floods and desertification (Figure 4).

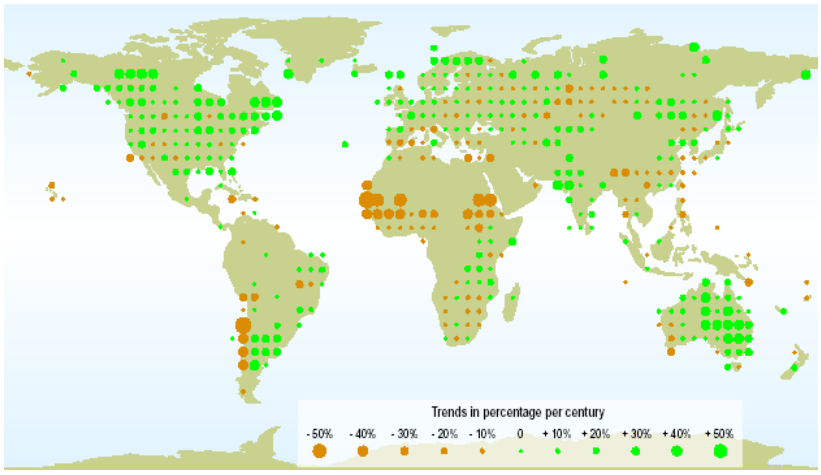

Figure 4: Rainfall variability (IPCC, 2001a)

South African rainfall predictions made by the Hadley Climate Model (HADCM2)[1] model shows a decrease in summer rainfall over most of the country whilst winter rainfall is expected to decrease by 25% for the country (Turpie, *et al.,* 2002).

2.1.3 Changes in sea level

Global increases in temperature may lead to a rise in sea level due to the melting of ice sheets and thermal expansion[2]. Analysis of geological data indicate that global average sea level has risen at a rate of 1.0 to 2.0 mm/yr over the 20th century (Figure 5) which is equivalent to 10-20 cm. Global trends indicate a potential sea level rise of 0.09 to 0.88m within this century.

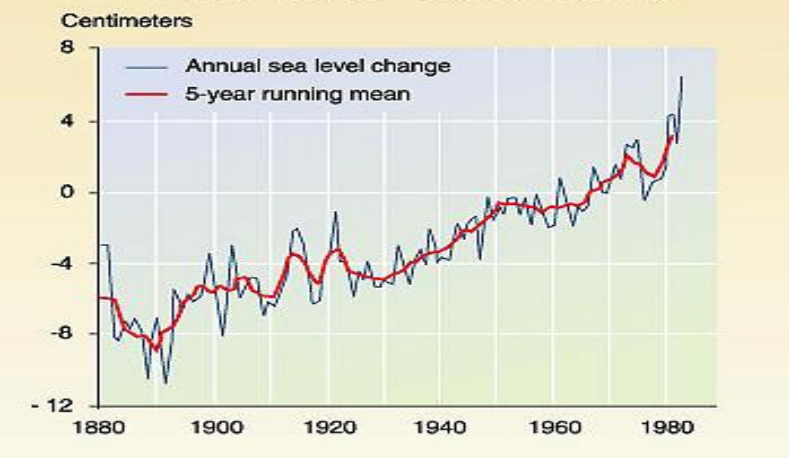

Figure 5: Global sea level rise (Scholes, 2005)

[1] HADCM2 is a model developed by the Hadley Centre for Climate Prediction and Research for the United Kingdom Meteorological Office

[2] Warming of the ocean causes it to expand resulting in thermal expansion (IPCC, 2001a)

For the South African situation, the global predictions of sea level are applicable and widely used (Turpie, *et al.,* 2002). Current observations reveal that sea level in South Afrrica, has risen by 10-15 cm over the last century which correlates with global observations (Turpie, *et al.,* 2002).

2.1.4 Changes in climate variability and extreme weather events

Data indicates that where total precipitation has increased, so has heavy and extreme precipitation events (IPCC, 2001a). Primarily in the Northern Hemisphere there have been statistically significant increases in the frequency of precipitation events together with increased insurance claims and economic losses (Figure 6).

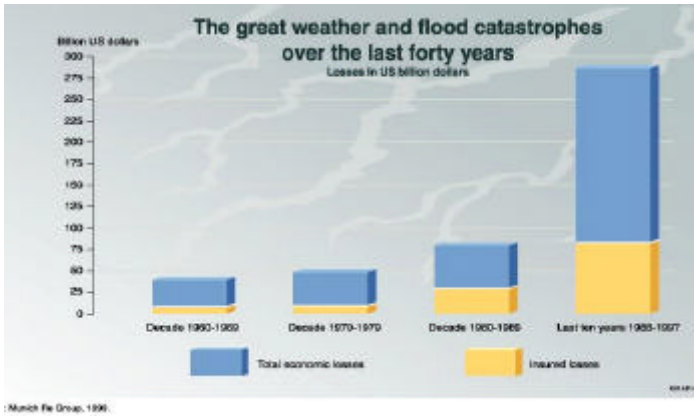

Figure 6: Increased Extreme Weather Events (Scholes, 2005)

3 THE SOUTH AFRICAN CONTEXT

South Africa's energy sector is the key driver for the country's development. It is also, however, the largest single source of GHG emissions. This is due to the fact that South Africa's economy is heavily dependant on energy. In 2003, the energy sector contributed 15% of South Africa's Gross Domestic Product (GDP) (World Energy Council, 2003). This can be attributed to the abundant supply of cheap and reliable energy, and on the types of industries that dominate the economy (minerals extraction and processing). The National Electricity Regulator (NER), 2001 electricity supply statistics indicate that approximately 90% of electricity was generated from coal (Engineering News, 2005).

South Africa has, thus, been described as one of the most energy intensive economies. This implies that when one compares energy inputs with measures of economic outputs such as GDP, South Africa has one of the most energy intensive economies in the world (Spalding-Fecher & Williams, 2000). Energy intensity is problematic because a reliance on fossil fuel resources carries significant environmental impacts such as the release of air pollutants that cause acid rain, respiratory problems and climate change. Of most concern is South Africa's significantly high release of GHGs into the atmosphere.

3.1 Greenhouse gas emissions

In 2004, South Africa released its Initial National Communication (INC) under the United Nations Framework Convention on Climate Change (UNFCCC). This report documents South Africa's vulnerability to climate change and its ability to adapt to climate change. The report shows that in 1994, total CO_2, CH_4 and N_2O produced amounted to 379 842 giga gram (Gg) CO_2 equivalents[3]. This converts to 103.6 million tons of carbon. These emissions were produced mainly by the energy, industry, agriculture and waste sectors (EDRC, 2003). More importantly, the energy sector contributed 78% of the country's total emissions in 1994. Of the main GHGs, CO_2 was the most significant and contributed more than 80% of the total greenhouse inventory for 1990 and 1994.

Due to the energy intensive nature of the economy, South Africa is globally ranked fourteenth in terms of harmful GHG emissions and the nineteenth most carbon intensive economy (EDRC, 2003). Furthermore the "South African Country Study", a study commissioned under the INC for South Africa highlighted the fact that the majority of these emissions were produced by electricity generation from coal fired power stations (EDRC, 2003).

For the industrial sector, CO_2 emissions have decreased slightly from 28 913 Gg in 1990 to 28 106 Gg in 1994. This represents 10.3% and 8.9% of the total CO_2 emissions (DEAT, 2004a). The most significant emitter within the industrial sector is the iron and steel industries.

Methane emissions contributed 12.4% in 1990 and 11.4% in 1994 of the total GHG emissions. The main sources of CH_4 were from the agriculture and waste sector (DEAT, 2004a). Total N_2O emissions were 75 Gg in 1990 and 67 Gg in 1994 (DEAT, 2004a). This represents 6.7% and 5.5% of total GHG emissions in South Africa for the years 1990 and 1994, respectively (DEAT, 2004a). The main source of these emissions was from the agricultural sector which contributed 83% of the total N_2O emissions (DEAT, 2004a).

4 CLIMATE CHANGE AND POLICY DEVELOPMENT

Climate change influences polices ranging from renewable energies to transport management, industrial emissions to forestry. It in turn provides a scientific, technological and socio-economic basis for strategies to address this issue (European Commission, 2004).

These large scale and long-term changes present major policy challenges. However, in the last decade a number of policies have been formulated to assist with vulnerability and adaptation to climate change (Herald Tribune Online, 2004). South Africa is a signatory to a number of international conventions which play a key role in guiding internal environmental policy. In

[3] A metric measure used to compare the emissions from various GHGs based on their GWP (IPCC, 2001a).

most instances, it is the formulation and implementation of national policies and measures that determine whether a treaty or convention succeeds (Sewell, 1996).

4.1 Policies in response to climate change

For the purposes of this review, only key polices were identified, however, for a more detailed breakdown of the various climate change policies the following website can be accessed: http://home.earthlink.net/~apronto/treaties/environ.htm

4.1.1 International meetings/fora

4.1.1.1 World Summit on Sustainable Development (WSSD)

The goal of the WSSD was to review progress since the 1992 Rio Conference in order to reinvigorate global commitment to sustainable development. The two main documents adopted at the Summit were the Johannesburg Plan of Implementation and the Johannesburg Declaration. These outlined the objectives and targets necessary to achieve sustainable development. The outcome relevant to climate change is the agreements on: Water and Sanitation, Energy, Health, Agriculture, and Biodiversity and Ecosystem management (WEHAB). These commitments form part of the Johannesburg Implementation Plan and are also featured in NePAD as part of the priority sectoral projects (WSSD, 2002).

4.1.2 Multilateral environmental agreements

4.1.2.1 United Nations Framework Convention on Climate Change (UNFCCC)

At the Earth Summit in Rio de Janerio, 180 countries including South Africa, adopted the UNFCCC. The UNFCCC establishes a framework and process for agreeing to specific actions for the reduction of anthropogenic GHG's. The convention recognises the right of poorer nations to economic development whilst not neglecting the fact that these countries are most vulnerable to the impacts of climate change (Rukato, 1999). Therefore, much of the burden for mitigating climate change lies with the developed, industrialised countries. The convention once ratified indicates a commitment to follow procedures that mitigate the effects of climate change and allows countries to access financing for the implementation of these mitigatory actions (Rukato, 1999). It supports the concept of sustainable development and seeks to stabilise GHGs at a level that would not be dangerous.

Under the UNFCCC, both developed and developing countries have to formulate and submit national communications containing inventories of GHG's by source and removal by sinks (UNEP, 2001). Furthermore, countries have to take account of climate change in the development of social, economic and environmental policies (UNEP, 2001). Developed countries have specific targets for reducing their GHG's to levels experienced in 1990.

Developing countries however, do not have specific mitigation obligations but as signatories to the convention are required to show their commitment to reducing GHG's (Rukato, 1999).

4.1.2.2 Kyoto Protocol

Parties to the UNFCCC have been meeting since 1994 to implement and define the UNFCCC, and at the third meeting of the Parties, the Kyoto Protocol was adopted. This Protocol sets legally binding GHG reductions for industrialised countries and was entered into force on 16 February 2005.

In 1997, three flexibility mechanisms were created. These mechanisms are means by which developed countries can reduce their legally binding emission reduction targets by an average 5.2% below 1990 levels in the accounting period 2008-2012 (CSIR, 2002). The Kyoto mechanisms have been created with a view of achieving these targets at the lowest possible cost for the countries committed to GHG reductions. Under the flexibility mechanisms, an artificial market is created in which the emission allowances or emission reduction units are traced (Kim, 2001). The flexibility mechanisms include:

- The Clean Development Mechanism (CDM);
- Joint Implementation (JI); and
- International Emissions Trading (IET).

4.1.2.3 Montreal Protocol

The Montreal Protocol is an international agreement designed to protect the stratospheric ozone layer. The treaty was signed in 1987 and amended in 1990 and 1992. The Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere such as CFCs are to be phased out by 2000 (World Bank, 2006). Whilst this Protocol does not directly relate to climate change, it has indirectly assisted in reducing GHGs as halocarbons are gases that have contributed to global warming.

4.1.3 International commitments

4.1.3.1 Agenda 21

At the Earth Summit in Rio de Janeiro, a set of principles to guide future development were adopted in recognition of the integral and interdependent nature of the Earth. These principles defined the rights of people to development, and their responsibilities in safeguarding the environment (IISD, 2000a).

One of the key outputs was Agenda 21 which provides the options for combating degradation of the land, air and water, conserving forests and the diversity of the various species. It predominantly focuses on poverty, excessive consumption, health, education and cities (IISD, 2000b). It identifies that population; consumption and technology are the primary driving forces of

environmental change. It stipulates the requirements for a reduction in wasteful and inefficient consumption patterns whilst encouraging increased but sustainable development. It also offers policies and programmes to achieve a sustainable balance between consumption, population and the Earth's life-supporting capacity.

It calls on governments to adopt national strategies for sustainable development which must be developed with wide participation, including non-government organisations and the public.

4.1.3.2 Millennium Development Goals (MDGs)

The MDGs are targets that have been set to eliminate problems such as poverty and gender inequality. These goals were developed under the Millennium Declaration and are as follows (UNDP, 2005):

- Eradicate extreme poverty and hunger;
- Achieve universal primary education;
- Promote gender equality and empower women;
- Reduce child mortality;
- Improve maternal health;
- Combat major disease;
- Ensure environmental sustainability; and
- Develop a global partnership for development.

A number of efforts are currently in place to assist countries in integrating the MDGs into their national development frameworks. Countries are tailoring the MDGs to national circumstances by incorporating them into national development strategies and policies. The goals are also integrated into assistance frameworks and programmes.

4.1.3.3 New Partnership for Africa's Development (NePAD)

The New Partnership for Africa's Development (NePAD) is a pledge by Africa's leaders, based on a shared vision and conviction to eradicate poverty and to place their countries on a path to sustainable development (NePAD, 2001). This vision stems from a determination to change Africa's current situation from underdevelopment and exclusion in a globalising world, to one of development and inclusion. The fundamental objective of NePAD is to promote sustainable development on the African continent in a manner that embodies social, economic and environmental dimensions (NePAD, 2001).

NePAD aims to achieve this by promoting innovative leadership that is committed to sustained human development efforts, eradication of poverty, as well as the initiation of global partnerships. These initiatives aspire to encourage shared responsibility and mutual interest in all aspects of development. Africa, over the years, has been exploited for its natural resources and cheap labour, thereby perpetuating underdevelopment. NePAD however, now provides an opportunity for these resources to be used in a sustainable manner.

4.1.3.4 Southern African Development Community (SADC) commitments

There are a number of Regional Economic Communities that are consolidated under NePAD, one of which is directly relevant to South Africa, that being the Southern African Development Community (SADC). This community was established in 1992 and aims to achieve effective protection of the environment and the sustainable utilisation of natural resources. Due to South Africa's partnership with neighbouring communities, it has entered into a number of protocols including:

- SADC Treaty: Promotes development, economic growth, alleviation of poverty and the improvement of the quality of life of the people of Southern Africa; and
- SADC Policy and Strategy for Environment and Sustainable Development: Forms the basis for the implementation of Agenda 21.

4.1.4 National policies and legislation

As a party to a number of Conventions and international commitments, it is important that South Africa gives legality to measures of monitoring, verification and enforcement of GHG reduction targets. Therefore, policies, strategies and legislation have been formulated to assist South Africa in reducing its GHG emissions. These are discussed below.

4.1.4.1 National Environmental Management Act, 107 of 1998

The National Environmental Management Act (NEMA), 107 of 1998 is the overarching framework for environmental management in South Africa. A number of other legislation falls within this framework such as the Air Quality Act, 39 of 2004.

The Act provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state (RSA, 1998). The Act states that an environmental assessment processes should take place for activities that have a potential impact on the environment. NEMA specifically states that the Minister may make regulations for the assessment of potential impacts of an activity that (RSA, 1998):

- Affects the interest of more than one province or traverses international boundaries; and
- Affects compliance with obligations resting on the Republic under customary or conventional international law.

4.1.4.1.1 Air Quality Act, 39 of 2004

The aim of this Act is to reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of

pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development (RSA, 2004).

It specifically addresses air pollution that could cause international problems such as climate change (RSA, 2004). It requires investigations into any situation that may result in air pollution across boundaries or that may result in a violation of international agreements. In addition, it gives the Minister the right to prescribe measures to prevent, control or correct any situation that may cause releases of air pollutants.

4.1.4.2 National Climate Change Response Strategy

In September 2004, South Africa released its 'National Climate Change Response Strategy'. This strategy was identified as an urgent requirement in preparation for the ratification of the UNFCCC. The aim of the strategy is to promote integration between the various government departments to maximise the benefits of the country whilst minimising the negative impacts of climate change. It is envisaged to be in the national interest in order to support climate change response actions, as they can potentially act as a significant factor in boosting sustainable development (DEAT, 2004b).

5 REFERENCES

Barrow, C. J. 1995. *Developing the Environment: Problems & Management*. Longman Group Limited, Great Britain.

CSIR. 2002. *The Clean Development Mechanism and Environmental Assessments: A Guideline Document*. CSIR, Environmentek, Pretoria.

CSIR. 2004. *Nature Supporting People: The southern African Millennium Ecosystem Assessment.* CSIR, Pretoria, South Africa.

CSIR. 2005. *Climatic Future for Durban*. Report produced for the Ethekwini Municipality. CSIR, Environmentek, Durban.

DEAT (Department of Environmental Affairs & Tourism). 2004a. *South Africa's Initial National Communication under the United Nations Framework Convention on Climate Change*. Department of Environmental Affairs and Tourism, Fedsure Building, 315 Pretorius Street, Pretoria.

DEAT (Department of Environmental Affairs & Tourism). 2004b. *A National Climate Change Response Strategy for South Africa.* Department of Environmental Affairs and Tourism, Fedsure Building, 315 Pretorius Street, Pretoria

DFID. 2004. *The Impact of Climate Change on the Vulnerability of the Poor*. Vol: 3. Crown Publications.

European Commission. 2004. *Energy, Environment and Sustainable Develo*pment. [Online]. Available at: http://europa.eu.int/comm/research/eesd/leaflets/en/keyact02.html

EDRC (Energy & Development Research Centre). 2003. *Sustainable Development and Climate Change in South Africa*. University of Cape Town, Cape Town.

Goldemberg, J. 1999. *Energy, Environment & Development*. Earthscan Publications Limited, United Kingdom.

Herald Tribune Online. 2004. *The Earth's life-support system is in peril*. [Online]. Available at: www.iht.com/articles/125563.html

Hopwood, N. & Cohen, J. 2004. *Greenhouse Gases & Society*. [Online]. Available at: www.umich.edu/-gs265/society/greenhouse.htm

IEA (International Energy Agency). 2004. *World Energy Outlook*. [Online]. Available at: www.csis.org/energy/041109_WEO-2004.pdf

IISD. 2000a. *Rio Declaration*. [Online]. Available at: http://www.iisd.org/rio+5/agenda/agenda21.htm

IISD. 2000b. *Agenda 21*. [Online]. Available at: http://www.iisd.org/rio+5/agenda/agenda21.htm

IPCC (Intergovernmental Panel on Climate Change). 2001a. *Climate Change: The Scientific Basis.* Third Assessment Report of the IPCC for the UNFCCC. Cambridge University Press

IPCC (Intergovernmental Panel on Climate Change). 2001b. *Impacts, Adaptation, and Vulnerability*. Third Assessment Report of the IPCC for the UNFCCC Cambridge University Press.

Kim, J. A. 2001. *Institutions in conflict? The Climate Change Flexibility Mechanisms and the Multinational Trading System*. Global Environmental Change Journal, Vol. 11, Elsevier Science Ltd.

NePAD. 2001. *The New Partnership for Africa's Development (NePAD).* Meeting of the Implementation Committee of the Heads of State and Government on the New Partnership for Africa's Development, Abuja, Nigeria. Available at http://www.nepad.org

RSA (Republic of South Africa). 2004. *National Environment Management: Air Quality Act, 39 of 2004.* Pretoria, Republic of South Africa.

RSA (Republic of South Africa). 2004. *National Environment Management Act, 107 of 1998.* Pretoria, Republic of South Africa

Rukato, H. 1999. *A Basic Guide to Climate Change*. Group for Environmental Monitoring: Proceedings from the MEETI Climate Change and Policy Course. MEETI, Johannesburg.

Scholes, R. 2005. *Atmospheric Variability and Climate Change*. Proceedings from the Science of Climate Change Workshop held at the CSIR-Durban, 17 January 2005.

Sewell, G. 1996. *Conflicting Beliefs: National Implementation of the United Nations Framework Convention on Climate Change*. Environmental Impact Assessment Review, Vol. 16. Elsevier Science, New York.

Turpie, J., Winkler. H., Spalding-Fecher, R., & Midgley, G. 2002*. Economic Impacts of Climate Change in South Africa: A Preliminary Analysis of Unmitigating Damage Costs*. Research Paper sponsored by USAID and administered by the Joint Centre for Political and Economic Studies Inc.

UNEP (United Nations Environment Programme). 2001. *Climate Change: Information Sheets*. [Online]. Available at: www.unep.ch/conventions/

UNDP (United Nations Development Programme). 2005. *Millennium Development Goals*. [Online). Available at: http://www.undp.org/mdg/#Integrating

Vogel, C. 2005. *The Economic, Developmental and Livelihood Implications of Climate Induced Depletion of Ecosystems and Biodiversity in Africa*. A Scientific Symposium on Stabilization of Greenhouse Gases, Met Office, Exeter, United Kingdom. 1 – 3 February, 2005.

Warrick, B. & Jager, D. *The Greenhouse Effect, Climatic Change & Ecosystems*. Scientific Committee on Problems of the Environment, Great Britain.

Winteringham, F. P. W. 1992. *Energy Use & the Environment*. Lewis Publishers Inc, United States of America.

Working Group on Climate Change & Development. 2005. *Africa-up in Smoke?* [Online]. Available at: http://www.globalpolicy.org/socecon/envronmt/2005/06africaupinsmoke.pdf

Working Group on Climate Change & Development. 2004. *Up in Smoke: Threats from, and Reponses to, Impact of Global Warming on Human Development*. [Online]. Available at: http://www.neweconomics.org/gen/uploads/igeebque0l3nvy455whn42vs1910 2004202736.pdf

World Business Council for Sustainable Development. 2004. *Facts & Trends to 2050: Energy & Climate Change*. World Business Council for Sustainable Development.

World Bank. 2006. Montreal Protocol. [Online]. Available at: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTTMP/0,,menuPK:408237~pagePK:149018~piPK:149093~theSitePK:408230,00.html

WSSD (World Summit for Sustainable Development). 2002. *The Johannesburg Declaration on Sustainable Development*. Agenda Item 13, Political Document.