The

NATIONAL CLIMATE CHANGE RESPONSE POLICY

Discussion Document for the 2009 National Climate Change Response Policy development Summit, Gallagher Convention Centre, Midrand, 3-6 March 2009

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INTRODUCTION

South Africa is a signatory to both United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. As such, South Africa recognises the grave risks posed to our planet by global warming and is committed to playing its part as a global citizen to take necessary action to respond to the challenge of climate change. In particular South Africa finds itself in a situation in which it is both a high emitter of greenhouse gases, as well as a country predicted to experience the impacts of climate change in a severe manner.

Over the past decade, South Africa has participated in the UNFCCC processes, done a substantial amount of work to meet its commitments in terms of the Convention and the Protocol and has also taken forward the challenge of determining what national action is necessary to address climate change.

Specifically, South Africa produced an initial Greenhouse Gas Inventory (base year 1990) in 2004, and has now updated this and is completing its second Greenhouse Gas Inventory (base year 2000). It has produced a first National Communication that was submitted to the UNFCCC and is currently undertaking a second iteration of this for submission to the UNFCCC in 2010. It is an active participant in the Clean Development Mechanism (DNA) and now has a portfolio of projects at various stages in the CDM pipeline.

Over the past few years, the profile and significance of climate change issues has increased globally and in our own country. Within Government, Climate Change is regularly discussed at a Cabinet level and an Inter-Ministerial Committee on Climate Change is supported by an Inter-governmental Committee on Climate Change at an official level. In addition there is a National Committee on Climate Change (NCCC) which is a multi stakeholder forum ain which work around climate change is consulted and information shared.

It is accepted that Climate Change is a national priority of a cross cutting nature, with implications for a wide range of ministries across government and across all spheres of Government. Government's work on Climate Change is an action item on the Government Programme of Action. In October 2005 a national Climate Change Conference was held that was attended by a large number of Ministers. At this conference it was agreed that a participatory climate change policy development process would take place, following the conclusion of, among others, a detailed scenario building process to map out how South Africa can meet its UNFCCC Article 2 commitment to greenhouse gas stabilisation whilst sustaining its priorities of poverty alleviation and job creation.

In line with these agreements, the Long-term Mitigation Scenario (LTMS) process was initiated in 2006 and was concluded in July 2008. The LTMS was a participatory, research based scenario building process that focused on identifying South Africa's emissions trajectory and formulating a range of potential strategies that would allow South Africa to reduce its emissions over time in a way that is appropriate to its national circumstances and its capabilities. The LTMS conclusions (see 5.3, page 14) were taken to Cabinet in July 2008. Following this a number of decision were taken that provide an overarching framework for the development of a Climate Change Response Policy for South Africa.

These decisions include the following:

- Greenhouse Gas Emission Reductions and Limits. South Africa will follow a peak, stabilisation and decline greenhouse gas trajectory over the next 60 years. This will mean that emissions will peak during the period 2025 to 2035, will stabilise until the 2050 to 2060 period and will then decline.
- Build on strengthen or scale up existing initiatives. Existing initiatives around energy efficiency, renewable energy, the development of "green" industries, on-going research into climate friendly ways of doing business should be deepened, extended and scaled up to achieve a greater impact.
- Implement the Business Unusual Call for Action. South Africa must prioritise investment in research and technology development that would make a major impact on greenhouse gas emissions. This would include investments in R+D for electric and hybrid vehicles, new solar technologies, clean coal technologies, carbon capture and storage and participation in a range of other national and international initiatives that could achieve breakthroughs in achieving low carbon ways of doing business

- Vulnerability and Adaptation. South Africa's vulnerability to the impacts of climate change means that across government and society, we need to understand the potential impacts of climate change and be prepared to meet the resultant challenges.
- Preparing for the Future,

A further decision was taken to launch a policy development process that would result in a national Climate Change Response Policy in the form of a White Paper.

This conference formally launches the policy process that would translate the above decisions into fiscal, regulatory and legislative packages as well as sectoral implementation plans. The following timetable will guide this process.

MILESTONE	TIMING
National Climate Change Response Policy Development Summit (Adopt Framework)	Mar 2009
Sectoral policy development work	Mar - Sept 2009
Post-2012 negotiation positions	Up to Sept 2009
UNFCCC post-2012 negotiations concluded (Copenhagen)	Dec 2009
National policy updated for implementation of international commitments	Mar 2010
Green Paper published for public comment	Apr 2010
Final National Climate Change Response Policy published	End 2010
Policy translated into legislative, regulatory and fiscal package	Now to 2012

As such, this document is a conference discussion document summarising a set of information and policy proposals that underpin the debate at this conference and that will form one input into the Green Paper to be published for public comment in April 2010.

PART ONE: BACKGROUND AND INTRODUCTION

1. THE CHALLENGE OF CLIMATE CHANGE AND ITS SCIENCE[1]

The Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (AR4) provides the most recent and comprehensive estimate of the likelihood that human activities are causing currently observed temperature and climate change.

Their essential conclusions are that:

> *"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level"*

and that

> *"Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations".*

This level of certainty translates to a >90% probability (9/10 chance) that human activities are responsible for the global warming observed since the 1950's.

This finding itself compels a policy response. The urgency of that response needs to relate to the degree of projected warming, given a range of societal choices regarding fossil fuel use, land cover change and then a range of other less critical decisions. It is these projections that in turn impact on the estimate of climate sensitivity.

The IPCC Fourth Assessment Report (AR4) concluded in 2007 that there is a greater than 90% chance that human activities such as fossil fuel burning and deforestation are changing the earth's climate system.

The evidence for Climate Change is clear and unambiguous. Changes in climate have already been observed that are generally consistent with model projections, and are likely to continue to occur for many decades to come even if mitigation efforts are successful, because of lags and inertia in the global biosphere response. The global projections for a range of assumptions of climate sensitivity and societal development scenarios are for between a 1.2º and 5.8ºC rise in global temperature by 2100. The range of climate change projected clearly remains broad even at the global level, and the potential impacts remain uncertain to a greater or lesser degree depending on the affected sector in question.

During the conference session on the findings of the IPCC's 4th Assessment Report, the implications of this will be discussed in detail.

2. THE INTERNATIONAL CLIMATE CHANGE REGIME AND THE UNFCCC NEGOTIATIONS

During the mid to late 1980's there was an emerging body of scientific evidence that human induced global warming was taking place, with severe predicted consequence for current climate patterns. In this context the UN Environment Programme (UNEP) and the World Meteorological Organisation (WMO) set up an Intergovernmental Panel on Climate Change (IPCC) in 1988 to synthesise the scientific evidence for (or against) human induced climate change.

The 1st IPCC Assessment Report (1990) presented sufficient scientific evidence that climate change was a reality to trigger world wide concern and the negotiation of the UNFCCC, which was opened for signature at the Rio Earth Summit in 1992 and came into force in 1994.

At that time there was still some scientific uncertainty as to the causes and extent of the impact of climate change. Therefore the UNFCCC was exactly that – a framework, and only:

- Recognises a problem with "potential global consequences"

[1] Edited extracts from the Preface of: Midgley GF, Chapman RA, Mukheibir P, Tadross M, Hewitson B, Wand S, Schulze RE, Lumsden T, Horan M, Warburton M, Kgope B, Mantlana B, Knowles A, Abayomi A, Ziervogel G, Cullis R and Theron A. (2007) *Impacts, vulnerability and adaptation in key South African sectors: An input into the Long Term Mitigation Scenarios process*, LTMS Input Report 5, Energy Research Centre, Cape Town.

- Sets an "ultimate objective" of 2 parts:
    - Stabilising Green House Gas (GHG) concentrations (at a level which prevents dangerous anthropogenic interference with the climate system)
    - Within a time frame to: allow natural ecosystem adaptation to climate change; ensure food production is not at threatened; and enable sustainable economic development
- Outlines the principles which guide the international response to climate change
- Identifies the 3 major areas of work required to address climate
    - Mitigation of GHGs
    - Adaptation to the impacts of inevitable climate change and
    - Response measures (i.e. managing unintended consequences of climate policy on others – e.g. Oil exporters, trade barriers, subsidies)
- Distinguishes developed countries and countries with Economies in transition (EITs) from developing countries (Annexe 1 parties vs. Non-Annexe 1 parties)
- Sets up an institutional framework for agreeing on future action – (i.e. the Conference of Parties (COP), a Subsidiary Body on Implementation (SBI) and a Subsidiary Body on Scientific and Technological Advice (SBSTA))
- Takes some preliminary steps – i.e. setting a non-binding target of reducing GHG emissions to 1990 levels by 2000 for Annex 1 Parties and providing for conditional support for Non-Annex 1 action (specifically technology transfer, finance and capacity building)
- Provides for measurement and reporting
- Encourages further scientific research

SOUTH AFRICA'S COMMITMENTS IN TERMS OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

- Prepare and periodically update a national inventory of greenhouse gas emissions and sinks.
- Formulate and implement national and, where appropriate, regional programmes to mitigate climate change and facilitate adequate adaptation to climate change.
- Promote and cooperate in the development, application and diffusion of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases.
- Promote sustainable management, and promote and cooperate in the conservation and enhancement of sinks and reservoirs of all greenhouse gases.
- Cooperate in preparing for adaptation to the impacts of climate change.
- Take climate change considerations into account in the relevant social, economic and environmental policies and actions with a view to minimising adverse effects on the economy, on public health and on the quality of the environment.
- Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate uncertainties.
- Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change.
- Promote and cooperate in education, training and public awareness related to climate change.

The publication of the 2nd IPCC Assessment report in 1995 demonstrated that the actions outlined in the UNFCCC were insufficient and triggered the negotiation of the Kyoto Protocol, which were finalised in 1997 as a first, but insufficient, step towards a more ambitious international response to the global climate change threat.

The 3rd IPCCC Assessment Report in 2001 gave further scientific certainty that climate change was indeed largely caused by human activity and provided impetus to the further development and operationalisation of the Kyoto Protocol, that finally came into force in 2005 and which:

- Sets legally binding targets and timeframes for Annexe 1 (developed) countries (5% below 1990 level by the end of the 1st commitment period 2008 to 2012)
- Addresses the 6 main GHGs
- Provides for verification and compliance mechanisms
- Uses a market based "cap & trade" approach allocating "carbon credits" with 3 carbon credit "trading mechanisms", namely
    - An emissions trading system within industrialised countries

- A Joint Implementation (JI) project financing mechanism with Economies in Transition (EITs) (buying carbon credits from EITs)
- A Clean Development Mechanism (CDM) for project financing in developing countries (buying carbon credits from developing countries)

By 2005, based on evidence from the 3rd IPCCC Assessment Report and new emerging science, it was increasingly clear that the measures agreed to in the UNFCCC and its' Kyoto Protocol were an inadequate international response to the threats posed by climate change. In particular since the legally binding provisions of the Kyoto Protocol only covers less than 40% of the world's GHG emissions, due to the fact that:

- The world's largest GHG emitter (the USA) did not join the Kyoto Protocol and;
- The largest growth in GHG emissions going forward is projected to emanate from seven (7) more advanced developing countries (i.e. China, India, Brazil, Mexico, South Korea, Saudi Arabia and South Africa), all of which are currently not legally bound to any action within the international regime

Therefore, the 2005 Conference of Parties in Montreal developed package of decisions which basically launched a two track process to further develop the future international climate change regime: (i) The negotiation of further commitments by Annex 1 parties for the 2nd commitment period beyond 2012 – the "Kyoto track"; and (ii) set up a 2 year "Dialogue" to explore how the implementation of the UNFCCC could be strengthened - the "Convention track". These interacting processes were aimed at broadening participation and improving the effectiveness of the international climate regime.

In 2007 the IPCC 4th Assessment Report resulted in a significant increase in public, media and political pressure on the international community to seriously and urgently address the global challenge of climate change. The report highlights that:

- Observed and predicted future trends of a changing climate are "unequivocal" and (with 90% certainty) caused by human socio-economic activities.
- The impacts and risks of climate change are more imminent and severe than previously thought. Between 2050 and 2100 climate change could have disastrous impacts on economies, society, security, development and social safety net systems, particularly in poor countries. Not only do developing countries generally lack the means to cope with climate hazards, but their economies also have greater dependence on climate-sensitive sectors, e.g. agriculture, water, and coastal zones. Africa and Small Island Developing States (SIDS) are uniquely vulnerable.
- Existing technology, together with new developments in the pipeline, can solve the problem at a cost that is affordable (between 1% and 3% of global GDP by 2100). These conclusions are more conservative than but generally in line with the results of the Stern Review of the "Economics of Climate Change" which emphasises that "early action" costs less.

Against the backdrop of this increasing political pressure, the 2007 Conference of Parties in Bali decided to maintain the 2 track process agreed to in 2005 but to convert the "Dialogue" process under the Convention into formal negotiations aimed at strengthening implementation of the UNFCCC.

The Bali Action Plan and Roadmap launched a new round of negotiations to strengthen the climate regime after 2012, with an end date of December 2009. However, progress during 2008 was limited, due to a stagnant global political context influenced primarily by the timing of the USA elections, and the related inability of the G8 meeting in Hokkaido in July 2008 to show leadership on climate change despite progressive proposals put forward by the G5. Nevertheless, the negotiations cannot be described as dead-locked, and 2008 was an important year for exploratory and analytical work in the international negotiations. Many more advanced developing countries also used 2008 to reposition and/or do the in-depth domestic analysis required for the serious negotiations that lie ahead in 2009. India, Brazil, China, Mexico, South Korea and South Africa all published their work on developing national Climate Change plans.

At the 2008 Conference of Parties there was shift to serious negotiations that is intended to reach an agreed outcome by the end of 2009. This outcome should elaborate a meaningful balance between the 4 building blocks of the climate change regime (Adaptation, Mitigation, Technology and Finance) and ensure that the "shared vision" (with its underlying burden-sharing implications) is both equitable and supports a sustainable development approach to climate action.

In this regard, the 2009 negotiations need to address the following challenges:

- Ensure a decisive shift to implementation of adaptation, supported and enabled by significant financing, technology transfer and capacity building;
- Ensure that there is agreement on new quantified emission reduction commitments/targets for Annex I Parties under the Kyoto Protocol;
- Ensure that the USA, as the only Annex 1 Party that has not ratified the Kyoto Protocol, commits to internationally legally binding quantified emission reductions, comparable to those of Kyoto ratifiers;
- Proactively set a framework for mitigation actions by developing countries supported and enabled by technology, finance and capacity-building, both of which must be measurable, reportable and verifiable;
- Ensure that the issue of unintended consequences of climate change response measures on the economies of other countries is addressed effectively;

In order to achieve these objectives it will be necessary to engage in a political debate on the scope, structure and form of the agreed outcome to be adopted in Copenhagen. This political engagement will need to determine the balance between the building blocks and how they will fit together and include the consideration of the various legal means to give effect to an agreed outcome in Copenhagen, be they voluntary or binding/mandatory or a combination thereof.

3. CLIMATE CHANGE AND AFRICA[2]

Africa's major economic sectors are vulnerable to climate sensitivity, with potentially huge detrimental economic impacts. This vulnerability is exacerbated by the Continent's developmental challenges, including: poverty; limited institutional capacity; limited access to capital, markets, infrastructure and technology; ecosystem degradation; low levels of resilience to disasters and resource based conflicts. These in turn have contributed to Africa's weak adaptive capacity, increasing the continent's vulnerability to projected climate change.

Agricultural production and food security (including access to food) in many African countries and regions are likely to be severely compromised by climate change and climate variability.

A number of countries in Africa already face semi-arid conditions that make agriculture challenging, and climate change is likely to reduce the length of growing seasons as well as force large regions of marginal agriculture out of production. Projected reductions in yield in some countries could be as much as 50% by 2020, and crop net revenues could fall by as much as 90% by 2100, with small-scale farmers being the most affected. This would adversely affect food security in the continent.

Climate change will aggravate existing water stresses and push countries that currently do not experience water stress into risk. Climate change and variability are likely to impose additional pressures on water availability, water accessibility and water demand in Africa. Even without climate change, several countries in Africa, particularly in northern Africa, will exceed the limits of their economically usable land-based water resources before 2025. About 25% of Africa's population (about 200 million people) currently experience high water stress. The population at risk of increased water stress in Africa is projected to be between 75-250 million and 350-600 million people by the 2020s and 2050s, respectively.

Changes in a variety of ecosystems are already being detected, (particularly in southern African ecosystems), at a faster rate than anticipated. Climate change, interacting with human drivers such as deforestation and forest fires, are a threat to Africa's forest ecosystems. Changes in grasslands and marine ecosystems are also noticeable. It is estimated that, by the 2080s, the proportion of arid and semi-arid lands in Africa is likely to increase by 5-8%. Climate change impacts on Africa's ecosystems are likely to have a negative effect on eco- tourism given projections that between 25 and 40% of mammal species in national parks in sub-Saharan Africa will become endangered.

Climate variability and change could result in low-lying lands being inundated, with resultant impacts on coastal settlements. Climate variability and change, coupled with human-induced changes, may also affect ecosystems e.g., mangroves and coral reefs, with additional consequences for fisheries and tourism.

[2] Edited extracts from Chapter 9 of: Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha, R. Tabo and P. Yanda, 2007: Africa. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge UK, 433-467.

The projection that sea-level rise could increase flooding, particularly on the coasts of eastern Africa, will have implications for health. Sea-level rise will increase the high socio-economic and physical vulnerability of coastal cities. The cost of adaptation to sea-level rise could amount to at least 5-10% of gross domestic product.

Human health, already compromised by a range of factors, could be further negatively impacted by climate change and climate variability, e.g., malaria in southern Africa and the East African highlands. It is likely that climate change will alter the ecology of some disease vectors in Africa, and consequently the spatial and temporal transmission of such diseases. The need exists to examine the vulnerabilities and impacts of future climate change on other infectious diseases such as dengue fever, meningitis and cholera, among others.

At this conference we will need to discuss our South African Climate Change Response, taking into account the above picture and would also need to consider how we could best support and participate in broader African initiatives to address Climate Change. South Africa is currently the chair of the African Ministerial Conference on the Environment (AMCEN) and in that capacity has worked with the United Nations Environmental Programme (UNEP) to begin to structure a support programme to build African capacity around Climate Change. Over time, we will need a much more coherent African response and also joint programmes in particular with our neighbouring countries.

PART TWO - SOUTH AFRICA

4. CLIMATE VULNERABILITIES, IMPACTS AND ADAPTATION[3]

As identified above, South Africa is predicted to experience the impacts of climate change in a particularly severe way. The text below outlines in summary form issues drawn from the state of the science in relation to key sectors. It is important to note that the success of strategies to adapt to the impacts of climate change must be based on high quality information, sound modelling of long term trends. It is on the basis of this that sectoral and regional vulnerability assessments and the ability to integrate the results of all this work into government's short and long-term planning and budgeting can be done. The discussions in the presentation of the Science of Climate Change will elaborate on this summary and form a basis for discussion of what needs to be done to develop and implement an adequate response to the challenges posed.

4.1 Climate observations and trends

There have been noticeable changes in regional climatic trends in Southern and South Africa that are very likely attributable to anthropogenic climate change. Air temperatures over the past thirty years have increased and statistically significant trends of increased maximum temperatures have been recorded for the western and southern half of the country, and the north-west region. There are fewer frost days, particularly on the inland plateau. There is weak evidence of drying in the north-west, and a wetting in the north-east since the 1950s. Significant increases in the intensity of extreme rainfall events have been identified over more than two thirds of the country, and are broadly consistent with climate change projections.

4.2 Projected climate scenarios

Air temperature is virtually certain to continue to increase by between ~1^{o}C and 3^{o}C across the country over the next three to five decades at least, with the greatest increases towards the interior, and strongest trends in the daily minimum temperatures. Regional rainfall scenarios project a general drying in most seasons in the SW parts of the western Cape, and between 5 and 30% reductions during autumn and winter months. In summer and autumn the northern and eastern regions of the country are likely to become wetter, especially over regions of steep topography around the escarpment . The projected changes in the intensity and frequency of precipitation events remain uncertain.

Scenarios of regional climate change remain uncertain, particularly with regard to rainfall projections. There is a wide range of possible rainfall scenarios, especially in summer rainfall region. Projections of temperature can be made with a far higher level of confidence than those of rainfall.

4.3 Water Resources and Hydrology

Climate change and climate variability has imposed additional uncertainty on the availability of water, its accessibility and its demand. Even in the absence of climate change, present population growth trends and water use behaviour indicate that South Africa will exceed the limits of the economically usable, land-based water resources by 2050. Negative impacts of climate change will worsen the problem of water shortage, making these predictions even more imminent. If SA does not respond to negative impacts of climate change urgently, water crisis is a definite probability.

Rainfall pattern and water availability are the two mostly affected processes as a result of climate change. While heavy rainfall occurs in some parts of the world, the SADC region is faced with very short and high-intensity rainfall patterns followed by prolonged droughts. This compromises the existing storage capacity, resulting in water shortages that are not predictable through rainfall records.

A general increase of evapotranspiration by ~ 5 – 15%, projected throughout the region by ~2050, threatens sustainable water resources directly. South Africa is projected to have a higher relative irrigation water demand by ~2050. Indirect

[3] Edited extracts from the Executive Summary of: Midgley GF, et al. (2007) *Impacts, vulnerability and adaptation in key South African sectors: An input into the Long Term Mitigation Scenarios process,* LTMS Input Report 5, Energy Research Centre, Cape Town.

implications through reduced soil moisture levels could impact runoff generating mechanisms and dryland agriculture quite markedly, although all those processes will occur in interplay with as yet uncertain rainfall changes.

The annual number of storm-flow events is projected to decrease by ~2050 over most of the country, including some of the most crucial source regions of stream-flows in southern Africa such as the Lesotho highlands. Future increases in storm-flow events per year are simulated over much of the Northern Cape (where few storm-flow events currently occur), as well as in the Northwest of the country. Greater rates of soil erosion are projected by ~2050 over much of the interior in median and especially in wet years. Much of South Africa is projected to have more variable stream-flows despite higher predicted flows overall. However, parts of the Western Cape are projected to have considerably lower variability relative to the present, and lower overall predicted stream-flows.

4.4 Agriculture

Both summer and winter rainfall regions face challenges to agricultural production by ~2050. Winter rainfall agriculture faces imminent significant threats particularly due to projected increasing water shortages, resulting in greater competition with urban use of water, lower yields and greater yield variability in both irrigated and rain-fed crops. Additional heat stress will reduce the productivity of perennial and annual crops, especially chill unit-dependent deciduous fruit, and livestock.

Net water requirements for crops in the summer rainfall region are projected to increase by between 10 and 30% throughout southern Africa by ~ 2050. Projections for profitability of maize production are sensitive to temperature, rainfall and CO2 fertilization scenarios. A 2°C temperature increase alone is projected to reduce profits by around R500/ha across the highveld maize region, but CO2 fertilization may mitigate this loss almost completely.

Many autonomous adaptation options in agriculture exist that are simply enhancements of existing risk management or production enhancement activities. Where crops are near climate tolerance thresholds, or where multiple stresses exist (e.g. soil degradation), or where producers' capacity for autonomous adaptation is exceeded, deliberate planned measures (i.e. acclimation-type adaptation) will become necessary. The secondary impacts of projected climate changes on the broader rural and regional economy could be substantial, but have not yet been adequately quantified. Changes in the distribution of agricultural pests and their resilience to different temperature and weather scenarios, and the impacts of this on plants, animals and humans are an area for further detailed work.

4.5 Forestry

The formal forestry sector faces a wide range of potentially plausible outcomes that are very sensitive to projected rainfall change. Drought during 1991/92 caused the loss of approximately R450 million to the industry. With expected temperature increases by ~2050 of 2ºC and a reduction in rainfall of 10%, most forestry species show reduced viable production area of between 40% and 100%, but an increase of between 50% and 90% in planting area if rainfall increases by 10% with 2ºC warming. It should also be noted that the forestry sector is a key sector in relation to mitigation and carbon sequestration. The potential for this in South Africa must be assessed and investigated.

4.6 Biodiversity and ecosystems

Projections of enhanced extinction risk for several tens of percent of endemic species remain within the range of possible outcomes, but probably represent an extreme outcome by ~2050.

Several savannah woodland and grassland ecosystems may store between ~20 and 600% more carbon than currently stored due to temperature, rainfall and CO2 fertilization effects, but this is likely to depend to a large extent on future fire regimes. Fire regimes typical of several of South Africa's dominant ecosystems, such as Fynbos, Grasslands and Savannah, are projected to show a greater frequency, and possible increase in mean size with projected regional climate change, due to the prevalence of higher fire risk conditions for longer periods of time. Similarly in the marine context, climate change poses threats to the integrity of existing marine ecosystems, as well as to the fisheries that these ecosystems support.

4.7 Human health

The immediate health impacts of extreme climatic events are well established and documented, but the impacts of gradual changes in temperature and precipitation are less tangibly measurable. The pattern of increasing extreme rainfall events and rising temperature favour the geographical expansion of the borders of vector borne diseases such as

malaria. This is supported by several mathematical models as well as surveillance and direct observations in many quarters. Climate impacts on human health will interact with those on rural livelihoods, in particular.

4.8 Rural livelihoods

The impact of climate variability on assets links directly to the impact on livelihood activities. Production and income activities are likely to be significantly affected by climate change and increased climate variability by ~ 2050 at least, particularly in rural areas where changes in rainfall directly affect agriculture and natural resources that underpin many production and income activities. In South Africa, there is growing evidence of how changes in rainfall impact on livelihoods by increasing vulnerability of farming systems.

Adapting to climate change at the rural livelihood scale will be a critically important. It is particularly important to focus on the most vulnerable groups, so that their livelihoods are not eroded by climate events but rather to facilitate resilience to the expected changes in climate. This requires an integrated approach of both acclimation type and resilience type adaptation responses that address multiple sectors whilst combining the knowledge of vulnerable groups together with specialist insights.

4.9 Urban environment

Increasing frequency and intensity of extreme precipitation events will result in higher risk of flooding episodes in urban settings, and drought induced water shortages and fire risk, particularly in the Western Cape. Enhancement of resilience-type adaptation responses such as disaster management will become increasingly important to cope with this growing challenge. Whilst more gradual, the potential of sea level rise impacts, especially when accompanied by high tidal and storm events, are relevant for key coastal areas that are identified as vulnerable due to high population densities and settlements and infrastructure of all types.

Extreme events such as heat waves are expected to increase in frequency and severity with increased risk of mortality amongst the elderly and sick, and attendant risk of fire in informal settlements. Acclimation type adaptation responses to reduce urban heat loads, such as through greening programs, could help in reducing this threat.

5. GREENHOUSE GAS EMISSIONS AND SOUTH AFRICA'S MITIGATION POTENTIAL[4]

5.1 Introduction

South Africa has an emissions intensive economy primarily due to our reliance on coal based sources of power. In world terms we are the 11th highest emitter of greenhouse gases. A population or GDP measure places us even higher. We are also a developing country and must recognise the need for our economy to grow sustainably and for our infrastructure base to be expanded in order to meet the needs of our population for economic growth, job creation and poverty eradication.

The challenge we face as a country therefore, is how we both achieve our growth objective and we reduce our greenhouse gas emissions. In addition, this challenge must now be met within a global context of recession and declining growth that is likely to last for some time into the future, and that may have as yet unknown impacts on the world economy.

In the USA and the UK and on the agenda of the G20 is the concept of a "green" or "low carbon" path to economic recovery. Indeed, our President in the State of the Nations Address at the opening of Parliament in February, referred to the creation of "green jobs".

The following section of this document, sets out in broad terms the result of our latest Greenhouse Gas Inventory (base year 2000) and also the key conclusions of the Long Term Mitigation Scenario process as a framework within which we can begin to conceptualise our country's mitigation response.

[4] Much of the initial text in the following sections are edited extracts from South Africa's Initial National Communication under the United Nations Framework Convention on Climate Change, October 2000

5.2 The 2000 Greenhouse Gas Inventory[5]

South Africa's total greenhouse gas emissions in 2000, including emissions from bunker fuels is estimated to be around ~446 Mt CO_2-eq. This amounts to a ~28% increase in emissions in the last ten years from 1990. Of this, emissions from the combustion of fossil fuels for energy provision accounts for ~73% of total emissions (75% in 1990), an increase of ~25% since 1990. The next most significant sector is emissions from the agriculture, forestry and land-use sector that accounts for ~8% of total emissions (12% in 1990), a decrease of ~9% since 1990. The third most significant sector is the industrial processes sector that accounts for ~3% of total emissions (9% in 1990), a decrease of ~54% since 1990. The waste sector is the forth most significant sector and accounts for ~2% of total emissions (4% in 1990), a decrease of ~47% since 1990.

In terms of the sub-sectors that account for more than 1% of total emissions (together accounting for ~86% of total emissions), the following list ranks these sub-sectors in order of significance –

Source of emissions	2000 emissions	
	CO^2e Gg (Kt)	% of total emissions
Energy, Energy Industry - Sub Bituminous coal for public electricity	171,578	38%
Energy, Fugitive Emissions - Underground mining	43,115	10%
Energy, Energy Industry - Refinery coal	28,638	6%
Energy, Transport - Road Gasoline	25,005	6%
Energy, Manufacturing and construction - Other bituminous coal	24,503	5%
Agriculture, Forestry and Land Use, Livestock - Enteric Fermentation	18,986	4%
Agriculture, Forestry and Land Use, Livestock - Others	18,016	4%
Energy, Transport - Road Gas/Diesel	11,596	3%
Waste - Solid waste disposal on land	8,085	2%
Energy, Energy Industry – Auto-producers	7,858	2%
Energy, International Bunkers - Marine RFO	7,836	2%
Industrial Processes, Metal Industry - Iron production - Blast furnaces	7,304	2%
Industrial Processes, Metal Industry - Steel production oxygen furnace	6,825	2%
Energy, Manufacturing and construction – Blast furnace gas	4,823	1%
Total sub-sectors that account for more than 1% of total emissions	384,168	86%

It should also be noted that the base year for the most recent inventory is 2000 and South Africa's economy has grown quite dramatically from this time. Therefore, it is assumed that South Africa's greenhouse gas emissions in 2009 are likely to be substantially higher than those reflected in the 2000 base year inventory figures.

In this regard, and in order to ensure that current and future greenhouse gas mitigation interventions are properly monitored and measured, the Department of Environmental Affairs is in the process of developing the National Greenhouse Gas Information Management System as part of the South African Air Quality Information System (SAAQIS) that is hosted by the South African Weather Service. This system is likely to include mandatory greenhouse gas emission reporting by all significant emitters and emission information holders.

In support of this work, and in order to continuously improve the accuracy of the greenhouse gas inventory, both the departments of Transport and Agriculture are compiling detailed sector inventories to feed into, and complement, the national inventory. A cooperative relationship with industry in relation to greenhouse gas reporting has also been developed and lays the basis for on-going reporting over time.

[5] Please note that, although information is from the 2000 inventory compiled as an output of the Department of Environmental Affairs and Tourism's Greenhouse Gas Information Management Project, the information remains a working draft until signed off by the Project Steering Committee. Furthermore, this information has not been subjected to an independent audit, peer review or public comment process. Thus, the broad circulation and/or citation of this information is discouraged until such time as the independently audited and peer reviewed draft is formally published for public comment in the Gazette.

5.3 The Long Term Mitigation Sector Process and its Scenarios

The LTMS was a research based, scenario building process designed to assess the potential for greenhouse gas mitigation within the South African economy over a 50 year period. The LTMS was undertaken in a participatory manner through the establishment of a Scenario Building Team that brought together a wide range of stakeholders across government, business, labour, and the scientific community to look at options emanating from information generated by a large team of researchers.

The LTMS team modelled South Africa's greenhouse gas emissions over a 50 year period, using information provided by generators and by a range of government sources, and agreed to by the Scenario Building Team. MARKL, the modelling tool used is an internationally used energy modelling tool that produces least cost results in relation to the parameters fed into it. The key conclusion of the modelling is that if South Africa does not engage with the need to reduce its emissions, there would be a four fold increase in these emissions over the next 50 years. Given the fact that world emissions would double in this period, it would create serious problems for South Africa as a global citizen.

The result of this modelling was a series of potential interventions that could be put in place to reduce our greenhouse gas emissions as summarised in the following table -

Mitigation action	Mitigation Cost (R/tCO_2-eq)[6]	GHG Emission Reduction 2003-2050 (Mt CO_2-eq)[7]	Cost Ranking[8]	Emission Reduction Ranking[9]	Mitigation Costs as Share of GDP (%)[10]
Limit on less efficient vehicles	-4,404	18	1	36	-0.2%
Passenger modal shift	-1,131	469	2	16	-1.1%
Improved vehicle efficiency	-269	758	3	14	-0.4%
SWH subsidy	-208	307	4	25	-0.1%
Commercial efficiency	-203	381	5	22	-0.1%
Residential efficiency	-198	430	6	21	-0.1%
Renewables with learning	-143	2,757	7	10	-0.4%
Industrial efficiency	-34	4,572	8	5	-0.3%
Agriculture: manure management	-19	47	9	34	n/a
Land use: fire control and savannah thickening	-15	455	10	17	0.0%
Cleaner coal	-4.8	167	11	28	0.0%
Aluminium	0.2	29	12	35	0.0%
Renewables with learning, extended	3	3,990	13	6	0.0%
Synfuels methane reduction	8	146	14	30	0.0%
Waste management	14	432	15	20	n/a
Nuclear	18	1,660	16	12	0.0%
Nuclear, extended	20	3,467	17	8	0.1%
Agriculture: reduced tillage	24	100	18	31	0.0%
Land use: afforestation	39	202	19	27	0.0%
Escalating CO2 tax	42	12,287	20	1	0.9%
Agriculture: enteric fermentation	50	313	21	24	0.0%
Renewables	52	2,010	22	11	0.1%
Nuclear and renewables, extended	52	8,297	23	2	0.8%
Nuclear and renewables	64	5,559	24	4	0.6%
CCS 2 Mt	67	306	25	26	0.0%
CCS 20 Mt	72	449	26	19	0.1%
Renewables, extended	92	3,285	27	9	0.6%
Electric vehicles with nuclear, renewables	102	6,255	28	3	1.1%
Synfuels CCS 23 Mt	105	851	29	13	0.1%
Subsidy for renewables	125	3,887	30	7	0.8%

[6] Average of incremental costs of mitigation action vs. base case, at 10% discount rate
[7] Positive numbers are reductions of emissions by sources or removals of emissions by sinks
[8] Lowest cost is ranked 1.
[9] Greatest reduction is ranked 1.
[10] Negative numbers mean lower costs

Mitigation action	Mitigation Cost (R/tCO_2-eq)[6]	GHG Emission Reduction 2003-2050 (Mt CO_2-eq)[7]	Cost Ranking[8]	Emission Reduction Ranking[9]	Mitigation Costs as Share of GDP (%)[10]
Coal mine methane reduction (50%)	346	61	31	33	0.1%
Synfuels CCS 2 Mt	476	78	32	32	0.0%
Biofuels	524	154	33	29	0.1%
Electric vehicles in GWC grid	607	450	34	18	0.5%
Biofuel subsidy	697	573	35	15	0.4%
Hybrids	1,987	381	36	23	0.5%

Some of these interventions would result in relatively large reductions in greenhouse gases and others would result in smaller reductions. All of them are important and all would have some impact in putting South Africa on to a low carbon growth path.

These interventions were then put together into a set of possible scenarios that could be considered in developing a low carbon strategy for the country.

Three possible strategic options were finally agreed on and were constructed through putting together different combinations of the above interventions –

- Start Now – a combination of interventions that save money over time including, industrial efficiency, renewables, nuclear, passenger modal shift and improved vehicle efficiency.
- Scale Up – a combination of interventions that further extend the actions in Start Now and adding more interventions with positive cost including, industrial efficiency, renewables (extended), nuclear (extended), carbon capture and storage (CCS) from synfuels (23 Mt) and electric vehicles powered from a coal-dominated grid.
- Use the Market – a combination that is additional to, or replacing, the first two options, with an emphasis on tax and incentive packages including an escalating CO_2 tax and subsidies for renewables, biofuels and solar water heating.

The impacts of these three options compared to our current development path is summarised in the following table -

Mitigation action	Mitigation Cost (R/tCO_2-eq)	GHG Emission Reduction 2003-2050 (Mt CO_2-eq)	Cost Ranking	Emission Reduction Ranking	Mitigation Costs as Share of GDP (%)
Current Development Plans	-510	3,412	1	4	-2.4%
Start Now	-13	11,079	2	3	-0.5%
Use the Market	10	17,434	3	1	0.1%
Scale Up	39	13,761	4	2	0.8%

The LTMS concluded that –

- Growing without carbon constraints may be good for South Africa's economic growth, but it will result in rapidly increasing emissions. A four-fold increase in emissions by 2050 is likely to be unacceptable to the international community. It is also a high-risk approach on other grounds, such as rising oil prices, carbon constraints in trade, and advancing impacts.
- If all countries, including high emitters in the developing word, adopted a Growth without Constraints approach, climate change impacts in South Africa would be extensive.
- A massive effort would be needed by South Africa to achieve emissions reduction sufficient to meet the Required by Science target. The gap between where South Africa's emissions are going and where they need to go is large (1300 Mt CO_2-eq, more than three times South Africa's annual emissions of 446 Mt in 2003).
- Certain quantifiable strategic mitigation options are immediately implementable, even if they require significant effort. These include: energy efficiency, especially in industry; electricity supply options; Carbon Capture and Storage (CCS); transport efficiency and shifts; people-oriented strategies; supported by awareness. These

potential strategies show good emissions reduction results with costs to the economy ranging from affordable to significant. Significant mitigation action can have net public benefits, such as savings in energy bills and increased employment.

- Within the quantifiable mitigation strategies, South Africa can choose both regulatory and economic instruments. Neither of these, however, completely closes the gap. With an escalating tax, economic instruments go the furthest in closing the gap – by almost three-quarters. But they are not intrinsically more effective than regulation.
- Preparing for a range of further, more uncertain and (for now) less understood actions – from future technology to changes in social behaviour – needs immediate exploration.
- Key to success will be strong, committed and engaged South African leadership in government, business and civil society, coupled with international alignment and active support.

The LTMS process also undertook an both a static and a dynamic economy wide modelling process in order to understand the impact of the proposed interventions on factors such as GDP, employment and household welfare. Among the conclusions of this modelling was the potential for a notable increase in jobs due to the fact that many renewable energy technologies offer substantial job creation possibilities and also a minimal impact on GDP over the time period as a result of a shift to a low carbon growth path.

The LTMS and its conclusions have been debated fairly widely over the past year. however, in the policy process going forward, it will be necessary to address its conclusions in far more detail in order to derive a detailed implementation plan into the future.

PART THREE - THE SOUTH AFRICAN CLIMATE CHANGE RESPONSE

Following the conclusion of the LTMS process, a number of key policy approaches were agreed on by Cabinet. These are summarised below and provide an organising framework and starting point for the key policy areas that must be debated and addressed going forward in the policy process.

6. SOUTH AFRICA AS A GLOBAL CITIZEN

South Africa recognises that the carbon space is finite and some 70% of the "safe" carbon space has already been used up, due largely to the development pathways taken by industrialised countries in the past. At the same time, South Africa acknowledges that the solution to the climate change crisis requires concerted action on a global scale and that all countries share responsibility for the future. Therefore, it is important to agree on an effective international regime to deal with the global climate challenge in such a way that equitably shares the remaining carbon "development" space as well as sharing both past and future responsibility for climate stabilisation. In this context, South Africa is committed to work towards the achievement of a global agreement on climate change that ensures a balance between climate action and sustainable development; prioritises both adaptation and mitigation and that has high levels of ambition in order to avoid dangerous and irreversible climate change. For South Africa a central part of this agreement would be the requirement for all developed countries to take the lead by making deep legally binding quantified emission reduction commitments with a mid-term target towards the upper end of the ranges of 25% - 40% below 1990 levels by 2020 and 85% to 90% below 1990 levels by 2050. In turn, South Africa would play its part in reducing its greenhouse gas emission by ensuring that as a developing country it will undertake mitigation actions in a manner that is appropriate to our national circumstances, including our sustainable development objectives and our imperative to address poverty eradication and achieve economic growth. In line with the principle of equity, these actions need to be underpinned by the requirement for the international community to make commitments regarding the necessary financial, technical and capacity building support to enable implementation of these mitigation actions. Furthermore, South Africa would want to see equivalent levels of support for adaptation action, including, financing, technology transfer and capacity building be a central part of such a deal.

7. GHG EMISSION REDUCTIONS AND LIMITS

Climate change mitigation interventions should be informed by, and monitored and measured against a " peak, plateau and decline" emission trajectory where Greenhouse gas emissions stop growing (start of plateau) in 2020-25 and begin declining in absolute terms (end of plateau) in 2030-35.

[The LTMS conclusions demonstrate that there is considerable room for reduction in greenhouse gas emissions in the South African economy. To achieve this requires a conscious commitment to a transition towards a low carbon economy, with the concomitant shifts away from coal fired energy towards, nuclear and renewable, as well as the introduction of far reaching energy efficiency measures. It is important to note that an important condition for this to happen would be the provision of finance and technology by the international community to support national initiatives. This is currently being negotiated by the UNFCC and it is important to note that any interventions supported by international finance and technology would need to be monitored, reported on and verified and a similar set of conditions would apply to the finance and technology that is provided.

In order to achieve this, South Africa must establish a regulatory framework and set of partnerships to ensure that there is accurate measurement of greenhouse gas emissions by sector and that these measurements are regularly updated and the results made known. The latest Greenhouse Gas Inventory presented at this conference (see 5.2 above) is the first step in this process. The existing agreement with Business Unity South Africa on industry greenhouse gas reporting, as well as its participation in the GHG inventory work lays the basis for further work to agree on a South African GHG reporting system that lays the basis for emission reduction plans to be developed in specific economic and industrial sectors.

The "peak, plateau and decline" described above sets an ambitious framework for South Africa's low carbon growth strategy. The following key issues should be noted in relation to this.

- The increase in greenhouse gas emissions that will take place until the peak is reached derives from the LTMS modelling and presumes that most large infrastructure projects currently planned, including additional coal fired power stations, coal to liquid plants, refineries, and other large industrial facilities will be built.

- At the same time, the stabilisation phase would imply that there has been a dramatic increase in the achievement of energy efficiency economy wide; that there is a substantial increase in the amount of renewables and nuclear in our energy mix; that there has been a substantial switch in modal transport to low carbon and public transportation; that a fiscal and economic framework that supports carbon reduction is in place; and finally that new low carbon technologies are coming on stream on a commercial basis.
- In relation to the absolute reduction of greenhouse gases it is assumed that renewable and nuclear infrastructure provides the bulk of our electricity as old coal installations reach the end of their lives, that new transport technologies such as electric vehicles are widely available and that our economy is run at a high level of efficiency. Finally, it presumes that a fiscal and regulatory framework is in place that both incentivises efficiency and renewables and that penalises those who produce excess carbon. This would obviously link into the global carbon market.

The achievement of this is clearly contains huge challenges, embodying as they do, a fundamental restructuring of the way in which our economy is powered, our industry produces and the ways in which we live our daily lives.

In particular, the Department of Public Enterprises has drawn attention to the impacts of the global economic crisis on the affordability of the proposed trajectory and in particular on South Africa's ability to pay for the transition that is envisaged. Already, the planned nuclear roll out has been pushed back and the imperatives of the country's current energy supply situation has resulted in 3 more coal fired power stations being planned.

8. BUILD ON, STRENGTHEN AND/OR SCALE UP CURRENT INITIATIVES

Current energy efficiency and electricity demand-side management initiatives and interventions must be scaled-up and reinforced through available regulatory instruments and other appropriate mechanisms (made mandatory) In this regard proposed regulations being prepared by the Department of Minerals and Energy Affairs and the work done by NERSA in relation to the pricing structure for electricity, all have important greenhouse gas benefits. .

The electricity-crisis response and government's energy efficiency policies and strategies including the renewable energy and energy efficiency targets of, in climate change terms, offer an opportunity for a starting point to a deep and permanent approach to energy conservation that would support the achievement of the greenhouse gas emissions limitations framework agreed to as a result of the LTMS work.

Treasury has over the past number of years worked on an environmental fiscal reform framework and has recently begun to put budgetary measures in place that encourage both energy conservation as well as disincentive the use of environmentally "unfriendly". In the 2009 budget speech the Minister of Finance announced an adjustment to excise duties on motor vehicles by introducing an additional excise duty that takes account of the amount of carbon emitted by different vehicles; a charge of about R3 a light bulb on incandescent bulbs; and also proposed that investments by companies in energy efficient equipment should qualify for an additional allowance of up to 15%. This is on top of last years announcement of a 2c/kilowatt hour levy on non renewable sources of electricity that is to be effected this year. In effect, these measures are the beginnings of the pricing of carbon within the South African economy. Furthermore, Treasury is taking forward the LTMS recommendation to undertake a study on carbon taxation and is undertaking a carbon pricing study. The DTI and NEDLAC are also looking at fiscal incentives for carbon reductions. These two pieces of work are key inputs into a comprehensive fiscal framework that will provide necessary incentives and disincentives in relation to achieving carbon reductions economy wide.

In discussion at the conference the nature of this framework and the ways in which a price on carbon could be established are important areas for discussion. In particular, the issue of carbon taxation, the establishment of a cap and trade system as well as carbon trading should all be discussed as key policy areas.

9. IMPLEMENTING THE "BUSINESS UNUSUAL" CALL FOR ACTION

South Africa's current energy supply crisis has created an opportunity for a thorough going transformation in the way that our economy and society is powered. Additionally, green jobs and economic initiatives are being proposed worldwide as a key element of an economic recovery strategy. South Africa along with the rest of the world, must make the transition to a climate resilient and low-carbon economy and society by balancing our mitigation and adaptation response and, in the long-term, by redefining our competitive advantage and structurally transforming our economy through a shift from an energy-intensive to a climate-friendly path as part of a pro-growth, pro-development and pro-jobs strategy

Deriving from the LTMS conclusions, as well as South Africa's current need to reduce pressure on grid electricity until new capacity is on stream, the renewable energy sector should be identified as a key "business unusual" growth sector and policies and measures would need to be put in place to meet a more ambitious national target for renewable energy. This is consistent with the policy approach being taken by the Department of Mineral and Energy Affairs in relation to wind power and initiatives by the Department of Trade and Industry to facilitate a much larger roll out of solar thermal power than presently exists. Similarly the imminent announcement by the national electricity regulator of a feed-in-tariff for renewables, should go a long way to creating a framework that would allow for significant expansion of this sector. Other important initiatives in this regard, work being done to set "Green Building" Standards, as well as plans to retrofit existing buildings and industrial facilities with energy efficient and clean technologies.

The transport sector is yet another key "business unusual" growth sector and policies and policies and measures are being put in place to substantially reduce of GHG emissions from this sector. These measures include the various national, provincial and local initiatives around modal shift in passenger transport, the regeneration of the rail network, and the work being done to reduce vehicle emissions.

10. PREPARING FOR THE FUTURE

Government is committed to ensuring on-going and increased support for new and ambitious research and development initiatives in the field of carbon-friendly technologies – with the focus on the renewable energy and transport sectors. To this end the Department of Science and Technology (DST) has produce a Climate Change R+D Strategy and has also completed a Climate Change Technology Needs Assessment that has been submitted to the UNFCCC and that provides a high level assessment of technology transfer requirements in relation to both mitigation and adaptation.

South Africa is also engaged in a number of future oriented technology research initiatives. These include Government's support for the Joule – South Africa's electric vehicle, as well as R+D into thin film and other new solar technologies, including the possibility of a concentrated solar power plant.. In addition, South Africa participates actively in research initiatives are focused on clean coal technologies, and carbon capture and storage. There is also scope for South African scientists to participate in international work on longer term and innovative climate change solutions.

In the final analysis, combating the risks posed by climate change is an endeavour that requires a broad public awareness and understanding and a concomitant change in behaviour patterns, particularly by those leading energy intensive and environmentally unfriendly lives. Government is committed to using formal and informal forms of education and outreach to encourage the behavioural changes required to support the efficient and effective implementation of the climate change response policy and to support the development of mass awareness campaigns in this regard.

The LTMS (see 5.3, page 14) specifically looks to the future in its 'Reaching for the Goal' option, an action package that looks at interventions where the exact costs cannot be modelled, nor can the economy-wide impacts. The principal reason for this lies in the unknown technologies and behavioural changes that will have to mark this scale of emission reductions. Whilst it is acknowledged that the components of this strategic option cannot be modelled with any accuracy as was done with the other options, the LTMS attempted to describe some of what its salient characteristics might have to be by 2050 as described in the following sections.

10.1 New Technology

In the LTMS' 'Reaching for the Goal', technologies are seen as systems. Stand-alone technologies are integrated into larger systems, and taking a system view can increase savings. Technology interacts with human behaviour: An example would be a decentralised grid, in which citizens can generate their own electricity and pass surpluses back to the grid. Integrating distributed generation into the grid requires further research and development (R&D). Such efforts should build on the Department of Science and Technology's climate change R&D strategy.

These technologies require aggressive research and development effort, which should begin at the same time as the Start Now Strategy. Bringing these technologies to the market, at scale, backed up by investment, and driven by appropriate policy, is critical to 'Reaching for the Goal'.

10.2 Resource identification

The second set of actions refers again to technology, but with the stress on resource availability. Here two technologies stand out: imported hydro energy from the Congo or East Africa, and natural gas from Kalahari and elsewhere. Significant gas found in the region would play a significant role in switching from coal. Security problems would have to

be solved with imported hydro-electricity from our African neighbours. These two resource issues need further investigation, including the related political issues.

10.3 People-oriented measures

One of the most compelling results of LTMS is that although most of the significant emissions reductions need to be within the energy sector, the technology-based actions, even when all carried out together, do not "close the gap". Hence one must turn to the least studied of the possible options – social behaviour.

Changes in social behaviour, whether driven by policy, education, or awareness, may yet prove to have large scale and low cost mitigation effects. This may be so across a number of sectors –

- Human habitation, urban planning and the built environment are all areas where social change and new patterns, approaches and expectations will likely have significant mitigation effects.
- The distance between work, home and other life functions is also a factor.
- Modal shifts to public transport, moves away from individual car ownership towards the operation of shared vehicles, and other transport shifts deserve study. Business, commerce and consumption is currently heavily linked to transport of people. Much of this could potentially be replaced by, for example, internet-based interfaces.
- Food production and consumption, as well as the localisation of these activities, are also examples worthy of study.
- Population growth, but more importantly the growth of an urbanised population with high commodity expectations, could also be studied to see which changes may result in emissions reductions and how these might be driven.
- Tree planting and greening of towns is important.

10.4 Transition to a low-carbon economy

Another compelling result from LTMS concerns the composition of the South African economy. The composition of the economy has played a major role in our high emissions, and any change in this and in our competitiveness, is worthy of further assessment. Perhaps the most difficult but most fundamental approach to mitigation would be to shift South Africa's economy away from its energy-intensive path.

The LTMS results suggest that energy efficiency and a cleaner fuel mix are significant mitigation actions, but in the long run, the challenge is to consider the energy-intensity of our economy, structurally.

Considering this path would mean that instead of investing in energy-intensive sectors, which were at the heart of our economy over the twentieth century, South Africa would move towards a low-carbon economy. Industrial policy would then favour those sectors that use less energy per unit of economic output. Such a change would have to be integrated into the Department of Trade and Industry's National Industrial Policy Framework and Action Plan.

Over time, most economies shift from primary and secondary sectors to tertiary sectors. South Africa's GDP has already shifted significantly from mining through manufacturing to services. Associated with this shift is a decrease in energy intensity. Yet policy still tends to define competitive advantage around energy-intensive sectors. Climate change may require that we re-define what we mean by competitive advantage. This could have several dimensions.

One dimension would be to focus on those parts of the economy which are not so sensitive to energy price rises. A transition to a low-carbon economy in South Africa might involve shifting incentives – removing incentives for attracting energy-intensive investments and using the resources freed up to promote lower-carbon industries.

A low-carbon economy will not emerge overnight. Energy-intensive industries will continue to exist, and a comprehensive strategy would have to include transition for these sectors and their labour forces.

Policies to assist energy-intensive industry would include promoting higher value-added sectors, as well as ambitious energy efficiency targets (since the potential for energy savings are greater here).

More proactively, the transition would define new areas of advantage in climate-friendly technology. In much the same way as Brazil has become a world leader in biofuels, South Africa could deliberately seek to build new competitive advantage in climate-friendly technologies, such as solar thermal electricity. The aim would be to become a market leader, with Government providing supporting measures.

11. VULNERABILITY AND ADAPTATION

The impacts of climate change are already being felt in South Africa and will exacerbate existing challenges and create new ones in relation to climate variability, extreme weather events and changing rainfall patterns, This will affect a wide range of economic sectors and livelihoods and impact in major ways on the development of infrastructure into the future.

Government at all levels is committed to improving its climate forecasting and early warning systems, and conducting regular vulnerability assessments as a basis from which to be able to respond proactively to the risks posed by climate change. At both sectoral and regional levels, adaptation plans will need to be developed in order to build climate resilience. and improve our ability to respond to extreme weather events and climate linked disasters. These key sectors include infrastructure, planning, agriculture, biodiversity, water resource management and health sectors. Affected government departments must ensure that climate change adaptation strategies and plans in their sectors are included as departmental key performance areas

More than this however, the success of many adaptation initiatives will be experienced at community levels and in the ability of the poor to be able to respond successfully to climate challenges. In this regard work addressing vulnerability and adaptation has to have as a key element, the nature of the institutional structures, participatory processes and levels of ownership necessary to ensure that good policy results in good practice and successful outcomes.

Building climate resilience therefore is an on-going and integral part of government work. In relation to this we must also recognise that sound attention to the sustainability of our policies and programmes and best environmental practices will take us a long way towards coping with the challenges of climate change.

Already, there is a vast body of research and information that supports the work must be done. In particular, we should note the climate change strategies that have been developed by a number of cities and provinces as leading the way in an endeavour that must be both broadened and deepened.

Finally, although there is much work that has been done on adaptation, internationally and indeed on our continent and in our country, we cannot escape the fact that it is still often seen as second to mitigation. In discussion at this conference we must address this and give direction to the policy process going forward, that will ensure that South Africa achieves the desired adaptation, mitigation balance.

12. ALIGNMENT, COORDINATION AND COOPERATION

Climate Change and its consequences constitute the most serious challenge to the future of our planet. It is a cross cutting, social economic and environmental issue that must be placed high up on the political agenda so that its implications can be addressed in all elements of a government programme and in the way that society and economy are organized. The thrust of this document has been to argue that Climate Change is a key cross cutting issue in the organisation of the work of government now and for the foreseeable future.

Coherent and effective climate action demands that the roles and responsibilities of all stakeholders, particularly the organs of state in all three spheres of government in relation to climate change are clearly defined and articulated and that the mechanisms required to ensure alignment, coordination and cooperation must be specified. This is a prerequisite for ensuring the integration of climate change issues into the mainstream of government's work.

Ideally, all affected line departments must create a climate change capacity to drive the integration of climate issues into their programmes. This must apply at provincial and municipal levels. DEAT will continue to provide a central focal point for this work, and will ensure that coordination, information management and dissemination, and integration of the government's climate change programme takes place.

It is recognised that the country's climate change programme is an endeavour that requires a deep and on-going partnership across society. To this end, the National Committee on Climate Change will continue to provide a forum for discussion and consultation on the country's climate change strategy. Government will also continue to seek partnerships with labour, business and civil society in order to further the country's climate change agenda.

13. CONCLUSION

The above discussion document is primarily intended to provide information and an elaboration of key emerging policy directions as a basis for discussion at this conference. It is however not a stand alone document. By the time we discuss

it in the conference proceedings, we will have already heard a set of keynote addresses that will provide a framework for our deliberations and we will have also spent a full day discussing the science of climate change.

In the above context, we would like participants, both those physically at the conference and those interacting through the internet to consider what is in this document, as an aid to discussion and the starting point for the policy process outlined in its Introduction. Given the experience over the past few years of the deep interest and involvement of all spheres of Government, its social partners and civil society in finding a way forward in addressing the challenges of Climate Change and finding a South African response, we trust that our collective wisdom will generate a stimulating and challenging conversation to initiate the policy process.