

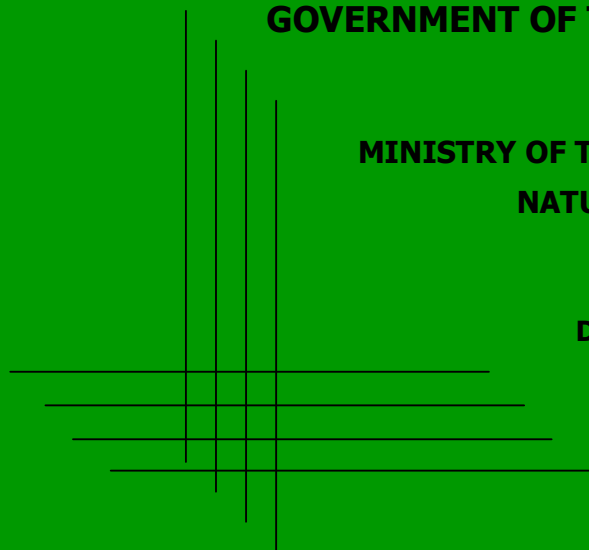


NATIONAL CLIMATE CHANGE RESPONSE STRATEGY (NCCRS)

GOVERNMENT OF THE REPUBLIC OF ZAMBIA

**MINISTRY OF TOURISM, ENVIRONMENT &
NATURAL RESOURCES**

December 2010



EXECUTIVE SUMMARY

Climate change is a significant development challenge globally and locally. It is likely that current extremes and challenges of climate variability (manifested often as floods and droughts) will be experienced for decades to come. Zambia has little influence over the direct causes of climate change and therefore more emphasis must be placed on how to respond and adapt to this looming crisis.

This National Climate Change Response Strategy (NCCRS) has been developed to support and facilitate a coordinated response to climate change issues in the country. The Strategy enables Zambia to position itself strategically to respond to the adverse impacts of climate change and contribute to the achievement of the overall objective of the UNFCCC, which it ratified in 1993.

The NCCRS' vision is "*a Prosperous Climate Change Resilient Economy*". Whereas the mission is "*to ensure that the most vulnerable sectors of the economy are climate proofed, and sustainable development achieved through the promotion of low carbon development pathways.*" By aiming to have the most sensitive economic sectors climate proofed, the NCCRS ensures that climate risks are addressed in the national development plans to minimize the adverse impacts of climate change and to ensure development effectiveness.

Both the vision and mission are aligned with Zambia's development priorities as articulated in a number of strategy papers including the National Long Term Vision 2030 (NLTV) and the Sixth National Development Plan (SNDP) (in progress and not yet published). They are also consistent with sectoral plans and other resources captured in the Medium Term Expenditure Framework (MTEF 2010 - 2012) within which the annual sectoral budgets are allocated. The NLTV is for Zambia to become a prosperous middle income country by the year 2030 through achieving a number of developmental goals including (i) reaching middle-income status (ii) significantly reducing hunger and poverty and (iii) fostering a competitive and outward looking economy (Fifth NDP, 2006 - 2010). In the NLTV, the process through which these goals would be achieved in the long-term, as well as the challenges that the economy would face, are outlined.

The NCCRS is aligned with and contributes to the fulfilment of the overall development goals of the NLTV. It also enhances "Pilot Programme for Climate Resilient (PPCR) project", which has targeted the financial sector and planning as a starting point to ensure that climate change issues are mainstreamed in the SNDP for sustainable economic development.

In the NLTV and SNDP, the Government of the Republic of Zambia (GRZ) has stressed the development of agriculture as the "engine of income expansion in the economy" since agriculture "offers the best opportunities for improving livelihoods" to about 60% of the total population and 70% of the poor who live in rural areas. Infrastructure, tourism, manufacturing, mining and energy are also prioritised as sectors that constitute the core economic sub-themes of the SNDP and NLTV. The NCCRS has also prioritised these same sectors for climate-proofing and sustainable development.

In the medium term, the Goal of the Strategy is to ensure that *Climate change is mainstreamed in the most economically important and vulnerable sectors of the economy by 2015*. This goal is aligned specifically to the period of the SNDP, however in the longer term the goal is to ensure climate change is mainstreamed in all sectors by 2030. The objectives of the NCCRS' are related to priority sectoral adaptation and mitigation actions needed to achieve the Strategy's vision of *a Prosperous Climate Change Resilient Economy*. They are summarised as:

1. **Land Use (Agriculture and Forestry):** To develop sustainable land use systems to enhance agricultural production and ensure food security under the changing climate
2. **Water:** To ensure sustainable management and resiliency of water resources under the changing climate
3. **Health and Social Infrastructure:** To protect people and health from climate change and climate variability
4. **Physical Infrastructure:** To climate proof infrastructure
5. **Transport:** To develop a less carbon-intensive and climate change-resilient transport system
6. **Energy:** To develop a less carbon-intensive and climate change-resilient energy infrastructure and grow using low carbon path
7. **Mining:** To develop a less carbon-intensive and climate change-resilient mining industry
8. **Governance:** To develop an appropriate climate change governance (policy, legal and institutional) framework
9. **Mainstreaming:** To mainstream climate change in all the key sectors of the economy

To achieve the Vision, Mission and objectives, the Strategy establishes five core pillars for action and implementation of the strategy. These are:

1. Adaptation and Disaster Risk Reduction

The aim is to ensure that the most climate-sensitive sectors are protected from the impacts of climate change by putting in place climate-resilient adaptation actions and ensuring that Disaster Risk Reduction (DRR) is mainstreamed in all sectors of the economy

2. Mitigation and Low Carbon Development

The aim is to ensure that mitigation actions are implemented in the most GHG-intensive sectors of land-use (agriculture and forestry), energy, transport and mining, and development proceeds using low carbon pathways

3. Cross- Cutting Issues

Under cross-cutting issues, five items are addressed. These are capacity building; research and development; technology development and transfer; climate change communication, education and awareness; Gender and HIV Aids.

4. Governance of Climate Change

The Governance pillar creates a dedicated climate change activities' coordinating institution called a National Climate Change and Development Council (NCCDC) which shall be chaired in turn by the Ministry of Tourism, Environment and Natural Resources (MTENR); Ministry of Finance and National Planning (MoFNP) and the Office of the Vice President (OVP).

5. Finance and Investment Framework

Achieving the Strategy's vision of *a Prosperous Climate Change Resilient Economy* requires substantial and additional financial resources to implement the proposed actions. The Strategy outlines ways and means of identifying sources and unlocking the financial resources needed for its implementation.

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Acronyms

BAP	Bali Action Plan
CBO	Community Based Organisations
CC	Climate Change
CCFU	Climate Change Facilitation Unit
CDM	Clean Development Mechanism
CEEEZ	Centre for Energy, Environment and Engineering of Zambia
COP	Conference of the Parties
DAI	Dangerous Anthropogenic Interference
DDCC	District Development Coordinating Committee
DENR	Department of Environment and Natural Resources
DJF	December, January, February
DMMU	Disaster Mitigation and Management Unit
DNA	Designated National Authority
ECZ	Environmental Council of Zambia
ENSO	El Niño/Southern Oscillation
EPPCA	Environmental Protection and Pollution Control Act
ET	Emissions Trading
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
GCM	General Circulation Models
GDP	Gross Domestic Product
GEEREF	Global Energy Efficiency and Renewable Energy Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GRZ	Government of the Republic of Zambia
IK	Indigenous knowledge
IPCC	Intergovernmental Panel on Climate Change

ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature
JI	Joint Implementation
JJA	June, July, August
LDC	Least Developed Country
LGP	Length of the Growing Period
MACO	The Ministry of Agriculture and Cooperatives
MAM	March, April, May
MASA	Meteorological Association of Southern Africa
MCT	Ministry of Communications and Transportation
MDGs	Millennium Development Goals
MEWD	Ministry of Energy Water and Development
MoFNP	Ministry of Finance and National Planning
MTENR	Ministry of Tourism, Environment and Natural Resources
NAMA	Nationally Appropriate Mitigation Action
NAPA	National Adaptation Programme of Action
NC	National Communications
NCCRS	National Climate Change Response Strategy
NCF	Nordic Climate Facility
NDF	Nordic Development Fund
NGO	Non-Governmental Organisation
NPE	National Policy on Environment
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OVP	Office of the Vice President
PDCC	Provincial Development Coordinating Committee
PPCR	Pilot Programme for Climate Resilience
PPM	Parts Per Million
REDD+	Reducing Emissions from Deforestation and Degradation Plus
RET	Renewable Energy Technologies
RVF	Rift Valley Fever
SADC	Southern Africa Development Community

SARCOF	Southern Africa Regional Climate Outlook Forum
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	Small Island Developing States
SNC	Second National Communication
SNDP	Sixth National Development Plan
SON	September, October, November
SRES	Special Report on Emission Scenarios
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UNZA	University of Zambia
V&A	Vulnerability and Adaptation
VCM	Voluntary Carbon Markets
WHO	World Health Organization
WWF	World Wide Fund for Nature
ZAWA	Zambia Wildlife Authority
ZCSCCN	Zambia Civil Society Climate Change Network
ZEPRIS	Zambia Emergency Preparedness and Response Information Management System
ZESCO	Zambian Electricity Supply Company
ZMD	Zambia Meteorological Department
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
tCO ₂	Metric Ton of carbon dioxide
tCO ₂ e	Metric Ton of carbon dioxide equivalent

Working Definition

Climate: Climate encompasses the statistics of meteorological conditions, that is, temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over long periods of time (usually 30 years).

Climate change: A change of climate, which is attributed directly or indirectly to human activities that alter the composition of the global atmosphere, and which is additional to natural variability, and observed over comparable periods of time.

Climate variability: Variations in the mean state and other statistics (such as standard deviations, the occurrences of extremes, etc) of the *climate* on *temporal and spatial scales* beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (*internal variability*), or to variations in natural or anthropogenic external forcing (*external variability*).

Capacity building: Capacity building and capacity development for climate change refers to the development or strengthening of personnel skills, expertise, and relevant institutions and organisations to reduce GHG emissions and/or to reduce vulnerability and adapt to climate-related impacts.

Technology transfer: A broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organisations and research/education institutions

Adaptation: Adaptation to global warming refers to actions aimed at coping with climatic changes that cannot be avoided and at reducing their negative effects. Adaptation measures include the prevention, tolerance or sharing of losses, changes in land use or activities, changes of location and restoration.

Mitigation: Mitigation refers to efforts that seek to prevent or slow down the increase of atmospheric GHG concentrations by limiting current and future emissions and enhancing potential sinks for green house gases

Kyoto Protocol: The Kyoto Protocol is an international binding agreement linked to the United Nations Framework Convention on Climate Change. It was adopted at the 3rd Conference of the Parties to the UNFCCC in Kyoto, Japan. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012.

UNFCCC: Is a non-binding global agreement on climate change, which sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. It was adopted in Rio de Janeiro, Brazil in June 1992.

Conference of the Parties (COP) to the Kyoto Protocol: Is a meeting of countries, world leaders, organisations, businesses, individuals, etc under the auspices of the UNFCCC.

Greenhouse gases (GHGs): Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emits infrared radiation. The Kyoto Protocol deals with six anthropogenic greenhouse gases, namely, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆) and two groups of gases: hydrofluorocarbons (HFCs e.g. HFC-23) and perfluorocarbons (e.g. CF₄).

Global warming: The intensification of the greenhouse effect, which results from anthropogenic actions, where the consequence is an increase in the concentration of greenhouse gases, aerosols and their predecessors in the atmosphere. These absorb and retain part of the infrared radiation emitted by the Earth's surface, thus increasing the average temperature on the planet and causing adverse climatic phenomena.

Emissions: Are used interchangeably with GHGs in this document.

National Adaptation Programmes of Action (NAPAs): As defined in Article 4.9 of the UNFCCC, and further provided for by Decision 5/CP.7 of the 7th Conference of the Parties (COP) to the UNFCCC, provide a process for Least Developed Countries (LDCs) to identify priority activities that respond to their *urgent* and *immediate* needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.

Nationally Appropriate Mitigation Actions (NAMAs): Refers to a set of policies and actions countries undertake as part of a commitment to reduce greenhouse gas emissions. The term recognises that different countries may take different nationally appropriate action on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities. It also emphasises financial assistance from developed countries to developing countries to reduce emissions. NAMA was first used in the Bali Action Plan as part of the Bali Road Map agreed at the United Nations Climate Change Conference in Bali in December 2007, and also formed part of the Copenhagen Accord issued following the United Nations Climate Change Conference in Copenhagen (COP 15) in December 2009.

Intergovernmental Panel on Climate Change (IPCC): Is a body or institution formed jointly by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1989 to provide broad and balanced information about climate change.

Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+): Is a mechanism that seeks to reduce emissions of GHGs from deforestation and forest degradation as well as to enhance forest carbon stocks. REDD+ currently operates under the voluntary carbon markets, but will likely be entrenched in a future climate change agreement under the UNFCCC.

Clean Development Mechanism (CDM): As defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one metric ton of CO₂, which can be counted towards meeting Kyoto targets. It is one of the three flexible trading mechanisms under the Protocol (the others being Emissions Trading-ET, and Joint Implementation-JI).

Carbon Markets/Trading: An international market regime in which carbon emission reductions allowances or credits are bought and sold.

Vulnerability: The degree of susceptibility to the negative effects of climate change. It is a function of the type, magnitude and frequency of climate events to which a system is exposed to (*exposure*) as well as sensitivity and capacity for adaptation (*adaptive capacity*).

Sink: Any process or activity that removes greenhouse gases or aerosols and their precursors from the atmosphere (or that does not result into further emissions).

Resilience: The ability of a system to adapt to climate change, whether by taking advantage of the opportunities, or by dealing with their consequences.

Sustainable development (Sustainability): Is development which meets the needs of current generations, without compromising the ability of the future generations to meet theirs.

Note: These definitions have been adopted from the UNFCCC and its affiliated organisations/agreements

1 INTRODUCTION

1.1 Climate Change, the UNFCCC and Beyond COP 15

Climate change is widely acknowledged as one of the greatest environmental and developmental challenges of our time. It has the potential to impact negatively on almost all sectors of the economy, particularly in developing countries, thereby hampering economic progress and development; this is to say climate change reduces development effectiveness. Additionally, climate change is a developmental threat because developing countries view climate change mitigation as a 'constraint on economic growth' as it restricts the use of fossil fuels (Egenhofer and Georgiev, 2009). This is a legitimate concern of developing countries because history shows that poverty reduction and economic development to a large extent require the use of fossil fuels.

Continued emissions into the atmosphere of anthropogenic greenhouse gases (GHGs) such as carbon dioxide, methane and nitrous oxide are the principal cause of climate change. High concentrations of GHGs have accumulated in the atmosphere in the last one hundred years, due primarily to the burning of fossil fuels for energy consumption, and land use change (clearing of land for agriculture, biomass energy and settlement).

The United Nations Framework Convention on Climate Change (UNFCCC)¹ is the overarching international agreement instituted to address anthropogenic (man-made) climate change. The main objective of the UNFCCC is outlined in its Article 2, which is to stabilize GHG concentrations in the atmosphere to a level that would **prevent dangerous anthropogenic interference with the climate system**. The specific objectives are: (1) to allow ecosystems to **adapt** naturally to climate change, (2) to ensure that **food production** is not threatened, and (3) to enable **economic development** to proceed in a sustainable manner.

The UNFCCC provides a process through which global consensus on measures to tackle climate change can be reached. Major agreements that have been reached under the UNFCCC include the Kyoto Protocol and the Marrakech Accords. The Kyoto Protocol was adopted in Kyoto, Japan at the 3rd Conference of the Parties (COP 3) in 1997. It commits 37 industrialised countries to reduce their emissions by an average of 5.2% below 1990 levels during the "First Commitment Period" (2008 to 2012). The Protocol's main evolution is the establishment of *carbon markets*, consisting of an international market regime of three "flexible mechanisms" (the Clean Development Mechanism-CDM, Joint Implementation-JI, and Emissions Trading-ET) designed and created to tackle international climate change commitments in a cost-effective manner. The Marrakech Accords, which were adopted in Marrakech, Morocco at COP 7 in 2001, set the rules for the implementation of the Kyoto Protocol.

The Kyoto Protocol's first commitment period to tackle climate change is set to end in 2012. Parties to the UNFCCC set the process for discussions on a long-term, binding agreement on climate change at COP 11 in Montreal, Canada where the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) was established. This was pursuant to Article 3, Paragraph 9 of the Kyoto Protocol.

¹ The UNFCCC was adopted in Rio de Janeiro in June, 1992 at the United Nations Conference on Environment and Development (UNCED), informally known as the Rio Earth Summit.

Negotiations under the (AWG-KP), whose mandate was to consider the commitments of the Annex I Parties for subsequent commitment periods at least seven years before the end of the first commitment period, started in 2006. At COP 13 in Bali, Indonesia, an agreement was reached that negotiations under the (AWG-KP) were to be concluded at COP 15 in Copenhagen, Denmark. In the months leading to COP 15, other views cropped up. In particular a view favouring a new globally binding agreement on climate change, i.e., one that would commit major emitters such as the United States of America (USA) and rapidly industrialising economies (China, India, Brazil, etc) to mandatory emission reductions was mooted. Thus, the main aim of the Copenhagen meeting was to try and reach a new global agreement that would replace the Kyoto Protocol or to agree to a second commitment period to the Protocol. However, such an agreement was not reached. Consequently, COP 15's only significant outcome was the "Copenhagen Accord", a non-binding agreement of which the COP just "took note of", but failed to adopt due to procedural issues. The Government of the Republic of Zambia (GRZ) has associated with the Accord, the instrument of association having been submitted at the United Nations Headquarters in New York on 9th March, 2010.

Significantly, the Copenhagen Accord recognises that global warming ought to be kept to less than 2°C². Such a target is to be achieved through voluntarily-pledged emission cuts supplemented by mitigation actions of developing countries as indicated in Nationally Appropriate Mitigation Actions (NAMAs) programmes of those developing countries that have submitted their NAMAs for inclusion in the Accord's annex.

However, many scientific models show that even if the emission reductions proposed in the Accord were to be fully implemented, they would be far from sufficient to meet the UNFCCC's goal of stabilizing atmospheric CO₂ levels at or below 350 parts per million (ppm)³. This is the level considered sufficient to limit global warming to 2°C over and above the pre-Industrial Revolution temperatures.

Temperature increases greater than 2°C will have potentially damaging effects on the world's ecological and economic resources including in Zambia. A localised analysis of these potential climate change impacts is provided in Chapter 4 of this Strategy. What is important to note is that countries, particularly the most vulnerable in Africa such as Zambia, need to prepare to adapt to these adverse conditions.

This is now even more urgent given that current scientific predictions project more severe impacts than what was previously projected as GHG emissions continue to increase unabated.

² 2°C is what has been scientifically [or rather: 'politically'] accepted as the safe upper limit beyond which ecological damage will be irreparable. It has also found wide acceptance within the climate change policy circles. But, it should be noted that there is no final agreement on 2°C being a safe, upper limit. Some countries, particularly the small island developing states (SIDS) and Least Developed Countries, to which Zambia belongs, are advocating for limiting temperature increase to well below 1.5°C.

³ For example, the Climate Interactive Scoreboard's projections produced by the "Climate Rapid Overview and Decision Support" Simulator (C-ROADS) show that emission reductions proposals as of 31st August 2010 would lead to temperature increases of greater than 4°C by 2100 (<http://climateinteractive.org/scoreboard>).

Zambia has developed this National Climate Change Response Strategy (NCCRS) to support and facilitate a coordinated response to key climate change issues in the country. The Strategy will support Zambia in positioning itself strategically to respond to the adverse impacts of climate change.

In addition, the NCCRS will help Zambia contribute to the achievement of the overall objective of the UNFCCC, which it ratified in 1993. The Strategy covers both adaptation and mitigation interventions, among other important recommendations.

Further, the Strategy has interventions that can support Zambia to take advantage of the opportunities presented by climate change. These opportunities are also contained in the Copenhagen Accord. Although the Accord is non-binding, it reflects progress in certain areas and provisions that have previously been quite contentious. These provisions are likely to be built on and entrenched in a future global climate agreement. The opportunities for Zambia and other developing countries include technology development and transfer to developing countries under the proposed Technology Mechanism, opportunities offered by the Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) Mechanism, as well as financing for both adaptation and mitigation activities under the proposed Finance Mechanism. The latter comprises the 'Fast Start Funds' (30 Billion USD for the period 2010-2012), rising gradually to 100 Billion USD annually by 2020.

As a response to climate change, Zambia has been implementing a number of projects. Zambia is one of the nine pilot countries implementing the UN-REDD Readiness Programme, whose aim is to prepare the chosen countries for the implementation of the REDD+ Mechanism. The country is also one of the pilot countries participating in the 'Pilot Programme for Climate Resilience' (PPCR). As a Least Developed Country (LDC), Zambia submitted to the UNFCCC secretariat a National Adaptation Programme of Action (NAPA) in 2007. The NAPA has prioritised ten adaptation projects; one of which, the "Adaptation of the Effects of Drought in the context of Climate Change in Agro-Ecological Region 1 of Zambia", has been funded and is being implemented. The National Climate Change Response Strategy (NCCRS) intends to build on these projects, and to provide a coordinated and harmonised approach to addressing climate change challenges Zambia is facing now and in future.

2 PROBLEM ANALYSIS & RATIONALE

2.1 Problem Analysis

Climate change is a significant development challenge for Zambia. It is likely that current extremes and challenges from climate variability (manifested mainly as floods and droughts) will be experienced for decades to come. Zambia has little influence on the direct causes of climate change (due to a low level of emissions)⁴ and therefore has to lay more emphasis on how to respond and adapt to this looming crisis rather than on mitigation.

El Niño induced drought episodes are increasingly common in southern Africa. For Zambia, based on historical records of El Niño events, the southern half of the country is usually prone to drier conditions (the Zambia Meteorological Department). The negative impacts of droughts are felt most by those dependent on climate sensitive economic activities, such as rain-fed agriculture, for their sustenance.

Erratic rainfall also has significant impacts on Zambia, especially on farming and human settlements. Floods and their impacts on crop production, health and economic infrastructure are the main concern.

These impacts are influenced not only by the exposure to the direct impacts of climate events, but also by sensitivity, which is determined by a range of non-climatic development stressors such as poverty, and poor health and social protection.

A feature of climate change is that its impacts are not evenly distributed, both socially and geographically. Marginalised and vulnerable groups are likely to be worst affected as they have the least means to stand against climate change challenges and to reduce their vulnerability. These are groups who are already poor or physically unwell and/or impaired and live in geographically vulnerable locations (e.g. in flood-prone areas), depend on sensitive livelihood systems (e.g. rain-fed agriculture). Gender is also another important factor in vulnerability to climate change as it has been shown that female headed households are particularly more vulnerable. On the other hand, those that are financially stable may not be very sensitive to climate change as they have a means to cope.

The exact extent of climate change impacts on Zambia is uncertain. It could be moderate or extreme. What is certain is that Zambia will continue to face tremendous development challenges in the next decades as a result of “natural” climate variability. These challenges will further be exacerbated by a decline in the natural resource base (e.g. a decrease in the amount of arable land) as population growth exerts pressure on available resources, as well as a volatile global economy. Climate change will thus be an additional pressure on development especially if measures to reduce the underlying vulnerabilities are not introduced in time. In the worst case scenario, climate change may reverse development gains of the past decades.

⁴ 2.9 million metric tons of CO₂e as of 2008 (US Energy Information Administration (EIA))

In order to understand the possible implications of climate change on Zambia, three scenarios should be considered: Scenario 1 involves Zambia taking no pre-emptive measures to avert the negative impacts of climate change (i.e. *business as usual*) and only reacts once damage has occurred (reactive adaptation). This will entail undefined costs of no action. Scenario 2 (i.e. the current situation in Zambia) involves the implementation of a number of climate change activities, but in an uncoordinated fashion, and based on insufficient information. Resources to respond to climate change are “available” but they cannot be easily accessed and used effectively as the intended actions are not well defined. Scenario 3 is that of the NCCRS. It involves a planned response to potential climate change risks in a coordinated effort in order to reach a high level of development effectiveness.

2.2 Rationale for a National Climate Change Response Strategy

From the outset, Zambia’s ability to cope with climate change impacts is compounded by many factors. The most important factor is poverty — 67% of the population is lives below the poverty line, with 46% living in extreme poverty (UNDP Zambia website⁵) — meaning that out of Zambia's estimated total population of about 12 million, more than 8 million people are experiencing some form of poverty. Poor people are vulnerable to climate change as their ability to cope with climate change induced changes and disasters is compromised because of low adaptive capacity. Other factors, in addition to poverty which are equally important include: weak and inadequate policies and institutions; poor infrastructure; lack of information; poor access to financial resources; high interest rates and the lack of credit to a majority of the population. These factors are elaborated further in the Strategy.

To cope with climate change risks, the country is in the process of putting in place measures for mainstreaming climate change into its development plans, including implementing climate change mitigation and adaptation actions. Such measures will be enhanced by the strategic focus provided by the NCCRS.

The rationale for formulating the NCCRS is to enhance a coordinated national response to climate change. The NCCRS provides a framework that will coordinate and harmonise all climate change activities in the country. This is demonstrated in the following chapters where climate problems in Zambia are analysed, the evidence of climate change shown, and an assessment of the actions that need to be put in place stated. The need for a comprehensive national institutional and implementation framework is justified and concrete actions and investments needed for mitigation, adaptation, research, capacity building, awareness, etc., in the most vulnerable sectors of the economy are proposed on a priority basis.

The Strategy proposes an institutional framework to oversee the implementation of activities through prioritized, coordinated and harmonized programmes and projects, across the sectors. It also provides information which could assist in unlocking funds from domestic as well as multilateral organisations such as the Global Environment Facility (GEF), the World Bank and other development partners, by clearly demonstrating and delineating climate change activities from those that can be considered conventional development activities.

⁵ http://www.undp.org.zm/index.php?option=com_content&view=article&id=1&Itemid=2

In summary, the purpose of the NCCRS is to respond to climate change by:

- Putting in place robust adaptation and mitigation measures needed in order to minimize risks associated with climate change while maximizing opportunities;
- Enhancing understanding of climate change and its impact nationally and in local regions;
- Providing a conducive and enabling policy framework and a concerted programme of action to combat the impacts of climate change, based on existing sectoral policies and strategic plans;
- Enhancing Zambia's participation in the global climate change negotiations;
- Enhancing understanding of international agreements, policies and processes and importantly the positions Zambia needs to take in order to maximize beneficial effects from these activities; and
- Providing a coordinated approach and overall guidance to the implementation of climate change activities including climate change adaptation and mitigation programmes, awareness creation, education, capacity building, technology development and transfer, and financing, among others.

What has been identified as lacking in Zambia is a coherent approach to tackle the climate change challenge in the development context. There have several but fragmented efforts thus far which are proved to have a limited overall effect. The aim of the NCCRS is to repackage the existing initiatives and opportunities in a more coordinated way as well as to provide a strategic vision to achieve sustainable economic development.

3 CLIMATE AND CLIMATE CHANGE IN ZAMBIA

3.1 Location⁶

Zambia occupies a near central location on the southern African sub-continent between 8° and 18° south latitude, and 22° and 34° east longitude. It is surrounded by the Democratic Republic of Congo in the north, Tanzania in the northeast, Malawi and Mozambique in the east, Zimbabwe, Botswana in the south, Namibia in the southwest, and Angola in the west. Administratively, it is divided into nine provinces: Central, Copperbelt, Eastern, Luapula, Lusaka, Northern, North-Western, Southern, and Western. Lusaka is the capital and largest city (Figure 1).



Figure 1: Map of Zambia showing surrounding countries, provinces, population nodes, transport infrastructure, main topographic features (UN, 2004)

Geographical characteristics

Zambia covers an area of 752 614 km². Most of the western and central regions of the country are situated on the great plateau of central Africa.

⁶ This section and the references therein have been adopted from Diaz-Chavez R, Mutimba S, Watson H, Rodriguez-Sanchez S and Nguer M. 2010. Mapping Food and Bioenergy in Africa. A report prepared on behalf of FARA. (Forum for Agricultural Research in Africa), Ghana

The plateau rises eastward from 915 to 1,520 metres above mean sea level (m.a.m.s.l) and has an average altitude of 1,200 m.a.m.s.l. A faulted escarpment zone known as the Muchinga Mountains, traverses most of Northern Province. Its highest point is 2,170 m.a.m.s.l. North of the escarpment the topography is dominated by the Bangweulu swamps; Lake Bangweulu; Lake Mweru Wantipa; the eastern half of Lake Mweru; the southern extremity of Lake Tanganyika; and the Chambeshi River valley. East of the escarpment towards the border with Tanzania and Malawi, the land rises to over 1,800 m.a.m.s.l. South of the escarpment the deep rift trough of the Luangwa River dominates the area.

Most of the western part of the country is drained by the Zambezi River and its tributaries. The river forms most of Zambia's southern boundary with Zimbabwe. Key features of the river include the Victoria Falls, the Kariba Dam and the deep rift trough of the Middle Zambezi Valley. Most of central Zambia is drained by the Kafue River and its tributaries (Aregheore, 2003, FAO, 2005). The Kafue is dammed above a gorge just south of Lusaka. The country has a further 1,700 medium to large concrete dams as well as about 3,000 small earth dams. The lakes, dams, and rivers comprise a water surface equivalent to 1,6 % of the country's total area. Expansive wetlands, covering almost 5% of the country's total area, are located on the alluvial plains of the main rivers. The Kafue Gorge Dam, Lake Kariba and Victoria Falls are equipped for hydroelectric power generation and generate more than 90% of the country's electricity (Batidzirai *et al.*, 1998).

Population: The projected population for 2010 (based on the 2000 Census) is about 12 million of which 45 % is below the age of 15. One third (35 %) of the population is urban. The median age of the population is 17.2 years. Life expectancy at birth is 38.86 years. The HIV/Aids prevalence rate is 14.8 % and 1.1 million are living with HIV/Aids (2007 Demographic and Health Survey). The net population growth rate is 1.6 % (2010 est.). At this rate the population will double by 2053. The population below the poverty line is 86% (2003). The fertility rate (children born per women) is 5.07 (2010 est.). The infant mortality rate is about 10%. The literacy rate is 80.6% (2003 estimates).

Government: The official name is Republic of Zambia. Zambia gained independence on October 24, 1964 from the Great Britain. The National Assembly has 158 seats of which 150 are elected in a popular vote and 8 are nominated by the President for five years.

Economy: Zambia's economy has experienced strong growth in recent years, with real GDP growth in 2005-2008 about 6% per year. The GDP is USD 18.5 billion (2009 est.) (PPP) and USD 1.500 per capita. The current GDP growth rate has fallen to 4.5% (2009 estimate).

Industrial production includes: copper mining and processing, construction, foodstuffs, beverages, chemicals, textiles and fertilizers. The agricultural sub-sectors include crop production, livestock, capture fisheries and aquaculture. The main products are maize; sorghum; rice; peanuts; sunflower seed; vegetables; flowers; tobacco; cotton; sugarcane; cassava (tapioca); coffee; livestock and poultry; milk; eggs and hides. The labour force by employment is: 85% in agriculture, 6% in industry, and 9% in services (2004). Electricity production is 9.8 billion kWh, which compares to the consumption of 8.8 billion kWh (2007 est.); 99.5 % of electricity production is from hydropower.

Poverty remains a significant problem in Zambia, despite a stronger economy in recent years. The decline in world commodity prices and demand impacted on GDP growth in 2009, but a sharp rebound in copper prices and a bumper maize crop have helped Zambia begin to recover. In 2005, Zambia qualified for debt relief under the Highly Indebted Poor Country Initiative, consisting of approximately USD 6 billion in debt relief.

Trade: The main export commodities are copper, cobalt, electricity, tobacco, flowers and cotton. Copper output has increased steadily since 2004, due to higher copper prices and foreign investment. The export partners are China (13.8%), South Africa (8.2%), Democratic Republic of the Congo (7.8%), Saudi Arabia (7.6%), South Korea (7.6%), Egypt (7.4%), Italy (6.7%) and India (4.6%) (2008).

3.2 Climate of Zambia

Overview

The climate of Zambia can be described as a wet and dry tropical, and sub-tropical. It is modified by altitude. On the basis of rainfall and temperature patterns, the year can be divided into four seasons: The Hot Season (September to October), The Rainy Season (November to March), The Post Rainy Season (April and May), and the Cool and Dry Season (June to August). Zambia is landlocked with the Indian Ocean approximately 800kms to the east as the nearest sea mass. The average highest temperatures over Zambia occur in October, with most stations recording mean daily day-temperatures of 28 – 31°C. The temperatures drops during the rainy season from November to March to 20 – 26°C, while night temperatures vary between 17°C and 21°C, falling to a minimum of 8°C - 9°C at dawn in June and July. The temperature difference between July and October during the day does not vary very significantly from station to station, at 6°C to 9°C over the whole country; with the greatest difference occurring in the south (Spain, 1972). Maximum air temperatures are usually below 35°C except in the major river valleys.

Mean annual relative humidity is normally less than 65% in the southern parts of the country to 72% around the shores of Lake Bangweulu in the north during the height of the rainy season. In the northern half, relative humidity does not go above 75% in this period. On a daily basis, values as low as 25% are reached in some areas during the hot and dry season. In rainy season however, relative humidity is well above 70% in most areas. The dew point follows much the same pattern as the humidity and the changes from September to January are quite large, varying from 9.8°C to 15.7°C in the northern and southern parts of the country, respectively. The average sunshine duration in rainy season generally exceeds 4 hours/day. Air-masses over Zambia are predominantly light easterly to southeasterly most of the year. The main exception to this is during the rainy season when air-masses become more variable and westerly or northwesterly in the northern and western parts of the country (Acharya and Bhaskara Rao, 1981; Spain, 1972).

In the *Köppen* climate classification, most of the country is classified as *humid subtropical or tropical wet and dry*.⁷ The modifying influence of altitude gives Zambia a more sub-tropical weather conditions rather than tropical during most of the year.

Zambia is divided into three agro-ecological regions (see figure 3 below) according to latitude, climate (temperature and precipitation) and topography⁸.

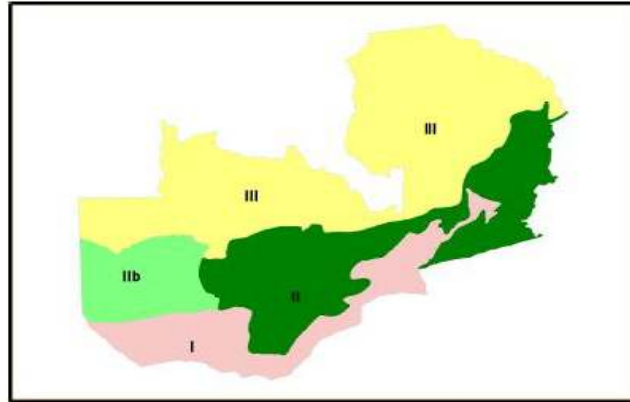


Figure 2: Agro-ecological regions in Zambia:

- Region I: The Luangwa-Zambezi rift valley receives less than 800 mm annual rainfall mostly in the southern part of the country. Region I is mainly sub-tropical.
- Region II: Receives less than 1,000 mm but more than region I. This is mostly in the central part of the country. Region II is divided into IIa with sandy soils and IIb with clay soils. Region 2 is mainly sub-tropical.
- Region III: Receives more than 1,000 mm and up to 1,400 mm of annual rainfall. This is in the northern part of the country. Region III is mainly tropical.

Thus, the climate experienced in northern Zambia is distinctively different from that of southern Zambia. The northern part of the country, especially the north-west and the north-east, receives the highest amount of rainfall. Annual rainfall amount decreases as one moves towards the southern regions. The driest areas are in the far south west around the Luangwa River and middle Zambezi River valleys. None of Zambia is considered to be arid or desert, but some parts of region I and IIb are semi arid. The extent of semi-arid land is estimated to cover 21%⁹ of the country's land mass (Watson, 2009; cited in the COMPETE Project Report, 2009)

⁷ The normal climate is based on data series of 30 years and any deviation of trends and observations from these average climate data is interpreted by science as climate change. Climate change is thus more observed in the changes on long-term trends than explained by single events of climate extremes although such events may also attributed to climate change.

⁸ Zambia is also classified into 36 ecological zones based on soil and vegetation types. The largest ecological zone of Zambia is *miombo* woodlands, which cover more than half of the country.

⁹ Compare with e.g., South Africa and Botswana where 73% and 99%, respectively of the land is arid and semi-arid

Summary of Key climatic features

A description of key climatic features in relation to temperature, rainfall and air-masses is provided below:

Temperature: The elevation of the great plateau on which Zambia is located, typically between 1,000 and 1,300 metres, modifies temperatures. During the rainy season, i.e. the months of November to April, the weather is warm and humid, but daily maximum temperatures are usually a little lower than in the warm and dry season. Most of the country is frost-free but in some years ground frost occurs, but is usually restricted to exposed hills of the southern part of the country. Temperatures are higher at lower elevations in the north, such as the Luapula-Mweru and Mweru Wantipa/Tanganyika valleys, and the lower Luangwa and Zambezi valleys in the south.

Rainfall - The distinction between rainy and dry seasons is marked, with mostly no rain at all in June, July and August. Much of the economic, cultural and social life of the country is dominated by the onset and end of the rainy season, and the amount of rain it brings. The rains are brought by the *Intertropical Convergence Zone* (ITCZ) and are characterised by thunderstorms, occasionally severe, with much lightning and sometimes hail.¹⁰ The northern parts of the country are directly influenced by the summer position of the ITCZ. Annual rainfall decreases from north towards Lusaka. South of Lusaka rainfall is dictated more by the East and Southeast trade winds, which have lost much of their humidity by the time they have reached so far inland.

Regional rainfall in Southern Africa is influenced by surface temperatures of the Indian Ocean. A factor of particular influence on inter-annual variability in rainfall is the *El Niño/Southern Oscillation* (ENSO) phenomenon. ENSO in some years results in warmer and drier conditions in Southern Africa and other complex influences on the rainfall distribution (Clay *et al.*, 2003). El Niño conditions (warm phase) bring drier than average conditions in the wet summer months (December, January, February - DJF) in the southern half of the country, whilst the north of the country simultaneously experiences significantly wetter seasons. The reverse pattern occurs with La Niña (cold phase) episodes (McSweeney *et al.*, 2008).

Air-masses – The prevailing air-masses in the dry season are generally moderate but occasionally more severe and may bring cool dust-laden air from distant arid regions. Whirlwinds are common but not usually destructive. In the rainy season, air-masses are localised with thunderstorms and may be destructive but usually confined to small areas, such as blowing roofs off buildings. Zambia is landlocked and has no experiences of severe damages from tornados or cyclones.

¹⁰ The ITCZ is a broad equatorial low pressure band with rains, where the trade winds of the Northern and Southern Hemispheres converge. The ITCZ mainly follows the equator over the sea, but due to the warming of the land masses the ITCZ will shift between the North and South of the equator and thus contributes to the seasonal rains. The ITCZ moves southwards in the second half of the year, and northwards in the first half of the year. Seasonal shifts in the location of the ITCZ drastically affects rainfall in many equatorial nations, resulting in the wet and dry seasons of the tropics rather than the cold and warm seasons of higher latitudes. Variability and longer term changes in the ITCZ can result in severe localised droughts or floods.

3.3 Climate Data and Forecasting

The location of weather stations in Zambia is historically linked to the main service they provided in the past. This was to provide weather information to the aviation industry. Thus, most of the weather observatories were located in aerodromes and airports. In view of the fact that nowadays meteorological services are provided to other sectors of socio-economic development that include agriculture, health and disaster mitigation functions, stations have been opened up in areas that include agricultural research stations.

3.4 Climate Trends, Variability and Climate Hazards

The Zambia Meteorological Department (ZMD) has summarised the climate trends in Zambia over the past decades as follows:

- An increase in the frequency of extreme events such as by floods and droughts over the past four decades.
- An emerging tendency of a delayed onset of the rainfall and earlier cessation, thus resulting in a shorter season with a more intense rainfall.
- A trend towards an increase in temperature in both the cool and warm seasons.

The UNDP Climate Change Country profile of Zambia (McSweeney *et al.*, 2008) assessed recent climate trends based on records from 1960 to 2003, as follows:

- **Temperature:** The mean annual temperature has increased by 1.3°C since 1960, an average rate of 0.29°C per decade. The rate of increase is most rapid in the winter, at 0.34°C per decade. Daily maximum temperature exceed the tenth percentile in the period 1970-99, while the daily maximum temperature is below the ninetieth percentile in the same period.
- **Precipitation:** The mean annual rainfall over Zambia has decreased by an average rate of 1.9 mm per month (2.3%) per decade since 1960. This annual decrease is largely due to decreases in DJF rainfall, which has decreased by 7.1mm per month (3.5%) per decade. Daily precipitation observations show some indication of reductions in the contribution of heavy events to total rainfall, and the magnitude of maximum 1 and 5 day rainfalls, but none of these trends is statistically significant.

The trends are towards higher average temperature, a possible decrease in total rainfall and some indication of heavy events of rainfall. These trends are uncertain and include the natural driving forces such as ITCZ and ENSO and the variability in the country between north and south. Localised events or intra-seasonal variation are not captured in the average figures. Moreover, the effect of weather extremes may also be compounded by changes in sensitivity, e.g. cultivation of flood prone land due to scarcity of suitable land.

Zambia experienced droughts in the 1990s (1991/92, 1994/95) that were linked to the ENSO. It is not possible to link all droughts to the El Niño phenomenon alone. It is also not possible to state categorically that each of the El Niño years results in a drought (Clay *et al.* 2003).

What has been observed is that the flooding in recent years, for example, the above average rains in January 2008 that caused severe flooding, is linked to a combination of both the ITCZ and La Niña.

Data on emergency events from Zambia suggests a drastic increase mainly in the flood events. The data does not reveal whether this trend is due to an increase in precipitation only or whether underlying sensitivity factors such as changes in land-use patterns (e.g. cultivation of flood-prone land) play a more significant role. However, there is evidence that current climate variability has a large impact on development in Zambia, both through 'low frequency – high impact' extreme weather events (like major droughts and floods resulting in disasters) and 'high probability – low impact' events (like erratic rain fall patterns, increase in warmer days and nights, and emergence of pests).

Table 1: Natural disaster emergency events in Zambia (1980-2009)

Natural Disasters	1980-1989	1990-1999	2000-2009
Droughts	2	2	1
Floods	1	2	11
Storms	0	0	0
<i>Emergency 'events'</i>	<i>3</i>	<i>4</i>	<i>12</i>

Source: data from www.emdat.be

3.5 Climate Forecasts and Climate Change Projections

Climate change scenarios are modelled using General Circulation Models (GCMs) or Global Climate Models. These models provide long term projections on the deviations (anomalies) from past weather regimes (defined as the time series of weather records averaged over 30 years), for example in temperatures and rainfall. The model projections are based on global development scenarios and associated levels of GHG emissions.

Using GCMs, the predicted temperature warming in Zambia for both equilibrium model and transient ranged between 2°C to 4°C with an annual mean increase of 3°C in 2075 as CO₂ concentration double or increase at 1% per year (Nkomok & *et al* 1999). The predicted temperature changes from the study are within a similar range as of studies carried out by the IPCC in 1992. Both models predict a decrease in the annual precipitation throughout Zambia by the year 2075. The rainfall decrease is projected to be in the range of 8% to 30%. Drought frequencies are shown to be more pronounced in Region I (southern Zambia).

Climate change projections for Zambia have also been conducted as part of the UNDP climate change country profiles.¹¹ The projections of the future climate are based on a similar approach as in the IPCC Fourth Assessment Report.¹²

With three scenarios and three points in time, the projections provide an indication of the direction, but less information of the magnitude of the possible climate change. Their main results are:¹³

- **Temperature:** The mean annual temperature is projected to increase by 1.2 to 3.4°C by the 2060s, and 1.6 to 5.5°C by the 2090s. The projected rate of warming is a little more rapid in the southern and western regions of Zambia than the northern and eastern regions.
- **Precipitation:** Projections of mean rainfall do not indicate large changes in amount of annual rainfall. Seasonally, the range of projections from different models is large, but the multi-model averages indicate decreases in September-October-November (SON) rainfall and increases in December-January-February (DJF) rainfall particularly in the northeast part of the country.
- **Extreme events:** The proportion of total rainfall that falls in heavy events is projected to increase annually, but mainly in DJF. All projections indicate substantial increases in the frequency of days and nights that are considered 'hot' in current climate. This has implications for heat-related stresses on crop and livestock production as well as human health.

Other projections for future changes in rainfall show a wide range of both increases and decreases depending on the model used, i.e. there is no robustness in the projections of climate change. This is usually due to the quality of the base data and the model assumptions. A mean response across multiple models indicates a 5 to 10 % *reduction* in precipitation over most of Zambia by 2050, but with an *increase* of 5 to 10 % in the northern regions (URC, 2008).

¹¹ The UNDP climate change profiles are prepared by the School of Geography and Environment, University of Oxford (<http://country-profiles.geog.ox.ac.uk>).

¹² The climate projections consisted of: a) three scenarios from the IPCC Special Report on Emission Scenarios (SRES). A 'high' (A2), 'medium' (A1B) and 'low' (B1) scenario for global emissions, b) 15 out of the 22 GCM used by the IPCC for the Fourth Assessment Report, c) a resolution of 2.5° by 2.5° grid, and d) a time scale including the decades of the 2030s, the 2060s and the 2090s.

¹³ These projections are simulations of future climate given the hypothetical emissions scenarios and model specifications. As for the IPCC results these are not climate predictions but projections based on given data and model assumptions.

4 Climate Change Challenges, Risks and Impacts in Zambia

Most Sub-Saharan African countries, including Zambia, are vulnerable to the impacts of climate change as a result of their generally weak economies contributing to a low adaptive capacity. The following text-box is a summary of an IPCC's assessment of potential climate change impacts on the region.

Textbox 1: IPCC on climate change and risks and adaptation in Africa

The IPCC Fourth Assessment Report (June 2007) noted that "*recent climate changes and climate variations are beginning to have effects on many other natural and human systems*" like the drought and uncertain rainfall in Sub-Saharan Africa are already prompting adaptation measures. But "*these impacts have yet to become established trends*". The IPCC concerns scientific evidence mainly of future climate change and impacts. The IPCC further notes that "*Africa is one of the most vulnerable continents to climate variability and change, because of multiple stresses and low adaptive capacity. Some adaptation to current climate variability is taking place; however, this may be insufficient for future changes in climate*".

By 2020 between 75 and 250 million people in Africa will be at risk of increased water shortage with a temperature increase of one degree and 350 to 600 million with a two degree increase. Eastern Africa may experience rainfall increase of seven per cent, while Southern and Northern Africa may experience reductions of between 20 and 40 per cent. These are long term impacts towards the end of the century. Water harvesting in the dry and semi-dry lands is already an adaptation strategy for climate variation and will also be relevant as adaptation to climate change. Sea level rise especially along the East African coast will increase flooding and with an adaptation costs of 5 to 10 per cent of GDP, while no adaptation may cost up to 14 per cent of GDP in East Africa. Tourism may be affected with 25 to 40 per cent of animal species in Sub-Saharan becoming endangered due to climate change.

Crops may also come under influence especially in Southern Africa with subsequent impacts on food security. Adaptation measures must address food security, access to credit and insurance and farming practices. Increase in temperatures in higher altitudes may make it possible to expand the area of more temperate crops like apples, pears and barley. IPCC notes that "*climate change is expected to have some mixed effects, such as the decrease or increase of the range of transmission potential of malaria in Africa*". An additional 80 million people could be at risk from malaria although the actual impacts are disputed among health experts.

Source: IPCC IV Working Group II report and the IPCC Working Group IV Summary for Policy Makers.

In the following sections, climate change risks/impacts on Zambia are discussed in the form of sectoral risks. The aim is to illustrate the potential impacts of climate change (as discussed in chapter 3) on various sectors of the economy and segments of the society.

4.1 Water resources

According to the Global Environment Outlook 2000 (GEO 2000), Zambia is one of the very few Sub-Saharan Countries that is water-secure. The country's total renewable water resource is estimated at 105.2 billion cubic metres, representing over 15% of the

entire Southern Africa region (UNEP, 2010). Zambia is home to major rivers such as the Zambezi (the fourth largest in Africa) and its tributaries—Luangwa and Kafue; and lakes such as L. Tanganyika, Mweru, Bangweulu as well as the world-famous Lake Kariba, a hydro-power dam on the Zambezi River.

The abundant water resources in Zambia is mainly due to geographical location and altitude that ensure the country receives a good amount of rainfall. For instance, the northern part of the country receives as high as 1,400 mm of rainfall annually. This has made Zambia the water tower of southern Africa, with virtually no area within its boundary considered arid¹⁴.

Impacts of climate change on water resources

Water resources are inextricably linked with climate, so the prospect of global climate change has serious implications for water resources and regional development (Riebsame *et al.*, 1995, cited in GEO 2000). Thus, that Zambia has abundant water resources does not imply that it faces no climate change challenges related to the water sector. To start with, pockets of semi-arid areas can be found within the country. Secondly, the current as well as projected shifting in rainfall patterns (e.g., decreases in SON rainfall and increases in DJF rainfall particularly in the northeast of the country as depicted by the McSweeney *et al.*, 2008/UNDP country profile (referred to in Chapter 3 of this document) have a major influence on the country's socio-economic development. The inadequacy of water capture and storage infrastructure in the country is yet another challenge in the water sector.

The following bullets illustrate the potential climate change impacts in the water sector:

- The impacts of climate change on Zambia's water resources can be summarised as "either too much or too little rain"¹⁵. This translates into either floods or droughts, with the former being the more frequent and more devastating in Zambia.
- Observations on an increase in the frequency and severity in La Niña linked floods in recent years have been made. For example, the above average rains in January 2008 that caused severe flooding in Zambia are believed to be a combination of the presence of the ITCZ and La Niña.
- Similarly, an increase in the frequency and severity of ENSO-linked drought episodes has been observed. It is not possible to state with certainty that all droughts are brought about by the ENSO phenomenon alone. It is also not possible to predict that each El Niño event would result in a drought (Clay *et al.* 2003). What has been observed is that severe droughts in Zambia, especially those experienced in the 1990s, coincided with ENSO events.

If this trend continues (as projected with the rising atmospheric GHG concentrations), then we are likely to see a reduction in the volume of water bodies. The aforementioned Nkomoki *et al.*'s model predicts a decrease in the annual precipitation throughout Zambia by the year 2075, with drought episodes projected to become more frequent in Region I (southern Zambia). High evaporation rates due to the rising atmospheric temperatures would only worsen the situation.

¹⁴ Note that pockets of semi-arid areas can be found in southern part of the country

¹⁵ A statement by Mr. Adam Hussen, the Director of Department of Water Affairs, MEWD

- These conditions (floods and droughts) have major socio-economic impacts, which are comprehensively discussed in other sections in this document. As an example, floods carry pollutants including fertilizers and other chemicals into water bodies, thus negatively impacting on the quality of water especially for human consumption.

4.2 Forestry sector

Forest cover assists in slowing down the spread of deserts, attracting clouds and enabling rainfall. In addition, they serve as a carbon 'sink', i.e. they are natural reservoirs of carbon dioxide.

Zambia has approximately 49.9 million hectares of forest. The miombo woodland covers approximately 60% of the land (Integrated Land Use Assessment (ILUA) 2005-2008 Report). Other forest resources include mopane¹⁶ and other woodlands, evergreen and deciduous forests, some of which provide habitat to wildlife (GRZ, Initial National Communication to the UNFCCC, 2004).

Deforestation is a major problem in Zambia, with deforestation rates being as high as between 250,000 to 300,000 hectares per year (ILUA 2005-2008). The main causes of deforestation include i) charcoal and wood fuel use (for domestic, commercial and industrial uses); ii) timber production; and iii) unsustainable agricultural methods and other land use practices, primarily, shifting cultivation, i.e. the 'chitemene' system (UN REDD Readiness Programme, National Programme Document (Zambia), 2010).

It is reported that the 'chitemene' system currently practised is different from what was traditionally practised in the past in that 'chitemene' consisted of the chopping and burning of tree branches and not of cutting of tree stalks as is currently the case. Further, it has been observed that 'chitemene' may no longer be sustainable due to increasing population's pressure on land resources (proceedings of the workshop for northern regions, June 18th, 2010).

Impacts of climate change on the forestry sector

- Climate change will add to the deforestation pressure forests are facing as it will affect the growth, composition and regeneration capacity of forests, thereby resulting in reduced biodiversity and ability to deliver important forest goods and services. This will then cause desertification, deforestation and general land degradation as communities strive to derive their livelihoods on declining forest resources.
- As temperatures increase and precipitation reduces, gradual drying up of forest/woodland systems will be observed. For example, according to the NAPA (GRZ, 2007), the regeneration of the miombo woodland, which usually occurs relatively rapidly, has already been hampered by drought and excessive temperatures.

¹⁶ Mopane Woodlands are dispersed throughout southern Africa, bounded by the Luangwa River in the north and the Pongola River in the south. Mopane tree (*Colophospermum mopane*) woodlands mix with Zambezian woodlands in lower-elevation areas, often along major river valleys

- Frequent drought episodes and rising temperatures are expected to lead to increased forest fire activity. Simulations performed for temperate forests indicate this trend: increased forest fire activity with rising temperatures (Flannigan *et al.*, 2000). It can be expected that forest fires in tropical regions would only be more frequent and more severe as these regions are projected to experience more warming with climate change.
- Changing climate patterns will cause existing forested areas to undergo changes in vegetation types and species composition. New assemblages may be established, and more invasive species are projected to emerge. Some vegetation may shift to higher elevations, while some may become extinct. Simulations show that miombo and *Baikiea* would reduce as the climate changes (GRZ, Initial National Communication to the UNFCCC, 2004).
- In addition, rise in temperatures and varying rainfall patterns could extend the ecosystems' range of pests and pathogens. This is likely to affect many aspects of forests such as tree-growth, survival, yield and quality of wood and non-wood products. In Zambia, the production of honey has decreased over the last few years (Proceedings of the NCCRS Consensus Workshop, 13th-14th November, 2010).

4.3 Wildlife resources

Zambia is well covered by open and closed forests and grasslands. The forest resources include miombo, mopane and other woodlands, evergreen and deciduous forests, some of which provide habitat to wildlife. Zambia is also home to the world famous black lechwe, which is endemic to the Bangweulu flood plain. Water animals like hippo and crocodile and a variety of bird species also inhabit the rivers, lakes and other wetland ecosystems (GRZ, Initial National Communication to the UNFCCC, 2004). Other important wildlife includes large mammals such as lions, buffaloes and elephants.

Wildlife is found in national parks (19 in number), Game Management Areas (GMAs) (36 in number) and wildlife sanctuaries (3 in number) (the Zambia Wildlife Authority, ZAWA's website, October 2010). In addition, 116 game ranches stocked with 26 species of wildlife as well as 7 crocodile farms have been established in different parts of the country (GRZ, Initial National Communication to the UNFCCC, 2004).

Wildlife resources play a very important role in the national economy as they support tourism, which in 2008, contributed 3% to the country's Gross Domestic Product (GDP) (Zambia's 2008 Economic Report, MFNP, 2009).

Impacts of climate change on wildlife

Studies have been carried out on the potential impacts of the changing rainfall and temperature patterns [climate change] on Zambia's wildlife resources.

One such study captured in the Initial Communication to the UNFCCC (2004) – documented the effects of temperature, rainfall and soil moisture content on the productivity of the grasslands upon which wildlife depends.

- The results of this study were that droughts would reduce soil moisture content, which in turn would affect fodder productivity and consequently affect wildlife, leading to migration and wildlife-human conflicts in some cases (as drought

would affect natural ecosystems and subsequent change in species' ecological range (e.g., drying up of wetlands, reduction in the size and quality of rangelands, less foliage, etc), altering predator-prey interactions, decoupling animals from food sources and/or reducing habitat span).

- Wildlife-human conflicts and other factors have seen the numbers of certain wildlife species decline. According to The Kafue River Crocodile – Hippo Survey Report (2007), hippos in the Copperbelt region (along the Kafue River channel) have been decimated over the years due to human-hippo conflicts¹⁷, with the highest number of conflicts being recorded in Itezhi Tezhi, Namwala, and Kafue Flats – Nyimba areas. Human-crocodile conflicts were also reported especially in the Chimfunshi area, but the extent to which these affected the crocodile population was not determined.
- Similar crocodile-human conflicts have been reported in the Zambezi River area (especially in Siavonga District) due to competition over resources. It has been noted that flooding aggravates the situation as crocodiles swim ashore and 'infest' farming fields (Leslie *et. al*, 2008).
- Excessive rainfall would lead to inundation of swamps and other wetlands, thus affecting the habitat of important wetland species such as the *puku*, *lechwe*, waterbuck etc.
- Excessive rainfall would on the other hand, have a positive effect on bush animals like lion, elephant and buffalo as these would thrive from the resulting abundant food and water resources.
- Changing/rising temperatures could also have an important influence on sex ratio of reptiles (e.g. crocodiles). The pivotal temperature for determining sex in Nile crocodiles (*Crocodylus niloticus*) during egg incubation is around 31°C, with more males hatching in warmer temperatures (Leslie A.J. and J.R. Spotila, 2001; Hutton, 1987). Projected higher temperatures could thus create a sex imbalance, and possibly lead to the crocodile's demise¹⁸.
- Changes in temperature and rainfall could also see the emergence and re-emergence of certain animal (both wild and domestic) diseases. According to the US-based Wildlife Conservation Society (WCS), these diseases include avian flu, Rift Valley Fever (RVF), tuberculosis as well as a range of parasites (WCS, 2008).

¹⁷ The study acknowledges that further research needs to be carried out to ascertain the exact causes of the human-wildlife conflicts in the Kafue Flats. For crocodiles, it has been observed that the highest number of conflicts occurs during heavy precipitation/flood events as the crocodiles swim ashore to regions that are normally farmed (sometimes as close as 10 metres from the river bed).

¹⁸ For the Nile crocodile, a study is yet to be carried out to determine what the scenarios would be. But a similar study carried out on the American crocodile (*Crocodylus acutus*) determined that this species would disappear in the Costa Rica within the next 25 to 30 years if warming continues (<http://www.globalpost.com/dispatch/costa-rica/100921/crocodiles-sex-climate-change?page=0,0>)

4.4 Tourism

As indicated in section 4.3, the tourism sector is increasingly becoming one of the most important economic sectors in Zambia. Some of the popular tourist attractions include natural scenery such as the Victoria Falls as well as the rich biodiversity and culture of Zambia.

Impacts of climate change on the tourism sector

- Tourism is largely wildlife resource based, making the sector highly vulnerable to climate-induced disturbances of wildlife (human-wildlife conflicts, animal migration, etc) discussed above. For instance, "experts predict that one-fourth of the Earth's species will be headed for extinction by 2050 if the warming trend continues at its current rate"¹⁹ and this could greatly affect tourism, particularly in developing countries such as Zambia where the sector plays an important role in the economy and where adaptive capacity is low.
- A key finding of the 2008 'Davos Conference on Climate Change and Tourism' was that carbon dioxide emissions from the tourism sector's transport, accommodation and other activities were estimated to account for between 4 and 6% of total emissions, and this figure is likely to increase by approximately 150% over the next 30 years.²⁰ Air transport is greatly responsible for these emissions and currently there are negotiations on how best to address emissions from the global aviation industry. Any mitigation measures introduced in the industry could impact negatively on the tourism sector, e.g. it could lead to a reduction in the number of international tourists visiting Zambia.
- Other impacts include possible destruction of major tourist attraction sites by extreme weather events. For instance, according to a document from the UNDP Zambia's website, "if extreme weather changes continue, in about 50 years, all that will remain of the Victoria Falls (the 'Mosi-oa-Tunya' or the 'Smoke that Thunders'), known as the 7th wonder of the world', would be an empty ravine"²¹.
- Floods cause reduction in the length of tourism seasons, hence reduced income. Projected extreme weather events would only exacerbate the situation.

4.5 Agriculture

The contribution of the agricultural sector in Zambia to the country's national GDP fluctuates e.g. from 1.9% (agriculture, forestry and fishing combined) in 2007 (the 2007 Economic Report-MFNP, 2008) to 12% in 2008 (2008 Economic Report-MFNP, 2009). This fluctuation is due to many factors including the prevailing weather conditions in a season. Nevertheless, the sector is important to the national economy as it employs 85% of the labour force (CIA World Fact Book, 2010).

¹⁹ <http://www.nature.org/initiatives/climatechange/issues/art19623.html>

²⁰ Davos Conference, 2008 report by the United Nations World Tourism Organization (UNWTO)

²¹ <http://content.undp.org/go/newsroom/2010/january/climate-change-the-zambia-story.en> accessed on July 8th 2010

Crop and livestock production sub-sectors are the most important sources of income, together representing almost half of the total income earned by rural households (Freeman *et al.*, 2007).

Cultivation of crops is concentrated on the plateaus of Central, Eastern and Southern Provinces characterised by the drier miombo, whose top soil is more fertile than that of the wetter miombo (Chidumayo, 1999). The latter is predominant in the northern provinces of Zambia. The main crops cultivated are maize, rice, cassava, sorghum, groundnuts, millet, sweet potatoes, and cotton, amongst others (Aregheore, 2006).

The ruminant livestock sub-sector is also a major economic activity in Zambia. The sub-sector consists of cattle, estimated at 2.6 million in 2006 according to FAOSTAT; sheep and goats; and comprises traditional and commercial activities (Aregheore, 2006). It contributes about 35% to the national agricultural output. Livestock is kept mainly in Southern Province (1,100,000 cattle and 224,000 goats); Western (500,000 cattle); Central (363,000 cattle and 195 goats); and Eastern (251,000 cattle and 125,000 goats) (Aregheore, 1994 in Aregheore, 2006).

15 million hectares of Zambia's surface area is covered by water in the form of rivers, lakes and swamps. The country has 11 main fisheries distributed within the Congo (4 fisheries) and Zambezi (7 fisheries) basins. Fisheries in the Congo basin include Lakes Bangweulu, Mweru-Luapula, Mweru Wantipa and Tanganyika, while the Kafue, Kariba, Lukanga, Upper Zambezi, Lower Zambezi, Itezhi-tezhi and Lusiwashii belong to the Zambezi basin. These provide the basis for extensive freshwater fisheries.

Fisheries is therefore one of the important sub-sectors in agriculture. According to the FAO, Zambia produced 69,501 metric tons of live-weight fish in 2009; 25,000 people were directly employed in fishing while a further 30,000 were indirectly employed by the sub-sector through trading, processing and transportation. The value of fisheries exports exceeded \$US 1.9 million²².

Fishing in Zambia is carried out by two distinct groups: industrial operators and traditional or artisanal fishers. The industrial fishery is carried out on Lakes Kariba and Tanganyika, where the catches consist mostly of the Clupeids (Lake Sardines – *Limnothrissa miodon* and *Stolothrissa tanganicae*) and Buka buka (*Lates stappersii*), while the artisanal fishery, which has the majority of the fishing community, exploits the inshore fish stocks comprising mostly breams and catfish.

Impacts of climate change on the agricultural sector

a) Crop husbandry

Like the rest of Sub-Saharan Africa, Zambia's agricultural sector is largely rainfall dependent, making it highly vulnerable to climate change and climate variability. The Second National Communication to the UNFCCC²³ states that "climate change is

²² The FAO: *Fishery and Aquaculture Country Profiles (Zambia)*:
http://www.fao.org/fishery/countrysector/FI-CP_ZM/en

²³ Still a draft, and not yet published

expected to have a direct impact on agriculture and livestock activities, which underpin the livelihoods of most of the rural poor. Crop yields may be affected adversely by the vagaries of climate change, and the control of pests may become increasingly destabilized. Crop failure due to droughts, dry spells and flooding contribute significantly to food insecurity especially in rural Zambia". The following highlight some of the observed and potential impacts of these conditions on Zambia's agricultural sector:

- Flood events, especially those related to the La Niña phenomenon, affect agricultural activities as heavy waters inundate farming fields and submerge crops, sweep away assets including livestock, and keep away farmers from their farms.
- An increase in the frequency and severity of El Niño drought episodes especially since the 1980s has impacted negatively on crop production. Between 1988 and 1992, over 15 drought events were reported in various areas of southern Africa. Prior to the 1980s, strong El Niños occurred on average every 10 to 20 years, but the early 1980s marked the beginning of a series of strong El Niño events: 1982/1983; 1991/1992; 1994/1995; and 1997/1998 (Glantz *et al.*, 1997 in Kandji *et al.*, 2006). This increase in the frequency and intensity of El Niño episodes is exacting a heavy toll on the inhabitants and economies of southern Africa. Five of the El Niño events recorded between 1965 and 1997 resulted in significant decreases in agricultural production, exacerbating food insecurity throughout the region (Kandji *et al.*, 2006). The vulnerability of crop cultivation to climatic shocks in Zambia is further enhanced by the fact that a significant portion of arable land is in a semi-arid region, e.g. Central, Eastern and Southern Provinces (Thamana, 2008; Chidumayo, 1999).
- Economically, these impacts have major implications. A study by the International Food Policy Research Institute (IFPRI) estimates that climate variability costs the country USD 4.3 billion over a 10-year period (Thurlow *et al.*, 2009). These losses reach as high as USD 7.1 billion under Zambia's worst rainfall scenario. Moreover, most of the negative impacts of climate variability occur in the southern and central regions of the country, where food security is most vulnerable to climate shocks. Overall, climate variability is projected to keep 300,000 people, most of whom are dependent on subsistence agriculture, below the national poverty line by 2016 (Thurlow *et al.*, 2009).
- Further on economic implications, a World Bank study based on the Ricardian method predicts 252% and 243% reduction in maize production in Zambia as a result of a 20% decrease in mean precipitation between January and February and 1°C increase in mean temperature between November and December, respectively. A 1°C increase in mean temperature between January and February would result in 237% increase in maize production (Jain, 2007; de Wit, 2006).

b) Livestock and fisheries

- Climate change is also likely to have major impacts on poor livestock keepers and on the ecosystems goods and services on which they depend. These impacts will include changes in the productivity of rain-fed crops and forage, reduced water availability and more widespread water shortages, and changing severity and distribution of important human, livestock and crop diseases (Thornton *et al.*, 2007; WCS, 2008).

- Zambia's fisheries could also be under threat from climate change. The main threats emanate from falling water levels and rising water temperatures. Increased temperatures and decreased water levels (the latter due to frequent and extended droughts as well as increased evaporation rates as a result of the higher temperatures) are very likely to change the ecology of lakes. Lower water levels would limit the ability of the lakes to flush out harmful substances, such as phosphorous. Increased levels of phosphorous loadings, in some locations, would likely stimulate nuisance plant growth (e.g., of the water hyacinths that clog waterways) and upset current oxygen dynamics.
- Higher temperatures alone have important influence on primary productivity of phytoplankton as they lead to lower dissolved oxygen. For example, observational lake-temperature data from the past 90 years indicates that Lake Tanganyika has warmed significantly in response to global climate change, and that this increase has promoted an increase in stratification and consequently, a decrease in primary productivity (e.g. between 1975 and 2000, phytoplankton biomass reduced by over 70%) (Verschuren, D. (2003) in Tierney *et al.* (2010).
- For aquaculture, droughts would lead to reduced fish yields from lack of or insufficient water to sustain the fish ponds (or avoiding to stock for fear of flash floods following drought periods especially for 'dambo' ponds); reduced fish breeding; water quality deterioration, hence high fingerlings' mortality; and reduced manure and feed application to avoid further water quality deterioration.
- Slightly higher temperatures would promote fish breeding (e.g. breeding is minimal in the month of June in Zambia when temperatures are the lowest $\approx 24^{\circ}\text{C}$) but further increases would be detrimental as they would lead to lower oxygen levels and higher fingerling mortality. In general, increases in temperatures would be detrimental to both capture fisheries and aquaculture as they result in more male fish due to temperature-dependent sex determination. Temperature-dependent sex determination that predominantly forms one sex can lead to a species' extinction. It has been determined that a related phenomenon would lead to the disappearance of the American crocodile (*Crocodylus acutus*), Costa Rica within the next 25 to 30 years if warming continues.
- Higher temperatures will also lead to lower pH and nutrient availability; hence affecting fish breeding and yields.
- Other important climate change impacts on the fisheries sector include flash floods, which would destroy fish breeding grounds.

4.6 Mining

Mining has been a major part of the Zambian economy for many decades, and was in fact, the main economic activity. The two main minerals found in Zambia are copper and cobalt. Zambia has been the world's largest producer and exporter of copper (highest copper production peak of 700,000 metric tons was reached in 1977), although production has been steadily declining. Copper mining and export accounts for almost 90% of export earnings and has had significant contribution to the country's gross domestic product over the years. Copper and cobalt mining are the major activities in

this sector while coal and gemstone-mining activities have great potential that has yet to be fully realised.

Impacts of climate change on the mining industry

- Floods would cause inundation/water clogging of mines and disrupt mining activities. The Nkandabwe coal mines were once closed due to floods, while recently (2005), coal production at the Maamba coal mines was affected by heavy storms/floods which caused 4 months of operations shut down (Energy Regulation Board 2006 Report).
 - Flooding of mines would further cause local environmental degradation, e.g., bleaching and mine tailings. These would have an effect on site remediation costs, e.g. new designs for tailing lagoons could be required.
 - Extended droughts could create dusty working environment in mines. Such conditions will create employee health and safety hazards concerns.
 - Under these conditions, risk of death, disease or injury from floods, storms, fires and droughts for mining operatives could increase. This could create additional costs for mining companies through lower productivity, compensation claims and disputes, and business interruption.
 - Less water, declining water quality and growing water demand are creating challenges in the mining sector. These trends amplified by the affects of climate change are creating operational issues, restrictions on abstractions, more stringent water quality regulations, pressure to move towards full-cost water pricing, and increased public scrutiny of corporate water practices.
 - Climate change may create energy price volatility and security of supply challenges, and lead to operation disruptions. Disruptions and increases in energy costs could challenge the financial viability of operations.
 - Increase in operating and transport costs: Rising sea levels could affect operations of those mining firms that rely on marine transport for shipping, for example, spare parts when an asset or piece of equipment breaks down. Floods/storm events could have similar impact on road transport.
 - Additional reputation management measures, e.g. “to be seen to be dealing with climate change”: climate change has the potential to create or exacerbate tensions that lead to reputational damage, by modifying the relationships between investments and their surrounding environments and local communities.
- The potential reputational implications arising from competition for water resources and the wider impacts on local communities is an example.
- On the other hand, global efforts to mitigate climate change could also prove beneficial to Zambia’s mining industry. As industries in developed (and rapidly-developing/industrialising) countries could be required to cut their GHG emissions, Zambia could benefit by seeing such industries relocate to the country. For instance, smelting industries in coal energy-intensive countries such as South Africa might relocate to Zambia where electricity generation is almost 100% hydro-based.

4.7 Energy

The largest source of energy in Zambia is biomass. Seventy-five percent of the country's energy supply is from charcoal and firewood; only 25% of the population has access to electricity (UN REDD Readiness Programme, National Programme Document (Zambia), March 2010).

Zambia has abundant hydroelectric resources and meets most of its electric energy needs from its own hydroelectric stations, with 99.9% of produced electricity coming from hydro. Geothermal sources are currently being prospected/pilot construction done. Zambia imports all of its fossil fuels, apart from a small amount of coal (Zambia RECIPES²⁴ 2006). The country's hydropower resource potential is currently estimated as 7,000 MW against total installed capacity of only 1,786 MW²⁵. Demand for electricity in Zambia is almost equal to supply.

Currently, 49.3% of the urban population and 3.2% of the rural population have access to electricity (Zambia REDD Readiness Document, 2010). Electricity is exported to the Southern African Power Pool (Zambia RECIPES 2006). The energy sector is an important component of the economy. Combined with the water sector, it contributed 3.1% to the country's 2007 GDP (AfDB/OECD, African Economic Outlook, Zambia, 2008).

Impacts of climate change on the energy sector

- Droughts and rising temperatures would lead to gradual drying up of biomass, increasing hardship for the majority of Zambians, who are dependent on biomass for their domestic energy needs.
- During extreme wet seasons, access to biomass energy (firewood) is limited because of two main factors: (i) reduction in the amount of available dry firewood, and (ii) fetching firewood in such conditions becomes a life-threatening venture. This leads to increases in the price of firewood and greatly affects poor, rural households who depend mostly on biomass energy. Projected severe weather (flood) events will therefore only worsen the situation.
- Storm events would also destroy energy infrastructure (e.g. power transmission and distribution lines). Such episodes have already been observed in the past, but would likely increase with the expected/projected increase in extreme weather events. There is therefore need to "climate-proof" the energy infrastructure.
- Climate change is expected to dramatically alter the hydrology of African rivers, creating both worse droughts and more dangerous floods (the latter causing safety concerns for dams) (Pottinger, 2009) as well as leading to siltation of dams²⁶. The Stern Review on the Economics of Climate Change indicates that a 3-6°C increase in

²⁴ The RECIPES was a project funded by the European Commission to undertake a study on the status of renewable energy in a number of developing and emerging economies. See the report on Zambia's at www.energyrecipes.org/.../061129%20RECIPES%20country%20info%20Zambia.pdf

²⁵ Information on hydropower potential provided by the Department of Energy, MEWD

²⁶ It should however be note that conditions of above-normal rainfall are good for hydro-power generation. Thus, as far as the hydro-power sector is concerned, droughts are main concern.

temperature in the next few years will result in a 30% to 50% reduction in run-off in Southern Africa (Stern, 2006).

- Higher temperatures will also lead to increased evaporation of water from dams, thereby further reducing their hydropower production potential.
- Serious droughts have afflicted the Southern Africa region over the past 3 decades. The droughts of the 1980s and 1990s have had a marked negative impact. For instance, the water level of the Kariba Dam on the Zambezi River dropped by 11.6 metres between 1981 and 1992, resulting in a reduction of the dam's capacity to generate hydropower (Saundry, 2008).
- The economic impacts of hydro-vulnerability to climate change will be felt both in the costs of power cuts upon industrial output, and the cost of wasted investments in non-performing dams.
- Power cuts also have spill-over effects beyond the industrial sector, i.e. they lead to higher rates of deforestation as people resort to biomass energy (charcoal and firewood).

4.8 Transport and Telecommunication Infrastructure

Transport

The Zambian transport system comprises the following modes of transport: road, rail, water, air and pipeline. About 80% of people and goods are transported by roads and a significant percentage by the railway system. The latter is the principal means of transporting the country's bulk cargo. Very little investment has been made in the air transport industry, there is need however to improve this sector to complement other modes of transport. The contribution of water transport is currently insignificant and could be developed.

The transport sector is critical to development. Inappropriately designed transport strategies and programmes result in networks and services that are not responsive to the needs of the users, and harm the environment. World-over, transport is acknowledged as capable of stimulating growth by facilitating trade and by increasing access to health and education facilities, as well as to other amenities.

The status of the transport sector in Zambia is as follows:

Road transport: Road transport covers most areas in Zambia since the railway network coverage is very limited. Currently it is the fastest and most reliable mode of transportation in Zambia for the movement of freight and passenger traffic.

Zambia has a gazetted road network of approximately 37,000 km of which 6,476 km are bituminous and surfaced to Class 1 standard. Gravel and earth roads account for 8,478 km and 21,967 km respectively (Road Development Agency (RDA) 2010)²⁷. In addition there are about 30,000 km of un-gazetted community roads comprising tracks, trails and footpaths.

²⁷ This section and the figures therein were provided by the RDA

Railway transport: Zambia's railway network consists of two main systems namely, Zambia Railways and Tanzania Zambia Railways Authority. Other railway systems include the Mulobezi Railway and the Chipata- Mchinji Railway Project.

Air transport: Currently, there are 144 aerodromes in the country including four major airports (Lusaka International Airport, Ndola Airport, Livingstone Airport and Mfuwe Airport). The National Airports Corporation manages the four major airports. The rest are either managed by the Government and/or individuals/private sector organisations. Air navigation services are provided throughout the country by the National Airports Corporation Limited.

Inland Water Transport: The contribution of inland water transport to the movement of goods and passengers in Zambia is presently not significant. The country has abundant navigable lakes and rivers but the development of the sector has been inhibited by lack of technical know-how in the management of inland waterways.

Pipe line: Over 90% of Zambia's crude oil is transported by pipeline from Dar es Salaam in Tanzania to Ndola, where it is processed.

Communication

Landline telephone services are provided by the Zamtech, which is managed by the Lap Green of Libya. There are also a number of cellular phone service providers such as MTN and Zain (the latter soon to become Airtel).

Impacts of climate change on the transport and telecommunication industry

- Flood-related impacts could include destruction of roads and bridges, which will put extra burden on the economy in terms of additional infrastructure maintenance costs. An example is the floods of 2007 that destroyed roads and bridges, forcing the government to source for USD 39 million to buy earthmoving equipment to be used for clearing blocked roads (Entrepreneur, 2007).
- Floods would also destroy railway lines and submerge/destroy airport and harbour infrastructure.
- Further, extreme weather events such as rainstorms and thunderstorms could make travelling dangerous, further impacting negatively on the transport sector. Air and water navigation would particularly be affected.
- Extreme drought would also impact negatively on water navigation as it would lead to recession of water levels.
- Rising temperatures could lead to warping of railway lines, and possible derailment of trains.
- Changes in temperature would also affect flight operations (transportation of goods) as the loading capacity is dependent on temperature. The higher the temperature, the lower the loading capacity. Thus, for Sub-Saharan African countries such as Zambia where the temperatures rise will be expectedly higher than other regions as

as a result of climate change, it can be expected that flight operations would be frequently disrupted.

- Other possible climate change impacts include the effect of extreme weather events on pipelines especially those passing through areas prone to mudslides or landslides. Depending on their force, mudslides and landslides can cause great destruction. If such were to happen to pipelines, the supply crude oil would be interrupted, and with significant economic consequences.

4.9 Social Infrastructure (Human Settlements and Health)

“The impact of climate change takes place in cities, towns and villages. They in turn have the greatest impact on climate change”.²⁸ The location of human habitat determines the level to which populations are exposed to climatic risks. The differential impacts with regard to gender, age, socio-economic status and geology have yet to be assessed, but in general, populations residing in flood-prone areas, near paved roads and informal urban settlements (slums) are at greater risk to floods and their associated risks (water-borne diseases, landslides and mudslides). The following sections illustrate some potential climate change impacts on human settlements and health in Zambia.

Impacts of climate change on human settlements and health

- Inaccessibility to adequate and wholesome water during drought episodes: this situation would lead to the outbreaks of water-borne diseases such as skin diseases (e.g. scabies), sore eyes and trachoma.
- Increase in the incidences of climate related diseases such as malaria and cholera: studies carried out elsewhere have shown, that malaria is spreading to African highlands where the disease is not known to be endemic as the range of the disease vector (mosquito) habitats expands due to rising temperatures and changing precipitation patterns (Wandiga *et al.*, 2010). Similarly, Lindsay and Martens (1998) state that malaria incidences have been on the increase in the African highlands over the past 50 years, due to among others, ‘subtle climate changes’.
- Cases of water-borne diseases such as cholera, typhoid and dysentery reach epidemic levels in many places during floods²⁹. Those most at risk are the rapidly-urbanising populations where sanitation infrastructure is inadequate or lacking (WHO, 2007) e.g. in the Lusaka slums where in early 2010 alone, close to 6000 cases and tens of deaths from cholera were reported (OCHA Southern Africa Regional Floods Update, April 2010). Cholera outbreaks in Zambia and have been statistically linked to increases in temperature, rainfall and poor waste disposal (Proceedings of the Kabwe NCCRS Technical Review Workshop, 1st-3rd October, 2010). Some of the pre-disposing factors include improper/unplanned urban settlements, e.g. lack of or inadequate solid waste management plans (leading to the blocking of drainage systems by solid wastes) as well as improperly sited/built pit

²⁸ <http://www.unhabitat.org/content.asp?cid=5155&catid=550&typeid=24&subMenuId=0>

²⁹ Water-borne diseases may also occur during droughts as a result of lack of water to wash and maintain basic hygiene, hence un-sanitary conditions

latrines (hence the collapse and overflow of pit latrines) during heavy precipitation events.

- Heavy precipitation/floods would lead to increased incidences of water-based diseases such as bilharzias in some areas, especially those that are flood-prone. The National Adaptation Programme of Action (NAPA) Report (2007) has a record of such an occurrence in Mazabuka District during the 2005/06 rain season.
- Outbreaks of plagues have also been reportedly high during floods, and an association has been established to respond to such occurrences. For instance, bubonic plague was one of the major health concerns of the 2007 floods.³⁰
- Floods would also lead to displacement/migration and even to mortality. For instance, between December 2006 and March 2007, Zambia, like the rest of southern African countries, experienced massive flooding. This was worsened by Cyclone Eline. The flooding left hundreds dead in the region and around 1.25 million homeless. Houses, especially in Copperbelt, Western and Lusaka provinces were knocked down. People were forced to move to higher altitudes for safety (Mudenda, 2010).
- Recurrent droughts would also lead to reduced food crop production and to populations migrating in search of livelihoods elsewhere. Zambia could also face additional pressure from cross-border migration from its neighbouring countries with fragile climate. Migration would lead to scramble/conflict over resources as well as to environmental degradation.
- Further, malnutrition as a result of droughts can have a tremendous impact on those dependent on subsistence agriculture for their livelihoods. According to the World Health Organization (WHO), malnutrition causes millions of deaths each year from both a lack of sufficient nutrients to sustain life and resulting vulnerability to infectious diseases such as malaria, diarrhoea, and respiratory illnesses.³¹
- In addition, climatic place additional and disproportionate burden on different segments of the society, with women and children usually being the most vulnerable. This is primarily due to the differences in the social roles of men and women in the society. In many African societies, men are usually responsible for overall financial security and safety of the family, while women are responsible for food security, health, and all tasks related to everyday running of the household such as fetching water and firewood. It is only in fast-advancing democracies such as South Africa where these gender-differentiated responsibilities seem to be breaking down (Petrie Belynda, 2010).

All these climate-influenced events will further strain the already stretched public health and social infrastructure in Zambia. The government will be forced to divert resources from development to disaster management and mitigation. In addition, insurance agencies and the government would be burdened with having to make reparations to individuals for property damage and loss, unemployment, clean-up, and reduced socioeconomic viability of the communities affected.

³⁰ As demonstrated in this UNICEF's request for funding towards meeting the cost of managing the effects of the 2007 floods, http://www.unicef.org/infobycountry/files/Zambia_Immediate_Needs_6Mar07.pdf

³¹ WHO (2008): climate change and human health

5 STRATEGIC FOCUS: VISION, MISSION AND OBJECTIVES

5.1 Vision and Mission of the Strategy

Vision

The NCCRS' vision is a **Prosperous Climate Change Resilient Economy**.

Mission

The mission of the NCCRS is **to ensure that the most vulnerable sectors of the economy are climate proofed, and sustainable development achieved through the promotion of low carbon development pathways.**

Explanation and Linkages with Development Priorities

In order to achieve the NCCRS' vision of a **Prosperous Climate Change Resilient Economy**, the mission of the NCCRS is to ensure that the most vulnerable sectors of the economy are climate proofed, and sustainable development is achieved through the promotion of low carbon development pathways. By aiming to have the most sensitive economic sectors climate proofed, the NCCRS ensures that climate risks are addressed in the national development plans so as to minimise the adverse impacts of climate change and to ensure development effectiveness.

Both the vision and mission are aligned with Zambia's development priorities as articulated in a number of strategies including the National Long Term Vision 2030 (NLTV) and the Sixth National Development Plan (SNDP) (in progress and not yet published). They are also consistent with sectoral plans and other resources captured in the Medium Term Expenditure Framework (MTEF 2010 - 2012) within which the annual sectoral budgets are allocated. The NLTV is for Zambia *"to become a prosperous middle income country by the year 2030"* through achieving a number of developmental goals including (i) reaching middle-income status (ii) significantly reducing hunger and poverty and (iii) fostering a competitive and outward looking economy (Fifth NDP, 2006 - 2010). In the NLTV, the process through which these goals would be achieved in the long-term as well as the challenges that the economy would face are outlined.

Thus, the NCCRS is aligned with and contributes to the fulfilment of the overall development goals of the NLTV. It also enhances "Pilot Programme for Climate Resilience (PPCR) project", which has targeted the financial sector and planning as a starting point to ensure that climate change issues are mainstreamed in the SNDP for sustainable economic development.

In the NLTV and SNDP, the GRZ has stressed the development of agriculture as the "engine of income expansion in the economy" since agriculture "offers the best opportunities for improving livelihoods" to about 60% of the total population and 70% of the poor who live in rural areas. Infrastructure, tourism, manufacturing, mining and energy are also prioritized as sectors that constitute the core economic sub-themes of

the SNDP and NLTV. The NCCRS has also prioritized these same sectors for climate-proofing and sustainable development.

5.2 Goal, Objectives and Pillars of the Strategy

Goal

The Goal of the Strategy is to ensure that Climate change is mainstreamed in the most economically important and vulnerable sectors of the economy by 2015. The goal is aligned specifically to the period of the SNDP, however in the longer term the goal is to ensure climate change is mainstreamed in all sectors by 2030. The shorter term places priority on the most vulnerable sectors, but is cognisant of the fact that in the long term, all sectors of the economy could be vulnerable to climate change.

Objectives

The objectives of the NCCRS' are related to sectoral adaptation and mitigation actions needed to achieve the Strategy's vision of **a Prosperous Climate Change Resilient Economy** as well as the governance framework needed. They are:

- **Land Use (Agriculture and Forestry):** To develop sustainable land use systems so as to enhance agricultural production and ensure food security under the changing climate
- **Water:** To ensure sustainable management and resiliency of water resources under the changing climate
- **Health and Social Infrastructure:** To protect people and health from climate change and climate variability
- **Physical Infrastructure:** To climate proof infrastructure
- **Transport:** To develop a less carbon-intensive and climate change-resilient transport system
- **Energy:** To develop a less carbon-intensive and climate change-resilient energy infrastructure and grow using low carbon path
- **Mining:** To develop a less carbon-intensive and climate change-resilient mining industry
- **Governance:** To develop an appropriate climate change governance (policy, legal and institutional) framework
- **Mainstreaming:** To mainstream climate change in all the key sectors of the economy

The Strategy's Pillars

To achieve the above, Vision, Mission and Objectives, the Strategy has five core pillars. These are:

1. Adaptation and Disaster Risk Reduction

Under adaptation, the aim is to ensure that the most climate-sensitive sectors are protected from the impacts of climate change by putting in place climate-resilient adaptation actions and disaster Risk Reduction (DRR) mainstreamed.

2. Mitigation and Low Carbon Development

Under mitigation, the aim is to ensure that mitigation actions are implemented in the most GHG-intensive sectors of land-use (agriculture and forestry), energy, transport and mining. Ensure development takes place using low carbon pathways.

3. Cross- Cutting Issues

Under cross-cutting issues, five items are addressed. These are capacity building; research and development; technology development and transfer; climate change communication, education and awareness; Gender and HIV Aids.

4. Governance of Climate Change

The Governance pillar creates a dedicated climate change activities' coordinating entity called a National Climate Change and Development Council (NCCDC) which shall be chaired in turn by the Ministry of Tourism, Environment and Natural Resources (MTENR); Ministry of Finance and National Planning (MoFNP) and the Office of the Vice President.

5. Finance and Investment Framework

Achieving the Strategy's vision of *a Prosperous Climate Change Resilient Economy* requires substantial and additional financial resources to implement the proposed actions. The Strategy outlines ways and means of identifying sources and unlocking the financial resources needed for its implementation.

6 ADAPTATION AND MITIGATION INTERVENTIONS

6.1 Adaptation Interventions

The primary reason for adaptation is that even if all emissions were stopped today, the GHGs already present in the atmosphere will still cause significant climate change now and into the future. Anthropogenic climate change is already occurring: temperatures are rising; an increase in the intensity and frequency of extreme weather events (droughts and floods) has been witnessed; crops are failing, while diseases are spreading to new places. With rising CO₂ levels, climate change is only likely to worsen. For these reasons, the world must prepare for and adapt to the effects of global warming through adaptation actions and policies that are designed to tackle both current and future climate change threats.

In Zambia, the most vulnerable sectors include agriculture, tourism, infrastructure, health, forestry, water, and energy. This is because of the direct dependence of these sectors on climatic factors. For instance, electricity production in Zambia is 99% hydro-based; hence any changes in precipitation can have significant impact on hydrogenation potential. The following sections highlight some of the proposed response measures in these sectors.

Crop Sub-sector

Rain-fed agriculture/crop cultivation is an important livelihood source in Zambia as it employs over 85% of the labour force. Given its reliance on weather, agricultural production will bear the brunt of climate variability and change. Interventions in this sector should include:

- Increased support to the ZMD's Early Warning System to facilitate timely dissemination of weather information so as to enhance preparedness
- Support to ZMD to enable it develop community managed information platforms that can be used for timely dissemination of projected and downloaded weather information to farmers and other users
- Enhancing farming systems that encourage crop diversification including the cultivation and consumption of indigenous and more drought tolerant food crops like cassava, millet, sorghum and sweet potatoes
- Provision of farm inputs such as fertilisers and agricultural lime
- Promoting appropriate irrigation technologies suitable for different agro-climatic regions
- Addressing soil and land degradation by promoting improved soil and land management practices/techniques/technologies such as conservation agriculture (CA) and agroforestry

- Diversification of rural economies, e.g. through value addition to agricultural products, livestock keeping³² and the creation of other enterprises such as apiculture and sericulture
- Enhanced financial and technical support to agricultural sector research and development (R&D), e.g. research that aims to produce drought tolerant varieties
- Enhanced support to extension services, e.g. for the dissemination of crop varieties able to withstand adverse weather conditions
- Enhanced support pest and disease surveillance and control programmes
- Enhanced investment in water harvesting storage infrastructure for agricultural purposes

Livestock Sub-sector

Studies e.g. by Freeman A. *et al.* (2007) have shown that households that keep livestock in addition to crop farming cope better with climatic shocks. In particular, livestock is important in *ex ante* risk management strategies and in *ex post* coping strategies. But livestock keeping is also prone to climatic shocks, especially to drought events which lead to the drying of pasture-lands and watering points as well as to floods that can sweep away livestock as well as spread diseases and pests to new habitats. The following adaptation measures are therefore recommended:

- Provision of insurance schemes or government support programmes to enable restocking of livestock after adverse climatic condition,
- Value addition of livestock products,
- Promoting the use of indigenous livestock breeds,
- Investment in livestock research,
- Enhanced support to extension services, e.g. for the dissemination of livestock species able to withstand adverse weather conditions
- Promotion of fodder banks
- Promoting integrated crop-livestock systems,
- Developing strategies for communally grazed land
- Promotion of intensive livestock production systems
- Investments in forage harvesting and handling equipment for small scale livestock farmers, and
- Enhanced support pest and disease surveillance and control programmes.

³² Studies e.g. Freeman A. *et al.* (2007) have shown that households that keep livestock in addition to crop farming cope better with climatic shocks. In particular, Livestock is important in *ex ante* risk management strategies and in *ex post* coping strategies.

Fisheries Sub-sector

The promotion of aquaculture and capture fisheries can enhance the resilience of communities to climatic shocks. But as has been shown in chapter 4, aquaculture and capture fisheries are themselves not entirely invulnerable to the effects of the changing climate. The following adaptation measures are therefore proposed for these sectors:

Aquaculture

- Investment in fish hatcheries
- Investment in commercial fish feed production
- Investment in water harvesting and storage
- Capacity building in water forecasting and utilization in planning aquaculture
- Promotion of cage fish culture even in dams
- Research in predation control in line with seasonal variations
- Promotion of techniques that reduce flood effects
- Promotion of temperature control mechanisms
- Integration of afforestation with aquaculture
- Enhanced investment in extension services

Capture fisheries

- Identification and protection of fish breeding sites in capture fisheries
- Value addition to fisheries products (e.g. by training fishermen in post-harvest handling and processing)
- Capacity building in staff and infrastructure (training, manpower, labs, research and development, etc) e.g. fostering the ability to model/relate lake/river temperatures to fisheries
- Provision of technologies that reduce firewood in fish smoking (e.g. solar lanterns for drying of fish)
- Research and development: understanding climate change and fisheries
- Sustainable fisheries management (policies and laws and enforcement) to avoid fish depletion.

Water

With its natural endowment of renewable freshwater resource of 105.2³³ billion cubic meters which amounts to 8766 cubic meters per capita per annum under normal circumstances, Zambia is classified as a water-rich³⁴ country.

³³ This value has been obtained from <http://geodata.grid.unep.ch/results.php>. The per capita value is obtained by dividing by Zambia's current population of about 12 million

However, climate models indicate that climate change will result in some areas receiving less than normal average precipitation. Further, some projections indicate that even for areas where rainfall amount will not change, much of it would fall over a shorter period of time than in the past, creating periods of dry spells. As stated elsewhere, for Zambia just like for many other countries in Sub-Saharan Africa (SSA), the problem will be either “too much or too little rain”. The situation is further worsened by insufficient water harvesting and storage infrastructure in the country. For this reason, certain interventions need to be made in this sector including the following:

- Enhanced investments in water capture and storage/abstraction infrastructure such as dams³⁵, strategic boreholes, and tanks to ensure availability of water during dry seasons
- De-silting of dams to increase their water storage volume
- Construction/improvement of drainage systems as well as revision of the construction designs of water related infrastructure (drainage, culverts, etc)
- Protecting flood prone areas through the construction of dykes
- Protecting flood prone areas by putting in place adequate hydrometric network and flood warning systems to monitor river flows and flood regimes
- Investment in appropriate rainfall event measuring equipment e.g. automatic rain gauges to capture rainfall intensity
- Construction of inter-basin water transfers (waterways) to channel water from areas with excess water to areas with deficit
- Enforcement and/or enactment of laws and regulations required for efficient water resource management,
- Heightened awareness campaigns to underscore the importance of sustainable use of water resources
- Protection and conservation of water ‘catchment’ areas, river- banks, and water bodies from degradation and contamination, e.g. by afforestation and reforestation of ‘catchment’ areas
- Protection of wetlands (“dambos”)
- Developing and monitoring artificial re-charging of groundwater for threatened aquifers
- Water resources planning and information system for water resources, water supply and sanitation
- Surface and groundwater resource assessment and monitoring
- Legal and institutional framework capacity enhancement
- Building capacity for water resources management, e.g. training and deployment of personnel to protect watersheds and monitor water quality

³⁴ Water scarcity refers to a situation where a country’s renewable water resource availability is less than 1000 m³ per capita per year. Countries with more than 1000 m³ renewable water resource are considered to be water-rich.

³⁵ Such dams could also be used for flood control purposes

The proposed interventions in the water sector must however, take into consideration the importance of integrated water resources development and management, which has as its core the following principles:

- **Water is a finite resource:** essential to life, human development and ecological functions. It should therefore be managed in an holistic manner by linking the need for socioeconomic development and protection of the natural resource
- **Water has an economic value:** failure to recognise the economic value of water has led to its unsustainable use and degradation of its natural base in many regions of the world
- **Participatory approach:** involving different water users including gender groups, socioeconomic groups, planners and policy-makers in water resource management

In Zambia, integrated water resources development and management is currently promoted through the implementation of the “Integrated Water Resources Management and Water Efficiency (IWRM/WE) 2007-2030” Plan.

Forestry

Over the past decades, Zambia has been losing its massive forest cover at a rate of 250,000-300,000 hectares a year due to a combination of factors which include clearing forests for settlements and agriculture, illegal logging for commercial purposes, and encroachment into forest reserves. Climate change and variability are likely to increase the pressures that forests are already facing, as tree mortality increases with reduced rainfall, and incidences of pest, diseases and forest fires rise. In recognition of these threats and of the role forests play in the lives and livelihoods of ordinary Zambians, the GRZ and its development partners have embarked on programmes to restore the country’s forest cover. These include national tree planting programmes and the ongoing UN-REDD+ Readiness Programme. The latter seeks to prepare Zambia in readiness for a future REDD+ Mechanism’s implementation. Nevertheless, a lot more still needs to be done in the forestry sector to enhance its resilience to the adverse impacts of climate change. The following interventions have been proposed:

- Intensified and sustained afforestation and reforestation programmes to build on existing similar programmes including the rehabilitation of degraded forests
- Promoting agroforestry as a way of meeting both food/subsistence and fuel-wood needs
- Promoting alternative/non-timber livelihood systems³⁶ such as apiculture (beekeeping)³⁷ to take pressure off forest resources,
- Promote sustainable harvesting of caterpillars as well as research into domestication of caterpillar and mushroom farming

³⁶ E.g. through the creation of a lending scheme for youth and women from which they can borrow money to initiate alternative income generating activities

³⁷ Sericulture (silkworm rearing) and *Aloe vera farming* are also alternative non-timber livelihood sources being promoted in many places. More research into their viability in Zambia could be carried out.

- Research in and promotion of alternative energy sources³⁸, energy conservation initiatives, and efficient charcoal production and utilisation technologies to reduce biomass (wood) fuel consumption
- Involving forest-dependent rural communities in forests management through an institutional framework that recognises and defines their role
- Enhanced technical and financial support to extension services
- Application of improved and time-tested forest management practices that can enhance the resiliency of forests and forest products: e.g., planting mixtures of species, maintaining several age classes, reducing tree density, and pruning trees at strategic intervals, and
- Enhance support for disease and pest surveillance and control.

Energy

Zambia predominantly depends on biomass energy, which is comprised mainly of firewood, charcoal and agricultural waste. Seventy-five percent of the country's energy needs is met by charcoal and firewood (UN-REDD+ Readiness, Zambia 2010). Most of the biomass energy is used in rural households, poor urban households and small businesses. The country also depends on hydropower whose production depends on the availability of water in rivers and reservoir dams. As highlighted in Chapter 4, these sources of energy are highly vulnerable to climatic shocks. The following interventions³⁹ are therefore necessary:

- Promotion of efficient utilisation of hydro-schemes' upstream water to improve/ensure availability of water downstream for hydro-power production,
- Research and feasibility studies into inter-basin water transfer⁴⁰
- Promoting energy system diversification by:
 - Promoting the use of alternative renewable energy such as solar, biomass, wind, bio-fuels and their technologies⁴¹,
 - Promoting efficient firewood/charcoal cookstoves, solar and LPG cookers, with the Government addressing the high costs of acquiring these technologies through subsidies or tax waivers to poor households

Mining

As demonstrated in section 4.6, the mining industry faces climate change challenges that may be classified as direct (e.g. flooding of mines) and indirect (e.g. effect on other operators in the mining value chain such as sea level rise affecting marine transport).

³⁸ Especially in urban centres where much of the most population still use charcoal and firewood to meet their energy needs

³⁹ Zambia has developed a Renewable Energies Strategy detailing measures the Government intends to take in order to accelerate renewable energy development in the country. Under the Mitigation section in this chapter, different financial options for investments in renewable energy have been proposed.

⁴⁰ This is one of the projects of the *Water Resources* sector

⁴¹ Through e.g. zero-rating of taxes on renewable energy technologies and other financial incentives

The strategies proposed for the sector entail those that need to address local as well as global challenges, and should include⁴²:

- Implementation of efficient resources (e.g. water) utilisation
- Investment in dust suppression measures and technologies
- Appropriate design of tailing lagoons/effluent discharge systems that take into consideration flooding and water scarcity (drought) conditions
- Developing strategies to deal with the impacts of climate change on other operators in the mining value chain (for example, energy and transport)
- Developing strategies to deal with current and future climate change regulations and industry standards, e.g. measures to respond to possible mitigation legislation/regulation in the industry
- Evaluating the potential impacts (including economic/financial) of climate change in the sector, and developing appropriate measures to deal with such
- Ensuring that the management approach a firm takes is based on robust climate change information and assumptions, and
- Developing strategies for taking advantage of the opportunities that may arise, e.g. how does the Zambian mining industry ensure that it benefits from mitigation measures being imposed on the industry elsewhere?

Rangelands, Wildlife and Tourism

Tourism, which is one of the main foreign exchange earners, largely depends on wildlife, which in turn depends for its survival on rangelands. Extended dry periods which periodically affect rangelands, especially in the southern part of the country, can have devastating effect on wildlife, and consequently, on the tourism industry. Further, international processes such as possible introduction of mitigation measures in the aviation industry could have spill-over effects on Zambia's tourism sector. The following adaptation measures should therefore be undertaken:

- Developing the domestic tourism market to cushion the tourism industry against the spill-over effects of possible mitigation measures in the international aviation industry,
- Developing a National Wildlife Adaptation Strategy⁴³,
- Monitoring, management and remediation of degraded rangelands⁴⁴,

⁴² These strategies have been adapted from Acclimatise (2010): "Building Business Resilience to Inevitable Climate Change". Carbon Disclosure Project Report. Global Mining. Oxford

⁴³ The Zambia Wildlife Authority (ZAWA) in conjunction with other stakeholders including NGOs/civil society, the private sector, and others should take lead in this. This Strategy may involve evaluating potential socioeconomic impacts of mitigation measures (e.g. carbon tax or levy impositions on the air transport industry) on Zambia's tourism sector in a post-Kyoto Protocol regime, and developing strategies to deal with such likely future scenarios

⁴⁴ Well managed rangelands are a potential source of carbon finance given their potential to sequester thousands of tonnes of carbon.

- Encouraging participatory approach to rangeland management involving communities living in or around wildlife-protected areas, and who depend on rangeland resources for their livelihoods
- Creating community wildlife ranches and reserves⁴⁵ as an additional conservation effort for the conservation of endangered species as well as biodiversity enhancement,
- Improving the carrying capacity of rangelands (e.g. through the construction of watering-points/dams in parks and animal translocation)
- Enforcement of existing of laws and regulations.

Health

The country is vulnerable to a number of climate change-sensitive diseases including malaria, cholera, diarrhoea, Rift Valley Fever and dengue. Rising temperatures and changing rainfall patterns are changing the geographical spread of disease vectors (e.g. increasing the habitat range of mosquitoes to include higher altitudes), which necessitates the implementation of the following interventions to deal with the health impacts of climate change:

- Promote sustainable (environmental, social, and nutritional) public health interventions
- Promote sustainable medical facilities and practices⁴⁶
- Renovation and rehabilitation of the existing health infrastructure to bring them to the minimum acceptable standards
- Ensuring adequate water supply during droughts (e.g. through adequate water capture infrastructure) so as to reduce water-borne diseases such as sore eyes, scabies, trachoma etc
- Updating and improved compliance (enforcement) of the existing laws on public health
- Introduction of waste management interventions by the provision of approved and appropriate means of health care waste management⁴⁷,
- Improving access to clean water and sanitary facilities to limit outbreaks of water-borne diseases, alongside strong public awareness programmes to promote better hygiene
- Developing and implementing climate change action plans for urban and rural areas
- Developing climate resilient national water and sanitation policy

⁴⁵ A number of communities through their traditional chiefs, e.g. of Nyalugwe and Machiya have begun to initiate these projects

⁴⁶ By for example, ensuring that hospitals, pharmaceuticals, and practices (including diagnostics) are environmental-friendly. This is an important intervention considering that inappropriate handling of hospital wastes (e.g. through uncontrolled incineration) contributes not only to local environmental pollution, but also to the emissions of green-house gases

⁴⁷ This is potentially a CDM project, e.g. through solid organic waste re-use which would avoid methane emissions

- Conducting research on climate variability/change impacts on disease incidences
- Mainstreaming climate change adaptation into the National Health Policy and the Environmental Health Policy
- Heightened surveillance of new outbreaks including the deployment of technologies such as mobile telephones⁴⁸, with subsequent rapid responses to control the epidemics
- Scaling up of programmes such as the 'Roll Back Malaria' in response to the expected increases in incidences of malaria outbreaks
- Setting up vaccination and immunisation programmes against diseases whose occurrences will be exacerbated by climate change and climate variability
- Creating 'green spaces' in urban centres, i.e. planting trees in urban centres to moderate temperatures and ensure fresh air for healthy living
- Public awareness programmes to promote healthy living, e.g. promoting the safe use of public transportation and active movement such as biking or walking as alternatives to using private vehicles.⁴⁹

Social Infrastructure and Human Settlements

The impact of climate change is mostly felt in villages, towns and cities where populations reside. In Zambia, climate change will largely affect communities residing in poor urban neighbourhoods and those regions prone to drought, floods, geological movements (e.g. landslides). This will require implementation of climate change adaptation strategies including:

- Promoting disaster risk reduction⁵⁰,
- Relocation of humans from disaster prone areas, e.g. from flood-prone areas to alternative safer areas,
- Developing climate change awareness programmes involving all stakeholders,
- Proper planning of urban settlements including ensuring that they have proper housing structures, and adequate waste disposal facilities as well as piped water infrastructure⁵¹,
- Establishing insurance schemes to make reparations to persons and communities affected by climatic disasters,

⁴⁸ See Kamanga et al., 2010 for how mobile telephones can be used to monitor and communicate information about malaria outbreaks from remote areas to authorities responsible for disease control

⁴⁹ These could improve public health by limiting the emissions of gases associated with respiratory and cardiovascular diseases as well as of carbon dioxide, hence help mitigate climate change. For more details, refer to WHO (2009): Protecting Health from Climate Change: Connecting Science, Policy and People

⁵⁰i.e. financial and technical support to units concerned with disaster mitigation and management, constructing dams and dykes in flood prone areas, and improving skills including application of traditional/indigenous knowledge used in flood prediction during the 'Kuomboka' ('Get Out of Water') ceremony

⁵¹ This recommendation is important in view of expected increased rural-urban migration, which will partly be climate-induced.

- Diversifying economic activities to improve resilience to rural communities dependent on climate-sensitive sectors such as agriculture and livestock rearing
- Encouraging the formation of 'satellite committees' that can respond to emergencies, and involving them in key decision making
- Developing empowerment programmes that enhance climate resiliency⁵²

Physical Infrastructure

Like in many poor, developing countries, Zambia's infrastructure continues to be built without taking into full consideration the potential impact of projected climate change on infrastructure. Such approach is not right, considering that climate change is already threatening vital infrastructure such as road and rail networks as well as water and energy systems.

As Zambia expands and modernises its infrastructure, it is important that the country introduce measures that will assure the resilience of the infrastructure over its lifespan, particularly in the face of climate change, i.e. 'climate-proof the infrastructure'⁵³. Ways of achieving this could include:

- Revising the building codes to factor in climate change,
- Introducing changes in the design of infrastructure (e.g. enhancement of the designs of roads, bridges and drainage systems to suit different climatic conditions),
- Creating a strategic fund (either a separate Fund or as a component of the National Road Fund Agency) for responding to damages caused to roads and other infrastructure by extreme weather events (floods), and
- Continuing to use affected areas/sites, but through innovative measures practicable under the new prevailing conditions⁵⁴.

6.2 Mitigation Interventions

Although developing countries' emissions are still low when compared to those of developed countries, they are increasing at a fast rate, and in more or less similar fashion to economic growth. This trend is best described by the "Environmental Kuznets Curve (EKC) models (Grossman and Krueger, 1991). Many of such models show that the early stages of a country's economic growth are usually accompanied by massive natural resource consumption and the consequential environmental pollution. This is true for many developing countries with regard to CO₂ emissions (see figure 2 below for Zambia).

⁵² E.g., creating special lending schemes for engaging in various income-generating enterprises (tree planting, basket weaving, food for work programmes, etc)

⁵³ 'Climate-proofing' of the energy infrastructure may also include investing in alternative energy systems that are less prone to climatic vagaries. For a country like Zambia which is heavily reliant on climate-sensitive hydro power generation, climate-proofing the energy sector may include investing in geothermal and other alternative energy systems.

⁵⁴ An example is the construction of railways with materials engineered to withstand the projected high temperatures.

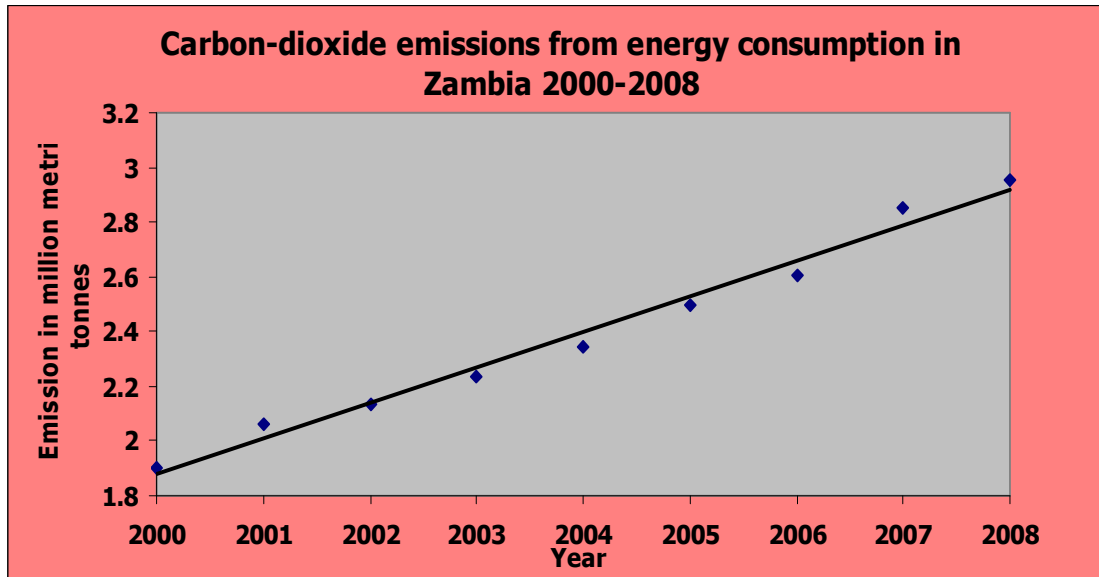


Figure 3: Growth of GHG emissions from energy consumption for Zambia (2002-2008). The figure is generated using data from the United States Energy Information Administration (IEA)

There is therefore a need for all countries to undertake emissions reduction measures if we are to achieve the UNFCCC’s overall objective of limiting global GHG emissions at a level that would ‘avoid dangerous anthropogenic interference with the climate system’. For developing countries, some mitigation actions could also act as adaptation measures. For instance, diversification of energy (e.g. by investment in wind, solar, geothermal and cogeneration technologies) can help cushion a country such as Zambia, which is highly reliant on hydro-power, against climatic shocks. In addition, Zambia stands to gain financially from the Clean Development Mechanism (CDM) and the Reducing Emissions from Deforestation and forest Degradation Plus (REDD+) by undertaking mitigation.

In Zambia, the sectors associated with large GHG emissions include land-use (forestry and agriculture) and energy (road transport and industries (mining) primarily due to fossil fuel consumption). The following are some recommended mitigation measures in these sectors.

Land-use Sector

The land-use sector (land-use, land-use change, forestry and agriculture) is the largest source of anthropogenic GHG emissions in Zambia, accounting for over 90% of the total (54,716 kilotons) emissions in 2000 (Second National Communication, 2010). Deforestation is the principal causative agent of these emissions. The primary drivers of deforestation vary across regions and include charcoal and wood fuel use (for domestic, commercial and industrial uses); ii) timber production; and iii) unsustainable agricultural methods and other land use practices, i.e. the ‘chitemene’ (shifting cultivation) (UN REDD+ National Programme Document, 2010).

Furthermore, these factors are a result of a complex set of underlying causes that are primarily caused by past and current development processes that cut across numerous sectors (e.g. energy, forestry, agriculture and water). Thus, in order to address them

fully, the entire mode of development within Zambia will need to be altered (UN REDD+ National Programme Document, 2010).

There are a number of interventions that can be applied in the land-use sector in order to reduce GHG emissions from the sector as well as enhance the resiliency of forest-dependent communities. These are partly covered in Section 6. on 'Forestry', but will hopefully be covered fully in a National REDD+ Framework currently being developed through the UN-REDD+ Readiness Programme. In addition to the interventions listed in Section 6., the following can also help reduce emissions from the land-use sector:

- Development and promotion of sustainable agricultural practices (e.g. CA) to discourage shifting cultivation ('chitemene'),
- Promoting sustainable silviculture, e.g. by mandating that commercial timber be produced from renewable planted woodlots, and
- Promoting the use of alternative energy technologies including those that use renewable biomass and biomass waste as fuel⁵⁵.

Transport

In Zambia, road transportation accounts for a large percentage of energy-sector emissions. Like the rest of the developing world, transport-related GHG emissions in Zambia are rising quite fast closely mirroring economic growth. The primary reason for this is as economies grow, the range of middle income earners expands, and consequently, the 'necessitation' of products previously considered being of secondary importance. This partly explains the rapidly rising acquisition rates of cars for private use in many developing countries. The other reason is the deterioration of the public transport sector, not just in Zambia, but in many developing countries.

In Zambia, the situation is worsened by the fact that there are no laws to regulate or restrict the age of vehicles that can be imported into the country. Thus, many people are importing highly fuel-inefficient cars based on old technologies. This trend could potentially 'technologically lock in' Zambia towards a high emissions path and negate the opportunities it could derive from the carbon markets. Besides, the resulting traffic congestion from such high vehicle importation rates has significant local environmental and health as well as economic consequences. For instance, a rough estimation of the economic impact of traffic congestion in Lusaka results in USD 290 million losses per year (Prem Jain, personal communication). Zambia therefore needs to put in place measures that can curb GHG emissions in this sector. Some of these measures include the following:

- Promotion of low-cost public transport modes such as bus rapid transit (BRT)⁵⁶ and other means of mass transport

⁵⁵ Zambia is one of the major timber producers in Africa. The wood-timber conversion process can generate a lot of waste (woodchips and saw-dust). Some saw-mills have invented stoves that burn saw-dust to produce energy for cooking. In Kitwe, Rainlands Timber Limited has invented such a stove, and is in the process of promoting it throughout Zambia. Burning saw-dust instead of firewood to provide cooking energy can help take pressure off forests and reduce deforestation. This is also a Clean Development Mechanism (CDM) opportunity.

- Proper urban transport planning to facilitate efficient and low GHG modes of transportation
- Encouraging non-motorised modes of transport (NMT) by creating bikeways and pedestrian walkways in urban centres
- Creating transport demand management measures that encourage or favour public transport and NMT⁵⁷
- Creating a programme to phase out old and inefficient (high fuel-consuming) motor vehicles, while encouraging importation of efficient vehicles through tax incentives and other financial tools
- Creating awareness and possibly “car-pooling” policies through punitive taxes and charges, e.g. road and fuel levies to reduce unnecessary travel
- Strictly enforcing vehicle inspection rules to ensure motor vehicles are well-maintained in order to reduce pollution⁵⁸
- Effective traffic management, which can reduce traffic congestion in urban areas and bring about significant environmental gains
- Enacting a law that would compel vehicle owners to install pollution-control devices such as the three-way catalytic converters⁵⁹

Energy

In Zambia, the main fossil energy GHG emission sources are kerosene lamps and candle wax used in rural homes as well as diesel-operated generator sets⁶⁰. In general, electricity related GHG emissions are low because electricity is generated mainly from hydro sources. Nevertheless, the energy sector presents a mitigation opportunity particularly because of the country’s large hydropower potential (currently estimated at 7000 MW). This has been well captured in the Renewable Energy Strategy (Ministry of Energy and Water Development, 2010), which aims to tap the potential from renewable energy sources that have previously been under-utilised. The following are some of the proposed strategies⁶¹:

- Developing renewable energy resource maps including wind-regimes and geothermal maps, and possibly, storing the information in an accessible location, e.g. a web-portal
- Promoting rural electrification using solar photovoltaics and other solar technologies

⁵⁶ GTZ (2008): There is no clear definition of what constitutes a BRT. A BRT is instead defined by various features which makes the system faster than conventional bus transport systems and these could include dedicated (exclusive right-of way) lanes; rapid boarding and alighting; free transfers between lanes; pre-board fare collection and verification; clear route maps; real-time information displays, etc.

⁵⁷ See Karekezi S., Majoro L. and Johnson T.M, 2003: Climate Change and Urban Transport: Priorities for the World Bank for more information concerning the first four interventions

⁵⁸ e.g., appropriate regulatory measures on vehicle size, weight, noise and fumes can be an effective protection against environmental pollution

⁵⁹ These can *inter alia* convert oxides of nitrogen including infra-red active (or global-warming) nitrous oxide into nitrogen and oxygen

⁶⁰ For example, the entire Lukulu and Luangwa Districts are served by gensets (Lemmy Namayanga, Zambia DNA Office, Personal Communication)

⁶¹ Please refer to the Renewable Energy Strategy for Zambia (2010) for more details

- Enhanced investment in hydro electricity generation schemes
- Promoting the use of renewable biomass as an alternative energy source
- Promotion of energy efficiency
- Investing in a biofuel industry, covering the whole chain of biofuels (from the cultivation of crops to processing of fuels)

In addition, the Renewable Energy Strategy has highlighted some barriers to the development of renewable energy, with financial constraint singled out as the main barrier. The Strategy therefore proposes the following solutions to help address funding and other challenges in the energy sector:

- The development of a renewable energy policy
- The development of a Renewable Energies Feed-in-Tariff (Refit) policy. Refit policies have been used effectively in many countries⁶² as a way of encouraging private sector engagement in renewable energy generation
- In combination with the waiver of import duties and obligatory annual license fees for solar home systems (SHS), there is need to include credit facilities⁶³ to enable more people access credit with which they can buy these systems
- Using revenue flow from the Clean Development Mechanism (CDM) or its future successor — to leverage investments in renewable energy technologies (RETs)
- Taking advantage of bilateral and multilateral funding opportunities available to developing countries to implement RETs projects, e.g. the European Commission's Global Energy Efficiency and Renewable Energy Fund (GEEREF), the Clean Technology Fund (a component of the Climate Investment Funds of the World Bank), etc
- Setting up a National Clean Energy Fund, as proposed in the Renewable Energy Strategy, which can provide concessional loans to individuals and organisations that would like to invest in green energy sources
- Developing a National Appropriate Mitigation Action (NAMA)⁶⁴ framework, detailing mitigation programmes and projects that can be funded through the NAMA mechanism likely to be entrenched in a future UNFCCC agreement

Mining

In Zambia, emissions from the mining sector include the use of charcoal and firewood (to a lesser extent), fugitive methane emissions from coal mining, and fossil fuel combustion to meet process heat energy requirements (draft Second National

⁶² e.g., in Germany, Kenya and South Africa, among many other countries

⁶³ A combination of financial tools (tax waivers, credit facilities, etc) has been proven to be the most effective way of accelerating the rate of solar PV acquisition. Some reports indicate that provision of credit facilities, provided the scheme is well designed e.g. through micro-finance institutions as has been tested in Kenya, can increase solar PV acquisition rate by as much as 50%

⁶⁴ NAMAs are voluntary mitigation actions by developing countries, which can be supported through technology transfer, financing and capacity building by developed countries under a post-Kyoto regime.

Communication, GRZ, 2010). Mitigation in the sector entails similar strategies proposed for the energy sector, and include *inter alia*:

- Fuel-switch, e.g. using electric conveyor systems as opposed to trucks for transportation of ores and other materials
- Promotion of the use of renewable energy sources including renewable biomass, e.g. charcoal and firewood produced from renewable plantation forests
- Promotion of energy efficiency (i.e. use of efficient technologies as well as process redesign to improve resource efficiency)

Textbox 2: Clean Development Mechanism and Reduced Emissions from Deforestation and Forest Degradation Plus

Developing countries (also known as Non-Annex 1 Parties) such as Zambia can voluntarily choose to undertake mitigation in various sectors including energy, transport, land-use (forestry and agriculture), and manufacturing, among others. By so doing, they stand to gain monetarily from 'carbon markets' that allow them to sell Certified Emission Reduction (CER) credits to developed countries (also known as Annex 1 Parties) to help the latter cost-effectively mitigate against climate change. This is legislated under the Kyoto Protocol's CDM compliance markets. The first of such projects in Zambia to be registered is the Lusaka Sustainable Energy, which is a renewable biomass/energy efficiency project. But like most poor countries especially in Africa, Zambia is yet to reap significant benefits from the CDM. Zambia needs to address some key issues to benefit more from the CDM include:

- Target capacity building for the private sector and investors to increase the knowledge of GHG reduction project development and markets, e.g. through a handbook for CDM Project Activities detailing the role of government and the UNFCCC, CDM cycle, types of projects, eligibility criteria, CDM transaction costs and how to sell Certified Emission Reductions (CERs);
- Need for a government-fronted manual that guides CDM implementation; this can be placed on a public website, as has been done by a number of countries including Tanzania;
- Strengthening relevant institutions such as the DNA and removing barriers to carbon trading such as high initial transaction costs and low level of awareness of CDM potential on the part of private sector, particularly investment and financial organisations;
- Providing tax incentives and favourable import tariffs on technology for projects that reduce emissions;
- Having clear energy pricing and CDM project policies including a general institutional framework and good governance;
- Designing a general ranking of the easiest and most viable project types to the most difficult and least viable (low hanging fruits first to build momentum);
- Creating a database of existing projects, emission reduction volumes, other benefits, project developers, financiers, government support
- Exploring ways of integrating carbon markets into the main economy and opening it to conventional legal and banking systems.

Carbon markets also comprise of the buying of 'carbon offsets' by individuals and organisations who wish to voluntarily offset their GHG emissions, i.e. under the Voluntary Carbon Markets (VCM). Currently, the VCM is dominated by the REDD+ projects. Under a post Kyoto Protocol regime, REDD+ will transform to a compliance market. Countries like Zambia with huge tracts of forest land [and high rates of deforestation] stand to gain from a REDD+ mechanism. Thus, the ongoing REDD+ Readiness project that seeks to strategically prepare the country for a future REDD+ mechanism is a welcome move. In order for Zambia to benefit from the REDD+ Mechanism, the REDD+ Readiness project must provide the following:

- Robust monitoring, reporting and verification (MRV) institutional arrangements (clear credible national forest monitoring baselines and guidelines);
- Means of filling the historical data gaps on forest cover throughout the country;
- Addressing the risk of non-permanence and leakage as a necessary condition for any parties or entities to participate in a REDD+ Mechanism activities;
- A capacity building framework on REDD+ Mechanism (e.g. on REDD+ methodology development);
- A means of providing financial support, technology transfer and capacity building to forest-dependent communities to enable them diversify their livelihoods and in the process, conserve their forests
- A framework for joint action involving both the public and private sectors in order to mobilise the necessary finance and accelerate REDD+ actions.

7 CROSS-CUTTING THEMES

This chapter addresses Capacity Building; Technology Development and Transfer; Research and Development (R&D); Communication, Education and Awareness; Gender and HIV Aids. These are cross-cutting themes which affect the efficiency and effectiveness of climate change mitigation, adaptation and policy measures.

7.1 Capacity Building

The need for capacity building is enshrined in Article 9 (d) of the UNFCCC, which calls upon the Subsidiary Body for Scientific and Technological Advice (SBSTA) – the body created under Article 9 of the Convention – to provide *'ways and means of supporting endogenous capacity-building in developing countries.'*

In view of the risks and opportunities presented by climate change, enhanced capacity building is required to strengthen capability of developing countries like Zambia which have few climate change specialists in the areas of science, policy, adaptation, mitigation carbon trading and carbon markets. Therefore, it is important to put in place a targeted capacity-building framework, and build the capacity of local communities to help them adapt to the adverse impacts of climate change.

In 2008, the United Nations Chief Executives Board for Coordination (CEB) produced a report, 'Acting on Climate Change, the UN System Delivering as One'. This report highlighted among others, areas of capacity building needs in climate change for developing countries such as Zambia. In line with this report, the following should be some of the target capacity needs for the country:

- **Training on Climate Change Competencies and Strengthening Institutions:**
 - Support to regional and sub-regional preparatory workshops for climate change negotiators where Zambia would participate with other developing countries, Small Island Developing States (SIDS) and Least Developed Countries (LDCs) on the UNFCCC negotiation process
 - Technical and policy support to Zambia as a party to the UNFCCC for preparing its National Communications
 - Support to the country in its efforts to implement UNFCCC decisions through country-driven approaches
 - Awareness-raising, development of communication tools, training and planning workshops at local, national, regional and global levels
 - Mobilising and enhancing the capacity of the Government, employers and workers' organisations to contribute to coherent policies and effective programmes leading to greening economies with green jobs
 - Capacity building in the use of geo-referenced demographic and socioeconomic data, in addition to setting up a GHG reduction policy and tools

- Strengthening the Designated National Authority (DNA), including additional personnel
 - Capacity building and support for the modernisation and development of the Zambia Meteorological Department (ZMD). The ZMD makes the following recommendations regarding its capacity building needs in climate change:
 - Creation of multi disciplinary research institute at a higher learning centre to build capacity through training and research in climate change
 - Training of personnel for climate modelling and/or downscaling and research, as well as for generating seasonal forecasts to strengthen early warning systems
 - Procurement of equipment for climate modelling and/or downscaling and research, as well as for generating seasonal forecasts to strengthen early warning systems
 - Training of personnel in the use of satellite remote sensing and technology for climate risk assessment and mapping
 - Financial resources to interpret and disseminate early warning products⁶⁵,
 - Acquisition of automatic rainfall stations
 - Expansion of the National Observation Network system
- **Capacity Building in Adaptation**
 - Providing advisory services on how to mainstream climate change considerations into development decision-making e.g. for the achievement of the MDGs
 - Supporting city and other local governments to mainstream climate change adaptation into their programmes
 - Strengthening planning and capacity development initiatives to reduce risk, prepare and recover from disasters including strengthening institutions in charge of Disaster Risk Reduction (DRR), i.e. the Disaster Mitigation and Management Unit (DMMU) in the Vice-President's Office
- **Capacity Building in Finance**
 - Creating awareness in and enhancement of capacity in climate change finance negotiation
- **Capacity Building in Mitigation**
 - Assisting Zambia to improve its level of participation in the CDM
 - Supporting the identification of policy options that enable the rural poor to engage in climate change mitigation by building the foundation for pro-poor payment for ecosystem service markets

⁶⁵ The products are available, but money is required in order to disseminate them

- **Capacity Building in technology transfer**

- Supporting education, training, information exchange⁶⁶, best practices and national strategy initiatives related to the development and applications technologies adapted to local needs
- Creation of regional networks of climate change focal points in governments to promote exchange of experience and knowledge on technology transformation
- Training programmes and capacity building in the use of the patent information systems and practical mechanisms for technology transfer
- Capacity building in the development and transfer of climate-friendly and resilient technologies
- Capacity building seminars/workshops in different regions to assist promote implementation of new standards aiming at the reduction of GHG emissions through radio and ICT devices

- **Capacity Building to REDD+ programmes**

- Capture opportunities offered by the UN-REDD Programme and Forest Carbon Partnership Facility as well as the REDD+ Mechanism under the Copenhagen Accord to prepare developing countries like Zambia for REDD+⁶⁷, e.g. to
 - Train personnel in carbon markets; offsets mechanisms; documentation (e.g. developing Project Idea Notes (PINs) and Project Design Documents (PDDs)); Monitoring, Reporting and Verification (MRV); forest mapping, and participatory forest management, and
 - Facilitate communities to develop alternative livelihoods (i.e. there is always an economic drive behind deforestation).

7.2 Research and Development

Research and development is important not only in understanding the causes, manifestations and impacts of climate change, but also in responding to it. Research activities are explicitly encouraged by numerous international Conventions and Agreements including the UNFCCC and the Kyoto Protocol, which call on Parties to promote; and to cooperate in: scientific, technological, technical, socioeconomic and other research; systematic observation and development of data archives.

Research focusing on technological development plays an important role in preparing a low-carbon society of the future by improving existing climate-friendly technologies and developing new ones, while agricultural research facilitates the identification of cost-effective ways of producing food for the growing human population. Through research and economic analysis, the most cost-effective measures to mitigate climate change can

⁶⁶ An example for such information sharing platform is the Zambia Emergency Preparedness Response Information System developed by the DMMU

⁶⁷ The ongoing REDD+ Readiness Project is an example

be identified. Further, research is required in predicting climate-related changes at local levels so that appropriate adaptation measures can be taken.

Key sectors where climate change research should be carried out and the specific research areas include:

Agriculture (Crop and Livestock Husbandry)

As an important sector to the country's economy and one of the sectors most vulnerable to climate change, there is need to scale up research in agriculture in areas that respond to climate change including:

- Countrywide assessments incorporating the use of technologies such as Geographic Information Systems (GIS) to determine regional vulnerability of the agricultural sector to climate change,
- Research on soil, plant and animal diseases and pests due to the changing climate,
- Research into and promotion of drought and flood tolerant crop and livestock species,
- Promoting research that combines traditional and modern methods of food preservation,
- Research on alternative livelihood systems that are currently not practised in Zambia, e.g. sericulture,
- Integrating long-term climate-risk perspectives into district and national planning and investments,
- Strengthening research on better marketing strategies/identification of new market niches for livestock products, and
- Validating indigenous knowledge (IK) with a view to disseminating it for integration into conventional technologies.

Fisheries

It is increasingly being recognised that both aquaculture and capture fisheries are important sub-sectors for supporting rural economic development. But as has been demonstrated in Chapter 4, both of these sub-sectors are vulnerable to climate change. Enhancing their resilience to climate change will require research to be undertaken:

- Vulnerability assessments of fisheries resources (lakes, rivers, streams, aquaculture ponds) to climate change
- Assessing the socioeconomic impacts of climate change on the livelihoods of fishing communities
- Investigating the current adaptation strategies of communities dependent on fisheries resources for their relevance to future climate change, and make appropriate recommendations
- Evaluating current natural resource management schemes and determining their effectiveness in adapting to the impacts of climate change and providing ecosystem services
- Identifying changes in yield, distributions, and markets in aquaculture and fisheries as a result of climate change,

- Improving reporting standards and access to fisheries catch data to improve assessment of the impacts of climate change on fisheries, and
- Identifying extinction-prone species, and designing strategies to protect them.

Energy

In the next decade or so, it can be expected that most of the advanced low-carbon energy technologies such as hydro, geothermal and cogeneration that Zambia needs will be imported. Nevertheless, the country could also engage in “rudimentary” energy research not only as a way of meeting its current energy needs, but also to help it in building its own expertise in energy research in general. Areas of such research relevant to climate change include:

- Enhancement of appropriate local capacity in the manufacture, installation, maintenance and operation of basic renewable technologies such as bio-digesters, solar water heating systems and small hydro-turbines
- Research on the sustainability of biofuels, e.g. a life cycle analysis (LCA) of biofuels⁶⁸
- Developing appropriate local skills and expertise in the conversion of biofuel sources into biofuel (e.g. jatropha seeds into biodiesel) using locally available materials
- Promoting research into efficient methods of conversion of wood and agricultural waste (coffee husks, maize cobs, etc) into commercially useful forms of energy
- Promoting research on improved kilns and ‘jikos’ for the production and use of charcoal respectively that will reduce biomass consumption while generating the same amount of energy.

Forestry

Forests and woodlands are an important part of the Zambian landscape, they also provide many benefits to society. By controlling evapotranspiration, forests are integral component of the hydrologic cycle, while their products provide livelihoods to many. Because of their direct influence on climate and of climate on them, forests and woodlands are highly susceptible to the changing climate. The following research studies should therefore be carried out to enhance the sector’s resiliency to climate change:

- Research that would enable the country benefit from a future REDD+ Mechanism:
 - evaluating the potential for remunerating natural resource users for natural forests conservation and restoration with funds from carbon markets⁶⁹, and
 - carbon qualification: determining the carbon sequestration capacity of various indigenous species by age, ecology, and spacing while taking into account the effects of climate variables,

⁶⁸Especially biodiesel and how its production on a large scale may interact with food crop production or whether its production and commercialization would result in a net GHG reduction in relation to conventional fuels.

⁶⁹ This is partly being currently undertaken under the ongoing REDD+ Readiness Project

- Developing technologies and strategies to rehabilitate naturally degraded areas or those cleared for charcoal burning
- Developing technologies for domestication and preservation of indigenous species
- Developing research on the management of invasive species
- Validation and integration of indigenous knowledge and technologies in woodlands management
- Market research on wood species of high market demand, and developing on-farm efficient wood-timber conversion technologies
- Developing integrated strategies for the management of new insect pests and diseases
- Promoting research programmes on indigenous tree germination, growth rates and flexible forest management regimes
- Collaborative research between the agricultural and forestry sectors

Health

In line with the recommendations of the report 'Protecting Health from Climate Change: Global Research Priorities' by the World Health Organization (2009), the following are some of the priority climate change-related health research areas that Zambia could undertake:

- Assessing the risks of climate change (including short and long-term public health effects of e.g. extreme weather events, temperature rise) to populations using climate-disease prediction models, and identifying the most effective interventions
- Supporting the use of GIS to map the spatial distribution of interacting risk factors and other critical data, and to communicate research results effectively to policymakers, stakeholders and the public
- Promote research on socioeconomic implications of climate change e.g. climate change-related migration leading to high population densities in urban centres and the likely spread of infectious diseases, and on epidemiology, laboratory science, infectious disease ecology of all diseases related to climate change

Water

Research on climate change-related water challenges should span hydrological systems, drinking water, wastewater and storm-water issues, and should involve:

- Intensified research on hydrologic cycle predictions as these have a direct effect on the spatial and temporal distribution of rainfall and therefore the quantity of fresh water available for domestic, commercial and industrial use
- Assessment of the vulnerability of watersheds, wetlands, groundwater and other water resources due to hydrological cycle change

- Assessment of water quality as it relates to source and receiving waters, storage, treatment, conveyance and demand, in addition to research on adaptation and management practices to protect and manage water quality
- Assessment of the potential impacts of climate change on water, waste-water and storm-water infrastructure – including risk exposure of key water infrastructure to weather extremes
- Assessing the use of cost effective and environmentally friendly water purification methods.

Tourism, Wildlife and Rangelands

Tourism is one of the key economic sectors the GRZ has lately focused on as part of its efforts to diversify the country's economy. But the sector is vulnerable to climate change as it depends on climate-sensitive natural resources — rangelands and the wildlife they support. In addition, Zambia's tourism industry is vulnerable to global climate change processes beyond the country's control, i.e. a possible mitigation regulation/law for the aviation industry that would affect the tourism industry globally. With these in mind, the sector stakeholders including the MTENR, the ZAWA, the private sector (e.g., tour operators), and others should undertake the following research items that would cushion tourism against climate change impacts:

- Assessing current climate change threats and risks to wildlife, and vulnerability indicators
- Assessing future climate variability and the vulnerability of species and ecosystems to projected climate change
- Strategic research into and development of appropriate strategies against the spill-over effects of possible mitigation measures in the international aviation industry⁷⁰.

7.3 Technology Development and Transfer

In the context of climate change, technology transfer is defined as *'a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, nongovernmental organisations and research/education institutions.'*⁷¹ It has been one of the topics that have continuously generated a much debate in the international climate change negotiation processes.

Technology transfer is one of the 'building blocks' of the Bali Action Plan (BAP), which calls for enhanced action on technology development and transfer to support action on mitigation and adaptation, including, inter alia, consideration of:

⁷⁰ Such strategies could complement the planned development of the domestic tourism market

⁷¹ IPCC (2000) Methodological and Technological Issues in Technology Transfer: A Special Report of the Working Group III of the IPCC-Summary for Policy Makers,p.4, <http://www.ipcc.ch/pdf/special-reports/spm/srtp-en.pdf>

- Effective mechanisms and enhanced means for the removal of obstacles to, and provision of financial and other incentives for scaling up of the development and transfer of technology to developing country Parties, to promote access to affordable environmentally sound technologies
- Ways to accelerate deployment, diffusion and transfer of affordable environmentally sound technologies
- Cooperation on research and development of current, new and innovative technology that facilitate win-win solutions
- The effectiveness of mechanisms and tools for technology cooperation in specific sectors.

The following illustrates some of the channels through which technology development and transfer may be enhanced to help Zambia meet its sustainable development goals:

- **The Kyoto Protocol's CDM or its future successor:** Essential for the transfer of advanced energy technologies such as cogeneration, geothermal, hydro and all other technologies that result in the removal or avoidance of GHGs
- **The United Nations Industrial Development Organization (UNIDO):** The UN report *Acting on Climate Change: the UN System Delivering as One* (2008) identified UNIDO as one of the UN bodies through which coordination of the transfer of clean technology to the developing world can be facilitated. UNIDO's role as a host organisation for the Cleaner Production (CP) programme, which was created to foster environmentally sound production and consumption in developing countries, also makes it a suitable channel for transfer of technology
- **South-South transfer of technology:** Essential for the transfer of 'adaptation technologies', e.g. agricultural technologies. According to the UNFCCC, 2006,⁷² '*crop and animal varieties are sensitive to local conditions and therefore much of the technology transfer in this area is expected to take place between regions with similar agro-climatic conditions.*' Essentially, this means that agricultural technology transfer is expected to flow between and among countries in the southern part of the globe because of their 'similarities' in agro-climatic conditions
- **North-South transfer of technology** through Foreign Direct Investment (FDI) including taking advantage of 'free-patent' technologies⁷³
- **Through development partners' initiatives:** To help developing countries meet their sustainable development needs, certain developed countries have established funding facilities to facilitate the transfer of their advanced technologies to low-

⁷² UNFCCC, 2006. Technologies for adaptation to climate change, http://unfccc.int/resource/docs/publications/tech_for_adaptation_06.pdf

⁷³ E.g., in 2008, the WBCSD formed the Eco-Patent Commons initiative to encourage the sharing of patents that provide environmental benefit but do not represent an essential source of business advantage. This sharing of environmental patents 'can promote environmental sustainability including eco-efficiency, enabling technology innovation to meet social innovation' (WBCSD, 2008)

income economies. An example is the Nordic Climate Facility (NCF), which was created within the Nordic Development Fund (NDF) of the five Scandinavian countries – Norway, Denmark, Finland, Sweden and Iceland. The NCF finances projects that have a potential to combat climate change and reduce poverty in low-income countries such as Zambia

- **Through the establishment and capacity enhancement of local technological innovation centres:** To help strengthen institutional technology generation and transfer through a learning-by-doing approach. The core aim of technology transfer is to help facilitate sustainable development in developing countries, and this can only be achieved by **developing indigenous innovation capabilities** in developing countries, i.e. the capabilities to adapt, develop, deploy and operate clean technologies effectively within specific developing country contexts. Further, empirical evidence suggests that incremental and adaptive innovation processes within developing countries facilitate the diffusion and development of technologies.⁷⁴ This requires sufficient innovation capabilities amongst developing country firms, universities and research institutes, and appropriate links with public sector actors including production sectors.⁷⁵
- **Technology transfer within a future climate change agreement framework:** The recent creation of a 'Technology Mechanism' within the Copenhagen Accord (although non-binding) gives the strongest indication ever that such a mechanism will one day exist. Zambia should place itself strategically - in terms of building the necessary capacities and identifying priority areas in which it can benefit from technology transfer through such a mechanism.

7.4 Communication, Education and Awareness

Communication

The crucial role of communication is to facilitate citizens to be better-informed on climate change issues and actively participate in programmes to combat it. There is therefore need to develop appropriate models of communications that will serve to transmit and disseminate information on climate change. The essential characteristics of communication models should among many include: community ownership and participation, language and cultural relevance, creating local content, using appropriate technology to meet the real needs of the people and which can be owned and controlled by the people, and learning & sharing among networks of people with similar concerns. It is vital for the government to gather and systematise already available data and generate additional information to ensure an adequate analysis including disaggregated data for marginalized groups. The following measures then need to be in place for effective climate change communication.

⁷⁴ Ockwell David and others (2009): Fulfilling the United Nations Framework Convention on Climate Change (UNFCCC) Bali Action Plan: Maximising the impact of low carbon technology transfer. University of Sussex

⁷⁵ Juma C. (2006): Re-inventing African Economies-Technological Innovation and the Sustainability Transition. The John Pesek Colloquium on Sustainable Agriculture

Public Awareness

Climate change is a relatively new topic in many developing countries including Zambia. As such, the level of awareness on the issue among the general populace is expectedly low. But climate change does impact on all, and moreover disproportionately on the poor and marginalised groups, who also happen to be the least informed of the subject. Everyone should therefore be well informed of climate change, its impacts and the necessary adaptation and mitigation measures to be taken.

Training at community level is necessary to ensure that various communities are aware of climate change and can use climate data and information acquired through systematic observations.

Some ways of raising public awareness include:

- Establishing a National Climate Change Awareness campaign
- Using print and electronic media to pass climate change information in various articles and programmes on climate change in the media
- Education-based entertainment, i.e. “edutainment”: educating the citizens on climate change while entertaining them at the same time through e.g., theatrical performances
- Creating climate change training material and programmes for target groups of stakeholders and specific groups, i.e. women, men children, youth, people with disabilities, religious groups
- Promotional activities and sponsorship of events with climate change themes, e.g. a reward scheme for pupils or individuals who plant trees and maintain them,
- Schools or colleges’ competitions where students perform drama, poetry, essays and music with climate change themes and the best get rewarded
- Formation of youth, women’s and men’s groups, CBOs, as forums for outreach, and including existing youth groups and initiatives in ongoing climate change and decision making activities
- Documenting climate change impacts and linking them to community livelihoods
- Online blogging on sites such as Facebook, Twitter, Google Groups, and Yahoo Groups through which various topics on climate change could be discussed
- Using graphical images to pass climate change information
- Eco-tournaments – using sporting events (athletics, football, etc) to raise awareness
- Encouraging individual voluntarism in raising awareness
- Involving the corporate sector, especially the mobile telephone industry e.g. to display ‘airtime top-up messages’ on climate change

Climate Change Education

In many developing countries including Zambia, there is a critical dearth of knowledge and skills in areas related to climate change science and policy. This is because climate change as a subject is a relatively new subject in many of these countries, and is

therefore not part of their schools' and colleges' curricula. In order to address this shortcoming, the following measures should be pursued:

- **Curricula review to integrate climate change into education systems:** The Ministry of Education should incorporate climate change into school curricula at all levels as part of education and public awareness. The expected outputs should include:
 - Updated school curricula with climate change content,
 - Updated textbooks and other learning material with climate change content,
 - Better educated pupils/students in the field of climate change, and
 - Updated or new courses incorporating climate change issues,
- **Develop, strengthen and harmonise national education, research institutions and programmes** on issues regarding the impacts of, adaptation to and mitigation against climate change. This in turn should lead to the development of technological capacity in various climate change fields
- **Involvement of local administration and community leaders:** Educating and training development workers, local authorities, community leaders on climate change results in committed mutual understanding and concerted action against climate change
- **Developing and disseminating climate change literature in local languages** for the benefit of marginalised populations and the general public, thereby encouraging their involvement in adaptation and mitigations programmes. Scientific data and terminologies should be well explained and simplified in literature, which could be in the form of brochures, illustrated pamphlets, billboards and journals

The above recommendations are in line with the just completed "Information Needs Assessment and Identification of Information Gaps on Climate Change in Zambia" (MTENR, 2010). The recommendations for climate change education, training and capacity building include the need to: (i) formally integrate climate change related topics at primary, secondary and tertiary levels to further entrench climate awareness and develop skills in climate related analysis, (ii) develop an aggressive awareness strategy at country level to include various stakeholders, (iii) develop climate expertise development strategy through learning by doing and involving as many institutions as possible.

The Report also notes that some institutions have made commendable strides in these areas. An example is the Energy and Environment Research Group (EERG) at the Physics Department, UNZA, which has been at the forefront in integrating climate change studies in the curriculum over the past two decades both at the undergraduate and post-graduate levels. Some progress has been made at the Copperbelt University in integrating climate change in the environmental engineering and biological studies curricula.

7.5 Gender, HIV and AIDS

HIV and AIDS is one of the existing developmental challenges in Zambia. These affect all sexes and age groups, but women and children are particularly vulnerable because of the gender-differentiated roles of men and women in a society. In most traditional African societies, men are usually responsible for overall financial security and safety of the family, while women are responsible for food security, health, and all tasks related to everyday running of the household such as fetching water and firewood (Petrie Belynda, 2010). This is to say that in most cases, women are the everyday livelihood seekers. But some studies show that men are increasingly playing a major role in livelihoods by providing finances to buy food and other basic needs.

Livelihoods, particularly in rural areas, depend to a large extent on rain-fed agriculture. Statistics indicate that this employs 85% of the Zambian population (CIA World Fact Book, 2010). With climate change and climate variability impacting negatively on agriculture, livelihood options are reduced. This, coupled with lifestyle changes, has seen many women go into commercial sex work as a “coping strategy” in order to sustain their families. The consequence is an increase in HIV and AIDS cases and other related sexually transmitted diseases. The situation is particularly grave in child and female-headed households. In addition, women are burdened with the need to care for those who fall sick to the pandemic. This further reduces their productivity.

In Zambia, HIV/AIDS prevalence is estimated at about 14.8% (2007 Demographic and Health Survey). The HIV/AIDS pandemic presents a number of challenges and differs from other shocks in that it i) has long-term impacts, ii) attacks the most productive cohorts iii) puts heavy pressure on women as they play a leading role in caring for the sick and orphans, iv) significantly reduces the gross national product. According to a study by the Ministry of Health, the impacts of HIV/AIDS include increased financial costs, pressure on agricultural labour and loss of employment.

Interventions

Some of the specific interventions include:

- **Mainstreaming of Gender and HIV and AIDS:** Government interventions on arable agriculture should not only focus on provision of farming inputs and technological packages but should include mainstreaming of gender and HIV/AIDS. Women and youth should particularly be targeted through focused programmes such as provision of draught power to women and the most vulnerable.
- **Access to credits by women and other marginalised groups:** Access to credit becomes very important in instances where women do not meet their basic needs. However, the prerequisites and processes for accessing these credit initiatives sometimes exclude certain members of society, particularly women, from accessing them. These credit programmes should be reviewed specifically to mainstream gender and allow equal access to related training, credit and skills-development programmes to ensure women’s full participation in climate change initiatives.
- **Research surveys for information gathering:** There is limited available survey data to clearly expose the disparity between female and male energy needs, use and how the gender groups are performing in terms of accessing modern energy

sources/fuels. It is recommended that research/ surveys in this area be conducted to inform energy related policies.

- **Provision of basic amenities:** Women still have to travel long distances to collect water. Water supply services need to be improved to provide reliable access to clean, potable water for basic needs that can also be used for productive purposes.
- **Skills improvement:** The need for skills among women to engage in economically productive activities such as basket weaving and commercial fishing is high among rural villages. Programmes geared at training and capacity building in all areas of business (such as marketing and book-keeping) as well as the development of the skills of those interested in learning weaving and fishing skills is needed. Development of reliable markets for local produce would go a long way in making local economic activities such as fishing and basket making economically viable. Support for women's groups to share experiences and exchange lessons in what they engage in should also be promoted.

8 GOVERNANCE OF CLIMATE CHANGE

Governance refers to the Policy, Legislation and Institutional or organisation framework which should be put in place in order to guide the implementation of all climate change activities in the country.

8.1 The Need for Climate Change Policy and Legislation

Why is a climate change policy and legislation needed? To answer this, there is need to understand the difference between a strategy, policy and legislation. A strategy is the overall direction and scope of an organisation/entity over the long-term in order to achieve its goal, while taking into account its resources, often within a limiting or challenging environment, to fulfill stakeholder expectations. Policy on the other hand, can be described simply as a purposeful statement by a government expressing its recognition of a problem and stating its commitment to address the problem through specified actions. One of the key functions of policy is to advise and direct government (officials and agencies) and the governed on necessary actions to address identified problem(s). However, a policy is not binding. There would be no legal consequence on a government or a people that fail to implement their policy. Therefore, every policy ought to be translated into law, as necessary, for effective implementation, but law has other functions that ought to be well understood. When problems are recognized in a society, it becomes necessary to pass laws to address them because law:

- Provides legitimacy for actions (programmes and activities) to address the problem(s) that may otherwise be unacceptable
- Sets goals that a society desires to accomplish in light of a recognized problem
- Is the only acceptable tool in regulating human behaviour and conduct
- Law has official sanctions that give it teeth against any non-compliance/disobedience.⁷⁶

8.2 The Constitution of Zambia

The Constitution of Zambia is the supreme law of the land. Although it does not explicitly mention climate change, it has strong provisions on the environment and sustainable development. It calls for the establishment of policies, legislation and institutions which have a direct and indirect bearing on the environment and climate change. Section 8.3 and 8.4 below reviews some of the more relevant policies, legislation and institutions.

⁷⁶ Dwasi Jane 2009: Development of a Suitable Institutional Framework to Promote Climate Change Adaptation and mitigation Measures

8.3 Climate Change Policy

Policies governing various environmental and economic sectors include the National Policy on Environment (NPE) which was launched in July 2009; the National Forest Policy of 1998; the Policy for National Parks and Wildlife 1998 and the National Energy Policy 1994. The NPE makes direct reference to climate change, whereas other policies have provisions that have indirect bearing to climate change such as the National Energy Policy 1994 provision to “overcome the constraints preventing wider use of new and renewable sources of energy” has a bearing on climate change mitigation since most renewable energy is carbon neutral. The NPE addresses climate change by addressing the four basic natural resources – climate, land, water and biological diversity, together with economic key sectors which an impact on environmental resources – agriculture, tourism, fisheries, forest, wildlife, mining, water, energy, industrial and commercial as well as heritage sectors (MTENR, 2005).

One of the objectives of NPE is *to minimize the adverse impact of climate change and to reduce air pollution and greenhouse gas emissions*. It states that greenhouse gas emissions must be reduced; sinks enhanced and localised air pollution controlled especially in the urban environment (MTENR, 2005)

Although NPE does address aspects of climate change mitigation, adaptation is not well addressed. This is despite the fact that adaptation is a key developmental issue/challenge for a developing country such as Zambia. Therefore, it can be justifiably concluded that there is currently no proper policy framework in Zambia to address climate change. This point has also been emphasised by the Parliamentary Committee in charge of Natural Resources and Climate Change.

Climate Change Legislation

Currently, there are a number of sectoral laws which address aspects of climate change albeit indirectly. They include the Water Act of 1948 (this is being repealed and replaced with Water Resources Management Bill); the Wildlife Act of 1998; the Forest Act, No. 7 of 1999; the Energy Regulation Act of 1995 and the Environmental Protection and Pollution Control Act (EPPCA) of 1990 (It should be noted that there is a bill in Parliament seeking to repeal the EPPCA and replace it with Environment Management Bill 2010). EPPCA, which was enacted for the protection of the environment and the control of pollution, also established the Environmental Council of Zambia (ECZ). The Act has provisions that can be applied to minimize the adverse impacts of climate change and reduce air pollution and greenhouse gas emissions.

Other Acts of relevance to climate change include Mines and Minerals Act which was enacted in 1995 and provides for the granting of mining rights, prospecting, mining and disposal of minerals. It is implemented by the Ministry of Mines and Minerals Development. Although it requires that an Environmental Impact Assessment (EIA) be undertaken prior to the granting of any mining right, it lacks incentives to encourage the adoption of environmental friendly waste disposal systems, rehabilitation measures and pollution control guidelines suitable for mining and prospecting.

There is Disaster Management Act of 13th of April 2010 which creates the DMMU with legal authority for guiding disaster management, risk reduction and other disaster management operations in Zambia. The Act has provisions that are geared towards

mitigating climate disasters such as the need for *"early warning systems covering all sectors"*, and the *"formulation of disaster prevention, mitigation and preparedness... to meet all foreseeable requirements in consultation"* with state and non-state actors.

The UNFCCC and its Kyoto Protocol require national implementing legislation to provide legal basis for agreed mechanisms. It calls for a law that provides legitimacy for all necessary actions intended to mitigate climate change, including provisions regulating carbon trading. This is expressed in the Preamble to the Convention, which states, among other things, that *"...States should enact effective environmental legislation..."*

By necessary implication, a country such as Zambia does not have to create a specific law on climate change. It can strengthen existing provisions to adequately provide for climate change adaptation and mitigation measures agreed in the UNFCCC and to reflect the reality on the ground. This is crucial as the above laws do not adequately cover climate change mitigation (including regulating carbon markets, etc) and adaptation.

Climate Change Institutional Arrangement

Government institutions responsible for climate change activities' implementation include:

- The Ministry of Tourism, Environment and Natural Resources (MTENR), whose mandate include formulation of relevant environmental and climate change policies and laws. Currently climate related issues are handled by the Department of Environment and Natural Resources (DENR), which is under MTENR. The DENR serves as a climate change focal point under the UNFCCC. The Climate Change Facilitation Unit (CCFU) whose objective is to strengthen national coordination of all efforts intended to respond to the climate crisis and integrate climate change responses into national strategic planning. Currently CCFU is supporting a number of climate change studies including development of the strategy. MTENR is politically responsible for the Environmental Council of Zambia (ECZ), which was established as an autonomous body through an Act of Parliament, the Environmental Protection and Pollution Control Act (1990), Cap 204 of the Laws of Zambia. The mandate of the ECZ is to regulate and co-ordinate environmental management; promote environmental protection awareness; ensure environmental protection through enactment and enforcement of regulations; and prevent and control pollution. Because of its expertise in environmental affairs, the ECZ has been involved in a number of climate change activities in the country, including the preparation of the National Communications (NCs) to the UNFCCC. It is currently the National Coordinator for the "Enabling Activities for the Second National Communication (SNC)". It is therefore the institution charged with the overall responsibility of producing the SNC, although the specific tasks within the project such as the Vulnerability and Adaptation (V&A), Cross-cutting Issues, National Circumstances, and Institutional Framework for the Implementation of the NCs, etc are contracted to consultants. Thus, climate change is one of the 'core activities' within the MTENR, where it has particularly developed expertise in climate change negotiations, the preparation of GHG inventories and approves

all CDM projects in the country since it houses the Designated National Authority (DNA).

- Office of the Vice President, the second highest office in the land, houses the Disaster Mitigation and Management Unit (DMMU) whose objective is to strengthen national capacities for effective disaster preparedness, response, mitigation, restoration, and prevention. It has vast mandate including all forms of disasters including all climate related ones. SNDP states that both DRR and climate change should be mainstreamed in Government policy and programmes. DRR focal points already exist in various line ministries and could be used to mainstream climate change. DMMU have an Information Management platform (ZEPRIS) which could be utilized for the management of climate related data. The ZEPRIS houses information across numerous sectors that MTENR can tap into. It already possesses links with the ZMD. DMMU has a well established and clear coordination structure at national, provincial and district level which can be utilized to mainstream climate change.
- Zambia Meteorological Department (ZMD) is mandated to coordinate climate change data. ZMD, a department of the Ministry of Communications and Transportation (MCT) whose traditional mandate is to provide weather information to the aviation industry. In recent years, it has seen its mandate expand with additional responsibilities/tasks such as climate change assessments, early warning information provision, insurance risk assessments and crop yield predictions. ZMD has the responsibility of collecting and managing weather and climate data as well as providing forecasts and other meteorological services. This is guided by the ZMD's strategy and the Meteorological Policy. A Meteorological Act is expected to be enacted soon. It may mandate the ZMD to provide services on a cost recovery basis. The ZMD is a member of the Meteorological Association of Southern Africa (MASA), a regional organisation within the Southern Africa Development Community (SADC) framework. Regional cooperation on remote sensing, data and modelling takes place within the SADC framework. Seasonal forecasts are prepared for the Southern Africa region through the *Southern Africa Regional Climate Outlook Forum* (SARCOF), which provides a 'consensus climate forecast' for rainfall seasons of the entire SADC region. The ZMD is thus a member of the SARCOF. The seasonal forecasts are provided as probabilities for above, below or normal rainfall for regions in Southern Africa based on models and experts' judgments.
- The Ministry of Energy Water and Development (MEWD) is responsible for the formulation and implementation of policies in the energy and water sectors, and ensuring an effective approach to the collection of data for monitoring purposes as well as sustainable development of water and energy resources.

Annex 1 further elaborates on the roles and responsibilities of government agencies involved in CC and challenges they face.

8.4 Institutional Framework for Climate Change Governance in Zambia

From the above, it can be concluded that there is no single institution which has a clear mandate on coordinating climate change activities in the country. An appropriate institutional and organisational framework for co-ordinating and mainstreaming climate change in all sectors of the economy is needed. The sections below propose an institutional framework taking into consideration a number of factors, including:-

1. The identified gaps in capacity of the different sectors to mainstream climate change in their specific action plans, strategies and budgets from community to national level
2. The roles and responsibilities of institutions such as MTENR, OVP and MFNP involved in climate change related activities in Zambia including potential for further mainstreaming.
3. The relevant national policies and laws providing institutional roles and functions to address climate change.
4. The need for an institution that will be acceptable by state and non-state actors to implement the NCCRS Vision and Objectives.
5. The need to ensure that the government's obligations towards meeting Article 4 and 12 of the UNFCCC and the Kyoto Protocol on mitigation of greenhouse gases and climate change adaptation

Table 2: SWOT Analysis of institutions with potential to coordinate climate change activities in the country

Institution	Strength	Weaknesses	Opportunities	Threat
1. Ministry of Tourism, Environment and Natural Resources (MTENR)	<ul style="list-style-type: none"> • Houses the CCFU (a project) which is currently providing technical and administrative backstopping to the NCCRS development process. • Also houses ECZ, which is in charge of National Communication on Climate Change • Experience in climate change including the development of the National Communications on Climate Change. Oversaw the 	<ul style="list-style-type: none"> • Regarded as an environmental ministry, • Climate change treated as projects under the department of environment. • Ministry has yet to convene a 'sectoral committee' for mainstreaming climate change in sectors. • Lacks "convening powers", that is, considered a lowly-placed ministry in terms of clout within the government structure and as such, may not be able to e.g., convene an inter-ministerial meeting 	<ul style="list-style-type: none"> • It has all the historical memory of climate change, • Most climate change specialists are based in the Ministry • Leads country international negotiations on climate change • Understands climate finance mechanisms created by UNFCCC 	Ministry is not very high up in 'the political hierarchy' and hence may not have convening and coordinating roles. This could threaten (or 'weaken') mainstreaming

Institution	Strength	Weaknesses	Opportunities	Threat
	<p>development of NAPA</p> <ul style="list-style-type: none"> • Houses the DNA whose role is to approve CDM projects • Leads climate change negotiations under the UNFCCC • Recognised by UNFCCC as the climate change focal point 	<ul style="list-style-type: none"> • MTENR is not supra ministerial and therefore does not have the political clout for coordination. 		
2. Ministry of Finance and Planning (MoFNP)	<ul style="list-style-type: none"> • Ministry in charge of mobilisation, planning and distribution of government resources <p>It is in a higher hierarchy politically.</p> <ul style="list-style-type: none"> • Has some “convening powers”. As far as distribution of resources is concerned 	<ul style="list-style-type: none"> • Lacks the climate change technical expertise. • Not recognized by UNFCCC as climate change focal point 	<ul style="list-style-type: none"> • Managing the Programme on Climate Change Resilience (PPCR) whose aim is to mainstream climate change issues in the Sixth National Development Plan and other strategies 	<ul style="list-style-type: none"> • Making it a coordinating ministry may work against mainstreaming due to the critical dearth of technical expertise in climate change in the Ministry.
3. Office of the Vice President (OVP)	<ul style="list-style-type: none"> • It is the second highest office in the land • Houses the Disaster Management and Mitigation Unit (DMMU) whose objective is to strengthen national capacities for effective disaster preparedness, response, mitigation, restoration, and prevention. • DMMU has a well established and clear coordination 	<ul style="list-style-type: none"> • DMMU addresses all forms of disasters not necessarily specific to climate change • There is no evidence of specialist knowledge and expertise in climate change • Not recognized by UNFCCC as a climate change focal point 	<ul style="list-style-type: none"> • Influential Ministry with “convening powers”. • DMMU was also created by an Act of Parliament, and thus has legal backing 	<ul style="list-style-type: none"> • Climate Change issues could then be relegated to disaster mitigation and management, yet we know climate change is not all about disasters

Institution	Strength	Weaknesses	Opportunities	Threat
	<p>structure at national, provincial and district level which can be utilized to mainstream climate change</p> <ul style="list-style-type: none"> • DRR focal points already exist in various line ministries and could be used to mainstream climate change 			
4. Zambia Meteorological Department (ZMD)	<ul style="list-style-type: none"> • Leader in the generation and dissemination of weather and climate information • It is the country's scientific authority in climate and climate change issues • It is a scientific institution not managerial 	<ul style="list-style-type: none"> • Perceived as a scientific as opposed to a managerial organisation. It is low in the government hierarchy (because it is only a department, and furthermore, within a lowly-ranked ministry- the MCT). 	<ul style="list-style-type: none"> • Has the capacity for custody of historical climate data for the country. 	<ul style="list-style-type: none"> • May be more inclined to the science of climate change to the detriment of other fields and issues within climate change

8.5 Options for a Climate Change Institutional Framework

With regards to the need for an institution that will be acceptable by state and non-state actors, three plausible options are presented based on the analysis of observations and findings of the consultative process:-

Table 3: Summary of Proposal from Consultative Workshops

Proposed Institution	Merits	Demerits
1. Climate Change Facilitation Unit (CCFU) elevated to a department of MTENR in charge of climate change and name changed into a Climate Change Coordination Unit (CCCU)	This will be headed by a director answerable to the PS. It can have staff seconded to it or employ new staff. It is cost-effective and relatively easy to establish	As a department, it will have limited convening power and coordinating powers. It will not have the desired influence to mainstream climate change in other sectors

Proposed Institution	Merits	Demerits
<p>2. Set up a National Climate Change Council (NCCC) akin to the Aids and Gender Council, which shall be headed by an appointee of the Head of State. The Council will be staffed with climate change specialists and have strong links to the Cabinet office, OVP and MoFNP</p>	<p>Reflects very high political will, and could result to an autonomous institution with powers to govern climate change in the country</p>	<p>If not well formulated could work against mainstreaming climate change at sector level by concentrating climate resources (expertise, etc) at one level to the extent that other sectors dealing with climate change will resent it or have no reason to get involved in climate change activities. Will still need a ministry to present it budget hence resulting in bureaucracy and delays.</p>
<p>3. Formation of a slightly modified National Climate Change and Development Council (NCCDC) with Steering Committee drawn from the key public and private sector including NGOs and civil society. NCCDC will be answerable to a committee of ministers. The Council's secretariat will be based at MTENR in the interim, with strong links (co-chairing arrangements) with MoFNP and OVP. NCCDC will act as a one-stop shop for all climate change information. The National Standing Committee will be harmonised with existing committees such as the UN-REDD, PPCR, NCCACC, etc whose mandate will be to supervise and monitor the implementation of the strategy; advise the government on climate change mainstreaming, adaptation, mitigation, policy development, research and development, education and awareness.</p>	<p>It also reflects very high political will. It has a horizontal structure which makes it respect and work with existing, structures. It has potential to enhance the integration and mainstreaming of climate change in sectors.</p>	<p>Mandate of members of NCCDC need to be well spelt out in their job functions including certain benefits. Otherwise it may not be seen as part of the job functions and committee members will have variable commitment, and could end up being ineffective and failing to deliver.</p>

8.6 The National Climate Change and Development Council

From the above, option 3 is most suitable to Zambia. A National Climate Change and Development Council (NCCDC) whose overall role is to coordinate all climate change activities in the country should be established. The Council shall be managed by a board of directors drawn from the state, private sector and civil society including NGOs and shall be answerable to the ministers of MTENR, MoFNP and OVP. Permanent Secretaries of these ministries will discuss finer details pertaining to the location of the Secretariat and the chairing of the NCCDC Steering Committee. For goodwill, NCCDC will have linkages with Parliament, Development Partners, House of Chiefs and other relevant institutions.

NCCDC has three main objectives, to:-

- Ensure adequate technical and managerial capacity to address climate change;
- Ensure adequate capacity to monitor and review climate change mainstreaming
- Ensure adequate the capacity to mobilize finances for investment in climate change mitigation, adaptation and related activities.

NCCDC shall employ three top managers equivalent to a Chief Executive Officer (CEO), Chief Finance Officer (CFO) and Chief Operating Officer (COO) who shall run the day today operation of the Council. The CEO equivalent shall be at the level of a government permanent secretary because Climate change issues are urgent and require quick decision making, including decisions on allocation of resources that only the Minister has executive powers to make, as and when necessary. Moreover, at the international level, climate change issues are riddled with a lot of political and technical issues that can best be handled by a techno-political ministry. These provides justification for the head of NCCDC to report to MTENR for all matters technical as well as pertaining to climate change negotiations.

The main function of the NCCDC is **to implement the NCCRS and:**

1. To coordinate all climate change activities in the Republic of Zambia
2. To ensure that there is technical and managerial capacity to implement projects
3. To ensure that climate change activities are complimentary, enhance existing and there are no duplication
4. To ensure mainstreaming of and integration of climate change activities in all the sectors of the economy including private sector and non-state sectors
5. To ensure capacity of institutions to carry out climate change mitigation and adaptation is enhanced and strengthened
6. To monitor and review implementation of climate change activities including the above
7. To mobilize financing for the above activities

As outlined in the organisation chart below, the institutional organisation has two main structures, the top decision making unit (labelled as 1 in the chart) and the operational unit, the secretariat (labelled as 2 in the chart). The top decision making organ is the NCCDC Steering Committee, which shall provide high level policy and technical guidance on policy and planning process; approve the NCCDC strategic plan; work-plans and budget, monitor the implementation of the NCCRS and the performance of the working groups. This will be chaired in turn by the MoFNP, MTENR and DMMU of OVP. It is up to the three ministries to agree on chairing modalities which could be on a rotational basis.

The Secretariat will provide administrative and logistical support to the Council and operational responsibility for the day-to-day running. The Secretariat will be autonomous in terms of managing its own budgets and will provide one-stop Climate Change information and coordination point including support to sectors, to the Designated National Authority (DNA) and strong linkages to ECZ and ZMD. The linkage with ZMD is

strongly recommended to provide and enhance a clear mechanism that allows easy access, interpretation and dissemination of climatic data at local level as well as how to incorporate local indigenous knowledge and methods of interpreting weather in the Early Warning Systems.

The specific technical objectives of the council shall be determined by **working groups** (WGs) which shall implement pillars of the strategy. Each WG shall prepare work plans in-conjunction with core members and submit them to the Council Steering committee for approval.

The five working groups, which implement pillars of the strategy are:-

1. WG on Adaptation and Disaster Risk Reduction
2. WG on Mitigation including low carbon development and carbon finance
3. WG on Cross-cutting Issues (Technology development and Transfer, R&D, Capacity Building, Communication Education and Awareness , Gender & HIV Aids)
4. WG on Governance (Policy & Legal Development and Negotiations)
5. WG on Finance (Identification of Sources and Mobilization of financial resources)

Each WG shall be headed by a National Programme Officer who shall ensure strong linkages with relevant sectors. For instance Mitigation will work very closely with Ministry of Energy and Water, Ministry of Transport and the forestry sector of MTENR. Implementation of climate change activities will be supervised by the secretariat but can also be delegated to various partner agencies e.g. ZMD and ECZ etc., but with specific terms of reference and achievable milestones.

Below is an organisational chart of the proposed National Climate Change and Development Council (NCCDC). The parts shaded yellow are the key structure of the NCCDC

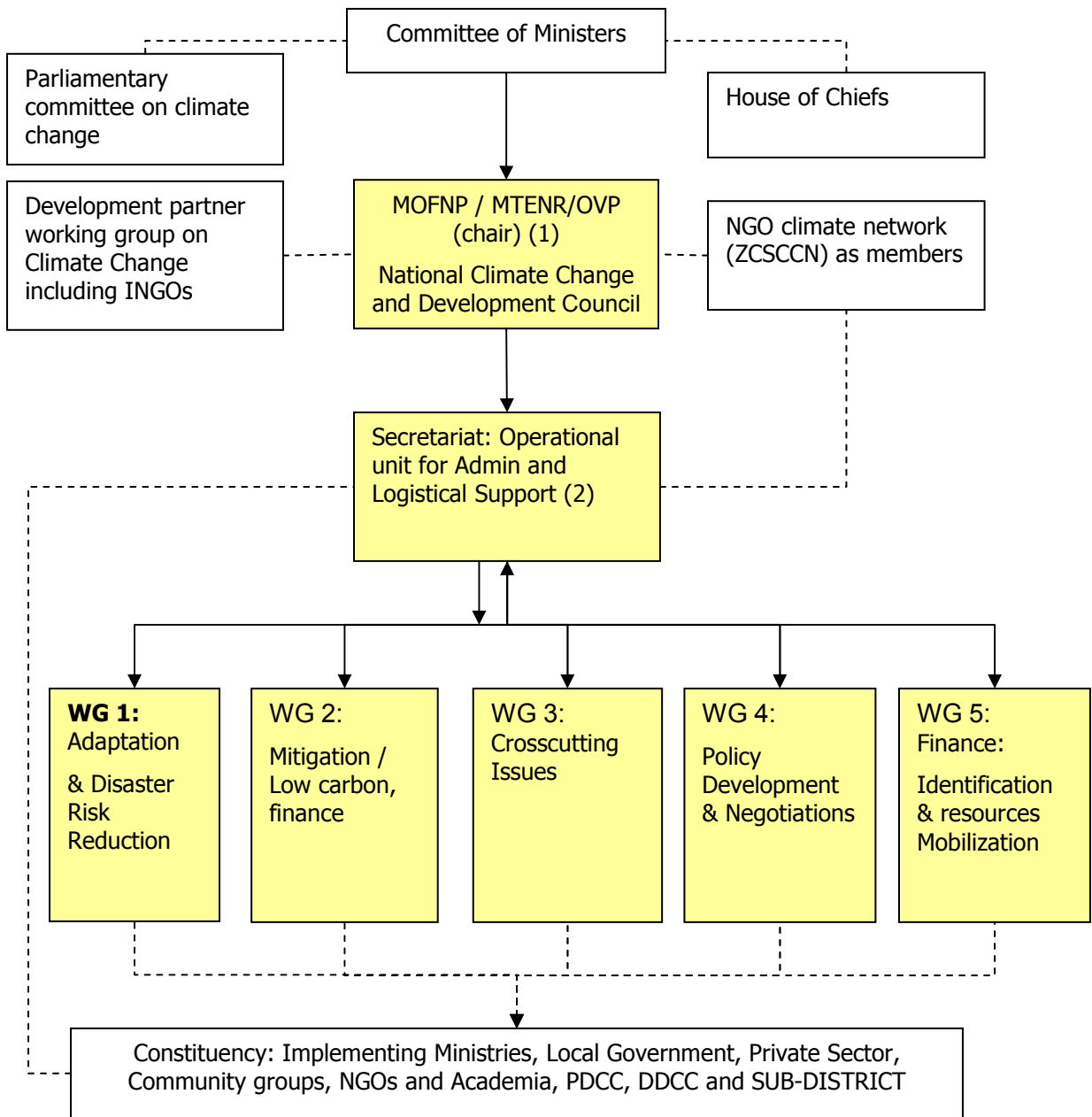


Figure 4: Organisational Chart of the National Climate Change Development Council

9 IMPLEMENTATION, FINANCING PLAN AND INVESTMENT FRAMEWORK

9.1 Implementation Framework

The NCCRS' Implementation Framework has identified key activities and milestones that should be achieved during the implementation of the Strategy. The key activities are based on the Strategy's five pillars, namely, Adaptation and Disaster Risk Reduction, Mitigation, Cross-Cutting Issues Governance, and Finance. The table below summarises the Implementation Framework as per these five pillars.

Table 4: Implementation Framework as per the Five Pillars

Action	Output / Indicator	Timeline	Responsible Organisations
1. Adaptation and Disaster Risk Reduction			
Identification of adaptation programmes and projects	Key sectoral adaptation programmes and projects identified	2012	Key Line Ministries (MEWD, MACO, MoH, MCT, MTENR, MLFD), NGOs, Local Community Leaders
Funding for key (flagship) adaptation programmes and projects	Adaptation programmes and projects funded and initiated	2013	Key Line Ministries/MoFNP, Developed Partners
2. Mitigation and Low Carbon Development			
Identification of mitigation programmes and projects (i.e. development of a NAMA)	NAMA developed	2012	Key Line Ministries (MTENR, MEWD, MACO, MCT), Private Sector, NGOs, Development Partners
Funding for key (flagship) mitigation programmes and projects	A major project in each of the key sectors of Land-Use (Agriculture, Forestry), Energy, Transport funded and commenced	2014	MoFNP, Key Line Ministries (MTENR, MEWD, MACO, MCT), Private Sector, NGOs, Development Partners
3. Cross-Cutting Issues			
Capacity enhancement in key climate change areas	Capacity building needs identified and capacity building framework developed	2016	MTENR, other line ministries, NGOs, Private Sector, Development Partners

Development of climate change research and development themes	Priority climate change related research areas identified	2016	Line Ministries, Academic and Research Institutions, Development Partners
Technology needs and needs assessment	Technology needs assessment carried out	2016	MTENR, Line Ministries, Development Partners, the Private Sector, Academic and Research Institutions
Development and incorporation of climate change education curricula	Climate change education curricula developed and incorporated	2018	MoE, MTENR, NGOs, Civil Societies, the Private Sector, Development Partners
Mainstreaming of climate change, gender and HIV in all sectors	Climate change, gender and HIV issues mainstreamed in all sectors	2016	Line Ministries, NGOs, Civil Society Organisations, Development Partners, the Private Sector
4. Governance: Policy & Institutional arrangement			
Establishment and operationalization of the National Climate Change and Development Council (NCCDC)	Circular or other legal notice from the MTENR establishing the NCCDC drafted	2011	MTENR, MoFNP, other Line Ministries, Development Partners, Civil Society, NGOs, the Private Sector
Operationalisation of the NCCDC	Mandate and funding for the NCCDC agreed upon and delivered	2011	MTENR, MoFNP, Development Partners
5. Finance & Investment			
Bankable actions/projects developed for specific funding opportunities	At least 3 funding proposals developed or a request of additional finance of minimum USD 200 Million	2012	MTENR, Line Ministries, MoFNP, the Private Sector, Civil Society
Sourcing of additional funding	USD 500 Million sourced from additional sources of climate finance for priorities under the Investment Framework	2013	MoFNP with support from MTENR and other line ministries

9.2 Investment Framework/Action Plan

In order to implement the activities proposed in the NCCRS, additional and substantial financial resources will be required. The total budget for key/priority activities in key sectors (see Annex 3: Investment Framework) has been estimated at USD 6.6 Billion. Compared to the potential climate change impacts on Zambia's economy, this is a relatively small investment to make. For instance, an ongoing study, "the Economic Assessment of the Impacts of Climate Change in Zambia", indicates the following impacts: agricultural GDP loss (USD 2.2 to 3.13 Billion); GDP loss due to ecological damage (USD 1.4 Billion); health-related impacts (USD 0.46 Billion); and energy GDP loss due to reduced hydropower potential (USD 0.27-0.45 Billion) for a combined loss of USD 4.33 to 5.44 Billion over a period of only 10 years, and much higher over a longer time frame (MTENR, 2010).

Thus, comparing the cost of climate change in Zambia (USD 4.33-5.44 Billion over a 10 year period) as determined by the "Economic Assessment of the Impacts of Climate Change Study (2010)" with that of responding to the problem, i.e., for adaptation to the adverse impacts of climate change as well as implementing a low carbon economy as determined by the investment framework (estimated at USD 6.6 Billion for activities whose period of implementation is as long as 20 years) validate the Stern Review's conclusion that the "benefits of strong, early action on climate change outweigh the costs" (Stern N., 2006).

9.3 Funding Sources

As indicated in the annexed Investment Framework, responding to climate change in Zambia, i.e. implementation of the NCCRS, will require additional and substantial finance. In addition to funding sources for mitigation actions proposed in Chapter 6, funding for the NCCRS could also be obtained from these other sources:

- **The GRZ national budget:** The mainstreaming of climate change risks into the development agenda (e.g. the SNDP and annual work plans) can influence budget allocation in a way that results in more funds being availed for climate change activities. Through such measures, the GRZ budget can provide leverage for securing additional funding from external sources, especially in situations where the government can co-finance climate change projects.
- **Dedicated additional climate funding from bilateral and multilateral sources:** There are also optional sources of funding from additional sources of external climate change financing for both adaptation and mitigation. By clearly demonstrating Zambia's needs through showing climate change challenges the country is facing, proposing climate change activities for which the funds would be used, as well as proposing an effective institutional framework to implement these activities, the NCCRS aims to unlock these additional funds (see Annex 2). The magnitude of this additional climate funding is uncertain and experience so far points towards cumbersome procedures to secure them, due to insufficient capacity and perhaps, lack of a coordinated approach to tackling climate change activities, with the latter area of concern addressed by the NCCRS.

- **Private sector finance and Foreign Direct Investments (FDI):** Investments in the energy sector and renewable energy, as well as the forestry sector, may for a large share come from the private sector. These funding sources can be supplemented by additional grants or soft loans from Multilateral Finance Institutions (MFIs). The involvement of the private sector may also be promoted through public-private partnerships.
- **Funding from carbon markets:** Funding can also be secured for mitigation from market based mechanisms such as the Clean Development Mechanism (CDM) or its future successor, REDD+ and voluntary carbon market schemes.

Table 5: Optional Climate Change Funding Mechanisms for Zambia

Funding Mechanism	Funding Mechanism's Sub-Group	Contributors	Target areas and pilot countries	Zambia involvement	Zambia opportunities/comments
Climate Investment Funds (CIFs) of the World Bank	Pilot Programme for Climate Resilience (PPCR)	Australia, Canada, Denmark, Germany, Japan, Norway, UK & USA	Bangladesh, Bolivia, Cambodia, Mozambique, Nepal, Niger, Tajikistan, Yemen & Zambia selected as pilot countries in 2009	Zambia is one of the target countries and a project document has been developed. The pilot phase can be implemented after approval by GRZ	The PPCR is a critical part of the implementation of the NCCRS. The PPCR is coordinated by MoFNP
	Scaling up Renewable Energy in low income countries Programme(SREP)	Japan, the Netherlands, Norway, Switzerland, UK & USA	Low income countries, first pilots to be selected in 2010	No action so far	SREP is country-led and builds on national policies and the activities of other existing energy initiatives
	Clean Technology Fund (CTF)	Unspecified	ODA eligible countries, and must have an active Multilateral Development Bank (MDB) project	No action so far	Financing of scaled-up, low carbon activities in a country
World Bank's Carbon Funds and Facilities	The BioCarbon Fund; FCPF; CDCF; Netherlands CDM Facility; Danish Carbon Fund; Italian Carbon Fund; etc	Contributed by governments and companies in OECD countries to purchase project-based greenhouse gas emission reductions in developing countries and countries with economies in transition	All developing countries and countries with economies in transition	No action so far	Viable emission reduction projects in both the compliance (CDM) and voluntary markets
UN-REDD Programme of the FAO, the UNDP &	N/A	Denmark, Norway & Spain	9 "quick start" pilot countries were selected in	Zambia is one of the pilot countries. A project is under design with	A strategy for REDD is expected in 2012.

Funding Mechanism	Funding Mechanism's Sub-Group	Contributors	Target areas and pilot countries	Zambia involvement	Zambia opportunities/comments
the UNEP			2009 (Bolivia, DRC, Indonesia, Panama, Paraguay, PNG, Tanzania, Vietnam & Zambia). A further 16 countries are joining in 2010	support from UNEP.	
Least Developed Countries Fund (LDCF) of the UNFCCC/GEF	N/A	20 major donors	All 50 least developed countries that have prepared National Adaptation Programmes of Action (NAPAs) are eligible for project grants	NAPA developed in 2010 with 10 priority projects and a budget requirement of 14.18 Mill. USD. Adaptation to the effects of drought and climate change in Agroecological Zones 1 and 2 in Zambia, a NAPA project; approved and being implemented currently at a cost of 3 Million USD ongoing	One project has recently been approved by LDCF / GEF focusing on agriculture in agro-ecological region 1 and part of 2.
Special Climate Change Fund (SCCF) of the UNFCCC/GEF	N/A	Unspecified	Developing countries	No action so far	For adaptation; technology transfer and capacity building; energy, transport, industry, agriculture, forestry and waste management; and economic diversification; set up in 2001
Adaptation Fund (AF) of the Kyoto Protocol, with the GEF providing secretariat	N/A	The share of proceeds amounting to 2% of certified emission reductions	Developing country Parties to the Kyoto Protocol that are particularly	No action so far	Opportunities to obtain adaptation funding

Funding Mechanism	Funding Mechanism's Sub-Group	Contributors	Target areas and pilot countries	Zambia involvement	Zambia opportunities/comments
for the Fund, while the World Bank acting as the Trustee		(CERs) issued for a CDM project activity	vulnerable to the adverse effects of climate change		
The proposed Copenhagen Green Climate Fund under the Copenhagen Accord	REDD+, NAMA Mechanism, Technology Transfer Mechanism, etc	All developed countries	All developing countries with priority on least developed countries, small-island developing states and Africa	No action so far as the fund is yet to be agreed on fully as well as operationalised	The EU has already committed 7.5 Billion USD towards the fast-track fund
Development Bank Of Southern Africa (DBSA)	The Energy and Environment Partnership Programme with Southern and East Africa (EEP-S&EA)	Finland and Austria	Kenya, Tanzania, Mozambique, Namibia, Swaziland, South Africa, Botswana and Zambia	Zambia is one of the pilot countries. A 2nd call for proposals for project funding was released in September 2010	Provides support for pre-feasibility and feasibility studies to the value of Euro 200,000 per project
COMESA Carbon Fund	N/A	Unspecified	26 Member States of COMESA, the East African Community (EAC) as well as the South African Development Community (SADC) member states	No action so far (Fund yet to be operationalised)	For investment into, and transaction with, project developments that are or will be registered under the Clean Development Mechanism (CDM) under the Kyoto Protocol as well as other select voluntary carbon credit registries

9.4 Monitoring and Evaluation Framework for the NCCRS

The Ministry of Tourism, Environment and Natural Resources (MTENR) shall be responsible for tracking, coordinating and overseeing the implementation of this strategic plan in collaboration with the ministry of Finance and National Planning (MoFNP).

Monitoring Plan

This monitoring plan has been designed to ensure collection of information for use by coordinating agencies and key stakeholders. In principle, monitoring is seen as a management process which systematically seeks to supply information to the **stakeholder** on the progress of implementation of the activities to facilitate timely **decision making** and to generate **evidence and arguments** that test and alter beliefs and assumptions so as **to influence mainstreaming** of the climate change into development programmes.

The main goal of the strategy is to enhance a coordinated national response to climate change. The Information shall be collected through reports submitted by the key sectors to the NCCDC once every six months.

In addition the following method shall also be applied;

1. Stakeholder analysis
2. Documentation review
3. Biophysical measurements
4. Direct observation
5. Cost Benefit Analysis
6. Questionnaires and surveys
7. Semi-structured interviews

Evaluation Plan

Given the number of strategic objectives, it is recommended that MTENR, MoFNP and OVP undertake a **mid-term independent evaluation** at the middle of the plan period and a **terminal evaluation** just before the end of the strategic plan period.

Both exercises should be conducted after the evaluation terms of reference have been drafted and agreed upon by all the major stakeholders.

A detailed M&E logic framework is elaborated in Annex 2

10 CONCLUSIONS

As highlighted in Chapters 2 to 4 of this Strategy, climate change is a significant development challenge to Zambia because of its adverse effects on key sectors upon which socio-economic development of the country is anchored. This National Climate Change Response Strategy (NCCRS) has been developed to support and facilitate a coordinated response to climate change issues in the country. The NCCRS (or Strategy) will enable Zambia to position itself strategically to respond to the adverse impacts of climate change. In addition, the NCCRS will go a long way in helping Zambia contribute to the achievement of the overall objective of the UNFCCC, which it ratified in 1993.

The Strategy has identified the sectors that are most vulnerable to the negative impacts of climate change, and proposed interventions to reduce, adapt to or mitigate these impacts. These interventions, which can be summed up as putting in place climate change resilient production systems and promoting a low carbon economy, are crucial to socio-economic development of Zambia. They include the following:

1. Increased investment in agricultural technologies (e.g. irrigation) that can enhance food production and food security;
2. Sustainable management of water resources;
3. Increased support to units such as the ZMD (to enable it provide downscaled weather information to different users), and the DMMU (to enhance its capacity to respond to climate/weather-related disasters);
4. Strengthening of public health systems (e.g. support for disease surveillance and rapid responses, as well as improving access to clean water and sanitary facilities especially in the informal settlements);
5. Climate-proofing of infrastructure (e.g., a special budget dedicated to respond to climate/weather-related infrastructural damages);
6. Increased investments in renewable/green energy resources, including the establishment of a National Green Energy Fund as well as the enactment of a Feed-in-Tariff (Refit) policy;
7. Development of a REDD+ framework that will ensure sustainable and equitable management of forest resources;
8. Investment in a mass transport system especially for urban centres
9. Developing a Nationally Appropriate Mitigation Actions (NAMA) framework, among other key interventions.

To ensure achievement of the above and successful implementation of the Strategy, *a National Climate Change and Development Council* is pivotal to the success of the NCCRS. Since the setting up of any institution is a process that requires a lot more consultation and information, there is need for main actors (MTENR, MoFNP and OVP) to ensure that the NCCDC will eventually be transformed into a fully functional institution.

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Annex 1 Roles, and Challenges of Climate Change Institutions⁷⁷

Stakeholder Organisation	Current Roles and Responsibilities	Reference of Legislation and policy that defines Roles	Challenges
Ministry of Tourism, Environment and Natural Resources	<ul style="list-style-type: none"> • Focal point for UNFCCC • Policy development • Environment and natural resource management • Public Awareness • Strategy development • Effect international policy and principles 	<ul style="list-style-type: none"> • NEAP • Constitution • Draft National Policy on Environment • Forestry Policy • Wildlife Policy • Zambia Wildlife Act • Forest Act • Tourism Policy • Tourism Act • National Heritage Conservation Commission Act 	<ul style="list-style-type: none"> • State responsibilities derived as directive principles and not justiciable • Constitution does not allow direct implementation of international instruments ratified by Zambia • Institutionalised sectoral approach with the Ministry structure created through legislation means it is difficult to restructure • Environmental protection and management efforts are fragmented and not well coordinated • Inter-sectoral conflicts • Fragmented and outdated legislation • Poor inter-sectoral coordination • Some duplication of efforts with other institutions
Environmental Council of Zambia	<ul style="list-style-type: none"> • Coordination of climate change activities • EIA • Monitoring and enforcement of environmental regulations • Pollution control 	<ul style="list-style-type: none"> • EPPCA 	<ul style="list-style-type: none"> • Overlap in functions between ECZ and other lead implementing sector agencies • Weak coordination and regulatory structure • Inadequate guidelines to regulate all categories of waste generators • Centralisation (not all towns are covered by ECZ) • Fragmented and outdated waste management

⁷⁷ Partly adapted from IUCN Draft Report on Wetlands Management, 2007.

Stakeholder Organisation	Current Roles and Responsibilities	Reference of Legislation and policy that defines Roles	Challenges
	<ul style="list-style-type: none"> Licensing Coordinating and advisory roles Public awareness International cooperation Strategy development Public Health Policy development 	<ul style="list-style-type: none"> Public Health Act 	<p>legislation</p> <ul style="list-style-type: none"> Fines too low to act as deterrent Inadequate resources to carry out mandate Weak enforcement mechanisms
Ministry of Health	<ul style="list-style-type: none"> Policy development Advisory role to councils Oversight on Councils Strategy development related to local government (including infrastructure and human settlement) Approval of development plans Payment of grants to councils Implementation of the Decentralisation Policy 	<ul style="list-style-type: none"> Local Government Act Town and Country Planning Act Decentralisation Policy 	<ul style="list-style-type: none"> Lack of institutional capacity to execute mandate Inadequate human resource to provide grants to councils Limited resource allocation Fragmented and outdated legislation
Ministry of Finance and National Planning	<ul style="list-style-type: none"> National Development Planning Economic Development External Resource mobilisation Resource allocation Investment and tax incentives 	<ul style="list-style-type: none"> The Public Finance Act The Appropriation Act Fifth National Development Plan 	<ul style="list-style-type: none"> Centralisation Bureaucracy slows implementation Investment and financial framework not comprehensive Combination of roles of planning and economic development Overlap in some roles with other Ministries Sometimes performs responsibilities of other Ministries

Stakeholder Organisation	Current Roles and Responsibilities	Reference of Legislation and policy that defines Roles	Challenges
City, Municipal and District Councils	<ul style="list-style-type: none"> • Solid waste management • Approval for location of waste disposal site • Land Use Planning • Resource Mobilisation • Setting tariffs 	<ul style="list-style-type: none"> • Town and Country Planning Act • Local Government Act • EPPCA • Public Health Act • Rating Act • Decentralisation Policy 	<ul style="list-style-type: none"> • Poor funding • Poor delineation of responsibilities between ECZ and Councils • Inadequate institutional capacity • Fragmented and outdated legislation • Weak enforcement mechanism • Improper financial practices by some councils • Lack of local waste management plans, natural waste management plan, waste recycling and litter plans
Ministry Energy and Water Development (MEWD)	<ul style="list-style-type: none"> • Energy and water sectors' management policies formulation • Coordination of activities in the water and energy sectors 	<ul style="list-style-type: none"> • Energy Act No. 23 of 2003 • Energy Regulation Act • Electricity Act • Electricity Amendment Act • Petroleum Act • Rural Electrification Act • Water Act No. 13 of 1994 	<ul style="list-style-type: none"> • No clear delineation of definition of roles • Outdated laws • Some duplication of roles with other institutions

Annex 2: M&E Logic Framework

OBJECTIVES	INDICATOR	VARIABLES	SOURCE OF INFORMATION	METHODS OF DATA COLLECTION	FREQUENCY OF DATA COLLECTION	FREQUENCY OF REPORTING	RESPONSIBILITY
1.0 Program Goal							
1.1 To have Climate Change mainstreamed in the most important and vulnerable economic sectors	No and type of sectoral programmes climate change proofed	Levels of investment in key climate change programmes Levels of involvement by key players in the target sectors of the NCCRS	Target sectors under the NCCRS	Periodic reviews and surveys	Semi-Annually	Annually	Climate Change Focal Persons (CCCU/MTENR)
Result/Outputs							
2.1 Land Use Agriculture and Forestry - To develop sustainable land use systems so as to enhance agricultural production	No and type of sector programmes climate proofed	Allocation of resources to programmes aimed at mitigating climate change in the sector	Programme beneficiaries (farmers, agro-input suppliers, researchers etc)	Periodic reviews and surveys	Semi-Annually	Annually	Climate Change Focal Persons (ZNFU, MACO, UNZA)
2.2 Water - To ensure sustainable management and resiliency of water resources under climate change	% Allocation to key sector programs identified under the NCCRS	Levels of programme implementation in key institutions under the sector	Target sector institutions	Periodic reviews and surveys	Semi-Annually	Annually	Climate Change Focal Persons in all key sector institutions (NWASCO, CUs, Zambezi River Authority, MEWD)
2.3 Health and	No and type	Diseases directly	Target sector	Demographic	Semi-Annually	Annually	Climate Change Focal

Social Infrastructure - To protect people and health from climate change and climate variability	of programmes of climate change proofed under the sector	linked to effects of climate change	institutions (public and private health institutions, the general public	surveys and sector reviews			Persons (M&E) MoE, MoH, MCDSS, MoLSS
2.4 Physical Infrastructure - To climate proof infrastructure	No and type of infrastructure climate proofed	Level of climate proofing in all infrastructure designs	Target sector institutions (RDA, NCC, MLGH etc)	Periodic reviews and surveys	Semi-annually	Annually	Climate Change Focal Persons (M&E) RDA, NCC, MLGH, MWS
2.5 Transport - To develop a less carbon intensive and climate change resilient transport system	No and type of transport systems climate proofed	Minimum Levels of carbon emissions allowable for transport systems	Target sector institutions (ECZ, ZABS, RDA, MTC)	Periodic reviews and surveys	Semi-Annually	Annually	Climate Change Focal Persons (M&E) ECZ, RATS, ZABS, RDA
2.6 Energy - To develop a less carbon intensive and climate change resilient energy industry	No and type of energy systems climate proofed	Minimum levels of carbon emissions allowable from energy systems	Target sector institutions (ECZ, MEWD, ZESCO, CEC)	Periodic reviews and surveys	Semi-Annually	Annually	Climate Change Focal Persons ECZ, ZESCO, REA, CEC, MEWD

Annex 3: Investment Framework

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
General Public Services	Legislation	Review and harmonisation of existing policies and laws to make them climate change responsive	MTENR, Development Partners	By 2016 Output: all natural resource/environmental related policies and laws reviewed to make climate change responsive	6,200,000	This figure has been obtained from the MTENR's Strategic Planning-Action Plan Matrix 2011-2015
		Enactment of a climate change policy and law	The Legislature, MJLA, CSOs, NGOs	By 2016 Output: climate change policy and law enacted	2,000,000	Based on an assumption that the process of enacting a law or policy requires about 1 Million USD
Total					8,200,000	

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
Economic Affairs	Crop Sub-sector	Enhanced investment in irrigated agriculture ⁷⁸	MACO, FAO, Development Partners, Department of Water Affairs (MEWD)	By 2030 Output: 200,000 additional ha put under irrigation	600,000,000	Based on an assumption that it costs between \$2000-\$4000 to develop an irrigation scheme per hectare (Information from the Chief Irrigation Engineer). This project will be undertaken as part of the Farm Block Development Programme as well as other potential developmental areas

⁷⁸ Some projects under the Irrigation Development Support Programme funded by the Government and its development partners and organisations are currently ongoing

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Conservation farming ⁷⁹ (Minimum soil soil disturbance; maintenance of soil cover, legume based soil crop rotation) and complementary soil and water conservation practices	MACO, CFU, FAO, Agricultural and Forestry Research Institutions (e.g. Zambia Agricultural Research Institute, CIFOR, etc), Development Partners	By 2015 Output: 400,000 more farmers inducted into CA (50% of all Zambian farmers aware of CA; 30% of them fully practising CA)	45,000,000	Information from MACO/ZARI indicates that 30 Million USD is required by the GRZ (MACO); and a further 15 Million USD by the CFU
		Diversification of rural economies ⁸⁰	MACO, Development Partners, NGOs, MoFNP	20 year programme Output: 50% of rural populations to depend on alternative livelihoods (i.e. apart from crop husbandry) including agro-processing and other enterprises by 2030	33,750,000	Estimates provided by MACO/ZARI
		Assessment and inventorying of land and soil resources in each district and storing the information in a database ⁸¹	ZARI, Zambia Survey Department, National Soil Survey Programmes (NSSP)	By 2030 Output: Each district has land and soil resources maps and database	657,000,000	Estimates provided by MACO and ZARI, based on a figure of 9 Million USD per district, and multiplied by the 73

⁷⁹ With Support from the Food and Agriculture Organisation (FAO), CA is being expanded into 16 other districts. The proposed project will thus complement the FAO funded projects

⁸⁰ This programmes has different components including value addition to agricultural products, and the creation of enterprises such as apiculture, etc

⁸¹ The aim will be to obtain a more fine detail about a district's land and soil characteristics, agro-climatic characters and other factors that can inform agricultural development programmes, e.g. whether a particular region is suitable for fisheries development or crop husbandry, what types of crops, etc

MTEF Function	Sector	Activities/ Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
						districts of Zambia
		Provision of farm inputs (in particular <i>environmental-friendly</i> fertilizers) ⁸²	MACO, Development Partners, MoFNP, NGOs	10 year programme Output: Number of farmers with access to fertilizers increased by 2020	89,000,000	Estimates were provided by MACO
		Promotion of sustainable "dambo" and wetlands utilization ⁸³	MACO, Ministry of Livestock and Fisheries Development (MLFD), MoFNP, Development Partners	By 2030 Output: An eighth of the "dambos" and wetlands developed for irrigation agriculture ⁸⁴	706,000,000	Estimates provided by MACO/ZARI based on an assumption that it costs \$300 to dig a well and install a pump; and that 2 wells can serve a hectare, and that the total land area in Zambia considered "dambos" and wetlands is approximately 94076.75 sq km (9407675

⁸² This is currently being implemented under the Farmer Input Support Programme (FISP)

⁸³ "Dambos" and wetlands have been commercially utilized in the past. Presently, a programme is being developed to use "dambos" in Chama in Eastern Province and Senanga in Western Province for an integrated fish and rice farming

⁸⁴ This takes into consideration the need for balancing between agriculture, other commercial purposes and conservation

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Seed multiplication and dissemination of crop varieties able to withstand adverse weather conditions (crop diversification)	Agricultural and Forestry Research Institutions (e.g. Zambia Agricultural Research Institute, CIFOR, etc), MACO, Development Partners	20 year programme Output: Increased number of farmers practising crop diversification by 2030	20,000,000 ⁸⁵	ha) Estimates provided by MACO/ZARI
		Support to research and development (R&D), e.g. produce flood and drought tolerant crop species as well as appropriate technologies ⁸⁶	Agricultural and Forestry Research Institutions (e.g. Zambia Agricultural Research Institute, CIFOR, etc), MACO, Development Partners	20 year programme Output: 50% farmers have access to improved agricultural technologies suitable for their agro-climatic regions by 2030	16,000,000	Estimates provided by MACO/ZARI
	Sub-Total				2,166,750,000	
	Fisheries Sub-sector: Capture Fisheries	Value addition to fisheries products (train fishermen in post-harvest handling and processing)	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: 1200 additional fishers trained in value addition to fisheries products by 2016	71,768	Figures provided by the Fisheries Department, which also indicates that 4,000 USD already available for the programme

⁸⁵ According to MACO/ZARI, initial capital investment will be high (around 5 Million USD for the first 3 years), and thereafter funding requirements will decline

⁸⁶ Examples of such research activities include the ongoing collaborative work between the Zambia Agricultural Research Institute (ZARI), the Department of Agriculture, local institutions (e.g. the National Irrigation Research Station-NIRS), and international organisations (e.g. the International Maize and Wheat Improvement Centre-CIMMYT), who are undertaking a research project aimed at producing irrigation technologies and drought-tolerant crops suitable for drought-prone regions of southern Africa. The CFU and the Technical Services Branch (TSB) of ZARI will undertake on-field demonstration of these technologies.

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Capacity building in staff and infrastructure (training, manpower, labs, research and development, etc), e.g. modelling... e.g. to relate Lake River to fisheries	Fisheries Department, Development Partners, the Private Sector	5 year programme. Output: 15 and 25 additional professional and technical staff, respectively trained by 2016	96,000	Figures provided by the Fisheries Department, which also indicates that 24,000 USD already available for the programme
		Provision of technologies that reduce firewood in fish smoking (e.g. solar lanterns for drying of fish)	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: 3 briquette manufacturing plants established (1 in Kaoma, 1 in Kitwe and 1 in Nyimba) based on raw material availability. Three solar tent demonstration sites established in Luapula, Northern and Western provinces by 2016	480,000	Figures provided by the Fisheries Department, which indicates that 3,600 USD is already available for this programme

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Research and development: understanding climate change and fisheries	Fisheries Department, Development Partners, the Private Sector	3 year programme Output: Appropriate equipment bought for 11 Research Stations 11 Professional staff and 30 technical staff trained Response to fish disease outbreaks strengthened Up to date fisheries information and functional database in place within 3years	112,000	Figures provided by the Fisheries Department, which also indicates that 1,600 USD is already available for this programme
		Sustainable fisheries management (policies and laws and enforcement) to avoid	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: Fisheries legislation harmonized with the Fisheries Management Plans (9 fishery areas) by 2016	32,400	Figures provided by the Fisheries Department, which also indicates that 7,600 USD is available for the programme
		Revise and modernize current pieces of legislation				

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		fish depletion	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: Capacity to effectively monitor and enforce legislation enhanced by 2016	405,500	Figures provided by the Fisheries Department, which indicates that 194500 USD is available for the programme
		Strengthen the Department of Fisheries (DoF) capacity	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: Capacity of governance institutions enhanced	360,000	Figures provided by the Fisheries Department 40,000 USD is available for the programme
		Improve fisheries extension service delivery	Fisheries Department	5 year programme Output: Fisheries extension service delivery improved	340,000	Figures provided by the Fisheries Department 100,000 USD is available for the programme
	Fisheries Sub-sector: Aquaculture	Education services: Training of personnel in aquaculture	Fisheries Department, Development Partners, the Private Sector	5 year programme Output: organisations, training institutions and facilities re-structured and strengthening to suit aquaculture needs, and	1,415,135	From the National Aquaculture Development Plan 2010-2015

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				syllabi and curricula revised to incorporate aquaculture		
		Extension and training services	Fisheries Department	5 year programme Output: Extension services improved	991,500	From the National Aquaculture Development Plan 2010-2015
		Research and Development	MACO (Fisheries Department), ZARI, Learning and Research Institutions, the Private Sector	5 year programme Output: Improved fish seed and feed and cage designs to suit needs of all classes of farmers	1,069,860	From the National Aquaculture Development Plan 2010-2015
		Service delivery improvement	Fisheries Department	5 year programme Output: service delivery including provision of extension services improved	634,700	From the National Aquaculture Development Plan 2010-2015
		Planning and information	Fisheries Department	5 year programme Output: Planning and information capture enhanced	729,415	From the National Aquaculture Development Plan 2010-2015
		Infrastructure support	Fisheries Department, the Private Sector, Development Partners	5 year programme Output: fish ponds on private and customary land as well as cages and pens in publicly held rivers, marshes,	9,194,000	From the National Aquaculture Development Plan 2010-2015

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				swamps, lakes and reservoirs developed		
		Private sector direct investment in aquaculture	Fisheries Department, the Private Sector, Development Partners	5 year programme Output: Aquaculture sites developed in most of the productive areas countrywide	69,520,000	From the National Aquaculture Development Plan 2010-2015
	Sub-Total				85,452,278	
	Livestock Sub-sector	Promotion of investment in intensive livestock production systems ⁸⁷	Ministry of Livestock and Fisheries Development (MLFD), Development partners	5 year programme Output: intensive livestock production systems (e.g. zero-grazing for milk production) established by 2016	16,000,000	Information from MLFD
		Conservation of indigenous/local livestock genetic resources as an adaptation strategy ⁸⁸	MLFD, Development partners	5 year programme	25,000,000	Information from the MLFD

⁸⁷There are currently no projects promoting the intensification of livestock production as a climate change adaptation strategy in the smallholder livestock sub-sector, where more than 60% of the country's livestock are kept. The Government and its development partners as well as the private sector should promote intensive livestock production systems by establishing a fund for promotion of the use of mechanization of forage harvesting, handling and utilization. This will be piloted among smallholder dairy co-operatives at milk collection centres on a cost recovery basis. This will be accompanied by promotion of the utilization of improved pasture materials in fodder banks at homesteads.

⁸⁸This will be done by establishing nucleus herds for the local livestock strains. Indigenous/local livestock genetic resources are threatened with extinction through indiscriminate cross breeding in favour of larger exotic breeds. This is despite of the indigenous strains' better adaptability to climate change (as they are more accustomed to local climatic and environmental conditions) and their lower carbon footprint compared to their counterparts (exotic breeds).

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				<p>Output: Law aimed at protecting and promoting indigenous/local livestock genetic resources enacted by 2016; Incentives for utilizing indigenous/local livestock genetic resources provided</p>		
		Research and development: Building capacity for climate change related research in the livestock sub-sector	MLFD, Development Partners	<p>10 year programme</p> <p>Output: Adaptation strategies validated and adapted to local conditions at research stations with appropriate research facilities opened at strategic locations by 2020</p>	10,000,000	Information from the MLFD
	Sub-Total				51,000,000	
	Water	Water resources management: water resources planning; information system for water resources, water supply and sanitation	NWASCO, MEWD, CUs, LAs, Training institutions, NGOs, MOH, UNZA, Consultants, Line ministries, Cabinet (GIDD), MOE, Multi-sectoral stakeholders, Contractors, Research institutions, IWRM	<p>5 year programme</p> <p>Output: water demands to meet needs of various users assessed and feasible investment options for implementation developed; national inventory of water points updated; decentralised information systems at catchment and sub-</p>	6,200,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
			centre.	catchment levels supported		
		Water resources management: surface and groundwater resource assessment	MEWD	5 year programme Output: groundwater use regulations implemented; surface water resources inventories updated	4,800,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water resources management: legal and institutional framework capacity enhancement	MEWD	5 year programme Output: catchment councils established and strengthened	8,400,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water resources management: international waters	MEWD	5 year programme Output: Capacity of the	1,800,000	Sourced from "The Integrated Water Resources Management and

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				International Waters Unit built		Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water resources management: drought and flood management and sustainable environmental management	MEWD, MTENR, DMMU	5 year programme Output: drought mitigation plans implemented; flood warning systems strengthened	27,800,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water resources management: protection of catchment areas and management of wetlands	Forestry Department (MTENR) and MEWD	5 year programme Output: catchment areas and wetlands protected and sustainably managed	4,600,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water resources management: Environmental institutional capacity building	MTENR, NGOs	5 year programme Output: capacity of institutions in charge of environmental management built	4,800,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Water resource infrastructure development: development and monitoring of infrastructure	MEWD, Local Authorities, Private Sector	5 year programme Output: 2 large multi-purpose dams constructed; safety of major dams inspected and surveyed	207,000,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water supply and sanitation: rural water supply and sanitation and institutional capacity building and enhancement	Ministry of Local Government and Housing, Local Authorities, Councils	5 year programme Output: water points and sanitation facilities constructed and rehabilitated, and appropriate technologies employed; Local Authorities supported in terms of management, planning systems, technical skills and equipment to undertake Rural Water Supply and Sanitation (RWSS)	58,000,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Water supply and sanitation: urban water supply and sanitation	NWASCO, Commercial water utilities	5 year programme Output: Commercial Units (CUs) supported in terms of management, planning systems, technical skills and equipment to undertake Urban Water Supply and	58,200,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Water supply and sanitation: peri-urban water supply and sanitation, and national solid waste management	Commercial water utilities, Local Authorities	Sanitation (UWSS) 5 year programme Output: water and waste water treatment plants constructed and rehabilitated in District Towns, and solid waste dumps constructed in all the Provincial Headquarter towns	128,800,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Monitoring, evaluation and capacity building: mainstreaming cross cutting issues-, climate change, gender and HIV/AIDS	MEWD, NGOs, MoE, Ministry of Health, Ministry of Community Development	5 year programme Output: cross-cutting issues implemented in the water sector	400,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Monitoring, evaluation and capacity building: institutional and human resource capacity building and enhancement	MEWD, NGOs	5 year programme Output: capacity of the institutions (personnel and equipment) in charge of water resources management enhanced	8,400,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Monitoring, evaluation and capacity building: water research and development	MEWD, UNZA, NGOs, Research Institutions	5 year programme	1,600,000	Sourced from "The Integrated Water Resources

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				Output: research and development in the water sector enhanced		Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
		Monitoring, evaluation and capacity building: public awareness and advocacy	MEWD, Media, MoE, NGOs	5 year programme Output: Awareness to underscore sustainable water resources use improved	1,200,000	Sourced from "The Integrated Water Resources Management and Water Efficiency (IWRM/WE) Implementation Plan 2007-2030" (GRZ, 2008)
	Sub-Total				522,000,000	
	Energy					
		Developing/updating a renewable resources map	MEWD, the Private Sector, Development Partners	By January 2012 Output: renewable energy resources map updated	800,000	Information from the Department of Energy (MEWD)
		Developing a renewable energy policy	MEWD, the Private Sector, Development Partners	By 2018 Output: comprehensive renewable energy policy developed	500,000	Information from the Department of Energy (MEWD)
		Development of small and mini hydro electricity generation schemes for rural electrification	MEWD, the Private Sector, Development Partners	By 2015 Output: more sites identified	300,000	Information from the Department of Energy (MEWD)

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				(feasibility study completed)		
		Promoting the use of wind energy: wind resource assessment ⁸⁹	MEWD, MoFNP, Rural Electrification Authority, ZESCO Limited, Private Sector	By 2015 Output: Wind atlas for the whole country developed	500,000	Estimated based on the cost of the Solar and Wind Energy Resource Assessment (SWERA) project whose cost was about 9.1 Million USD and implemented in 13 countries, and solar was included
		Developing a Renewable Energy Feed-in Tariff (Refit) scheme/policy	MEWD, MoFNP, Rural Electrification Authority, ZESCO Limited, Private Sector	By 2015 Output: Refit policy developed	300,000	Information from the Department of Energy (MEWD)
		Energy efficiency: energy efficient cook-stoves ⁹⁰	MEWD, MoFNP, Rural Electrification Authority, Private Sector, NGOs	By 2016 Output: 1000 using energy	300,000	Information from the Department of Energy (MEWD)

⁸⁹ Pilot projects in Southern Province where wind is used for water pumping. A study in Western Province to assess the feasibility of generating electricity and identifying other sites for data collection is also ongoing

⁹⁰ Currently targeting fuel efficient cook stoves with a budget of 60,000 USD

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				efficient cook-stoves by 2016		
		Instituting a National Green Energy Fund ⁹¹	MEWD, MoFNP, Development Partners, Private Sector	By 2020 Output: National Green Energy Fund established	25,000,000	Estimated based on international practice/experience and in liaison with the Energy Department
		Climate proofing the energy sector (climate change adaptation)	MEWD, MoFNP, Rural Electrification Authority, ZESCO Limited, Private Sector	By 2020 Output: climate change mainstreamed in the energy sector, e.g. vulnerability assessments carried out and coping strategies developed	200,000	Estimated based on international practice/experience
		Development of investment in geothermal energy	MEWD, Development Partners, ZESCO, the Private Sector (Independent Power Producers)	By 2020 Output: a 30 MW plant (or plants) developed	62,250,000	Based on a capital cost for geothermal power plants ranges from \$1150 to \$3000 per installed KW ⁹² (the average value is used)
		Development of green energy (solar, wind, renewable biomass)	MEWD, Development Partners, ZESCO, the Private Sector (Independent Power Producers)	10 year programme Output: 500 MW of additional green energy/electricity developed	2,200,000,000	Based on estimated cost of 10,000 USD per KW of solar (50 MW); 6,000 USD per KW of wind (250 MW); and 1000 USD per KW of

⁹¹ According to the MEWD, Department of Energy, the aim of this Fund will be fund/finance pilot projects in renewable energy (e.g., feasibility studies, etc)

⁹² See this reference: http://www.repp.org/geothermal/geothermal_brief_economics.html, for further details

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				by 2020		biomass (100 MW)
		Energy efficiency: provision of energy efficient light bulbs to domestic consumers	MEWD, ZESCO, Development Partners, NGOs, Private sector	5 year programme Output: 90% of domestic consumers use energy efficient bulbs by 2016	5,000,000	Estimated based on international practice/experience in liaison with the Energy Department
		Promotion of solar drip irrigation and solar water heating in buildings (low-end solar applications)	MEWD, Development Partners, NGOs, Private sector, MACO	10 year programme Output: 50% buildings have solar water heating installed by 2020; 1000 solar drip irrigation systems developed in southern Zambia	25,000,000	Estimated based on international practice/experience in liaison with the Energy Department
		Development of a Nationally Appropriate Mitigation Action (NAMA)	MEWD, MCT, Devt. Partners, Private Sector, ZESCO, MACO, NGOs	By 2012 Output: NAMA developed	150,000	Estimated based on international practice/experience in liaison with the Energy Department
		Biofuels policy development including blending ratios	MTENR, MEWD, MoFNP, the Private Sector, MACO, MCT	By 2011 Output: Biofuels policy implemented; consumption of biofuels raised	300,000	Information from the Department of Energy (MEWD)
		Sub-Total			2,320,600,000	

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
	Transport & Communication	Development of a mass urban transport system including a Bus Rapid Transit (BRT)/Bus Transit System (BTS) including traffic management for Lusaka City	RDA, MWS, MCT, MoFNP, Development Partners, the Private Sector, the City Council of Lusaka	5 year programme Output: BRT implemented by 2016	108,600,000	Urban Development Plan for the City of Lusaka (JICA, 2009)
		Development of a Light Rail Transit (LRT) system in Lusaka	MCT, MoFNP, Development Partners, the Private Sector, City Council of Lusaka	10 year programme Output: LRT in place by 2020	52,250,000	Estimated based on international practice/experience
		Expansion and modernization of the railway network to facilitate long distance and low-carbon transportation	MCT, MoFNP, Development Partners, the Private Sector	By 2020 Output: modern railway network operational in some places by 2020	250,000,000	Estimated based on international practice
		A strategic fund created within the National Road Fund Agency's budget to respond to climate-related roads (infrastructure) damages	MCT, MoFNP, NRA, Development Partners, the Private Sector	By 2020 Output: Strategic Fund in place	25,000,000	Estimated based on international practice
		Development of a policy/regulations on new road and bridges designs to factor in climate change	MCT, RDA, the Association of Building and Civil Engineering Contractors (ABCEC), Development Partners, the Private Sector	By 2013 Output: A new infrastructure development policy in place	300,000	Estimated based on international practice

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Enhance road and bridge designs to take into account extreme climatic changes	MCT, MoFNP, NRFA, RDA, Development Partners, the Private Sector, the Association of Building and Civil Engineering Contractors (ABCEC)	By 2020 Output: all roads and bridges designed/redesigned to take into account extreme weather events	93,750,000	Estimated based on international practice
		Appropriate regulatory measures/policy on vehicle size, weight, noise and fumes	MTENR, MCT, MoFNP, Development Partners, the Private Sector	By 2013 Output: policy in place by 2013	300,000	Estimated based on international practice
		Improve the planning, management and financing of rural road transport	MCT, MoFNP, NRFA, RDA, Development Partners, the Private Sector	By 2012 Output: new planning and management plans in place by 2012	200,000	Estimated based on international practice
		Upgrading the road infrastructure such as community roads, paths, tracks, trails and footbridges through community participation	MCT, MoFNP, Development Partners, the Private Sector	By 2020 Output: all existing roads upgraded to new standards that factor in climate change	125,000,000	Estimated based on international practice
	Sub-Total				655,400,000	
	[Wildlife] and Tourism	Developing the domestic tourism market	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels	By 2016 Output: 800,000 domestic	200,000	Information from ZAWA. Based on a budget of \$ 40,000

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
			Industry)	tourists per year by 2015		per year
		Improving rangeland carrying capacity: construction of watering points in wildlife areas in readiness for droughts	MTENR, ZAWA, the Private Sector (e.g. the Tours and Travels Industry), Development Partners	By 2015 Output: 10 boreholes per park sunk in all the 19 prone parks such as the Sioma-Ngwezi, Kafue National Park, and Lower Zambezi	950,000	Figures provided by ZAWA (a cost of \$5000 per borehole)
		Improving rangeland carrying capacity: construction of dams along the Luangwa River to serve wildlife and for other purposes (ecosystem based management)	MTENR, ZAWA, the Private Sector (e.g. the Tours and Travels Industry), Development Partners	By 2020 Output: 5 small dams developed along the system along the Luangwa River to serve a number of game management areas and parks	4,000,000	Figures provided by ZAWA (a cost of \$800,000 per dam)
		Improving rangeland carrying capacity: monitoring, management and remediation of degraded rangelands ⁹³	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels Industry)	By 2015 Output: degraded sections of the Mweru-Wantipa Park upgraded	2,000,000	Figures from ZAWA
		Developing a National Wildlife Adaptation Strategy	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels	By 2016 Output: A National Wildlife	200,000	Estimated figures

⁹³ Happening at small scale in the Kafue and Nsumbu National Parks

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
			Industry)	Adaptation Strategy developed		
		Encouraging community participation in rangelands and wildlife management	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels Industry)	By 2015 Output: existing programmes reviewed and new programmes adopted/proposed	500,000	Figures provided by ZAWA
		Creating community game ranches	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels Industry)	By 2016 Output: several pieces of land set aside by traditional chiefs for community ranches and conservancies	100,000	The estimated amount for awareness creation and capacity building
		Capacity building for regulations and laws enforcement	MTENR, ZAWA, NGOs, the Private Sector (e.g. the Tours and Travels Industry)	By 2015 Output: additional personnel trained and deployed	5,000,000	Information from ZAWA
					12,950,000	
Total					5,814,000,000	
Environmental Protection	Environment and Natural Resources	a) Mainstreaming climate change education and awareness: Heightened environmental protection awareness campaigns and programmes (e.g.	Spread across all sectors and ministries, but key ones include MTENR, MEWD, CSOs, CBOs, NGOs, the Private Sector	5 year programme Output: climate change awareness enhanced by 2016	376,000,000	Estimated based on international practice, experience

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		introduction of climate change into curricula, tree planting programmes by schools and colleges, waste management, etc)				
		b) Climate and climate change information: capacity building: Creation of a multi disciplinary research institute at a higher learning centre for capacity building	ZMD, Development Partners, Academic and Research Institutions, MTENR	By 2013 Output: a climate institute created in one of the higher learning institutions	2,000,000	Information from the ZMD
		Procurement of equipment and training of personnel for climate modelling and research	ZMD, MoFNP, Development Partners, Academic and Research Institutions	By 2012 Output: additional equipment purchased at a cost of 1,000,000 USD; 2 more personnel trained and employed by the ZMD at a cost of 500,000 USD	1,500,000	Information from the ZMD
		Enhancement of the capacity of the ZMD with respect to manpower and equipment for generating seasonal forecasts to strengthen early warning systems	ZMD, MoFNP, Development Partners, Academic and Research Institutions	By 2011 Output: additional and modern equipment purchased; more personnel trained and deployed	5,000,000	Information from the ZMD

MTEF Function	Sector	Activities/ Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Provision of resources to interpret and disseminate early warning products ⁹⁴	ZMD, MoFNP, Development Partners, Research and Academic Institutions	10 year plan Output: up-to-date climate information provided to end-users	3,000,000	Estimated at a cost of 300,000 USD per year (Information from the ZMD)
		Purchase of automatic rainfall stations	ZMD, Development Partners, MoFNP	By 2011 Output: 40 automatic rainfall stations purchased and installed	300,000	Information from the ZMD
		Purchase of more automatic weather stations	ZMD, Development Partners, MoFNP	By 2011 Output: 20 more automatic weather stations purchased and installed ⁹⁵	600,000	Information from the ZMD
					388,400,000	
	Forestry Management and Protection	Support to institutional strengthening: human resource development	Forestry Department (MTENR), FAO/UNEP/UNDP, the Private Sector, Local Community Leaders/Representatives, CBOs, Development Partners	5 year programme Output: Training programme developed; 18 more officers trained by 2015	1,500,000	Information from the Forestry Department

⁹⁴ The products are available but the means (finances) to disseminate them is lacking

⁹⁵ A proposal for the same has been made to the Finnish Government

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Support to institutional strengthening: restructuring of Forestry Department	Forestry Department (MTENR), FAO/UNEP/UNDP, the Private Sector, Local Community Leaders/Representatives, CBOs, Development Partners	5 year programme Output: Forestry Dept. Structure reviewed and recruitment & placement done	500,000	Information from the Forestry Department
		Policy and legislation review: revision and amendment of the Forestry Policy and Forests Act	Forestry Department (MTENR), PID, FAO/UNEP/UNDP, the Private Sector, Local Community Leaders/Representatives, CBOs, Development Partners	5 year programme Output: New policy in place; Amended Act in place	0	The budget for this activity has been captured under the section <i>Legislation-Review and Harmonisation of Policies and Laws</i> (Information from the Forestry Department)
		Afforestation and Reforestation: tree nursery establishment and tree planting	Forestry Department (MTENR), Local community, HRA, ZFC, CBU, MDD, ZDA, FAO/UNEP/UNEP	5 year programme Output: Forestry Nursery Manual developed & distributed to all the districts; 14 village nurseries established with capacity of more than 5 000 tree seedlings per nursery; 60 District Nurseries established; 9,000 hectares planted with appropriate	3,000,000	Information from the Forestry Department

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				species		
		Afforestation and Reforestation: reforestation of natural forests	Forestry Department (MTENR), FAO/UNEP/UNEP, Development Partners	5 year programme Output: 15,000 ha of degraded natural forests restored	4,540,000	Information from the Forestry Department
		Sustainable Forest Management: strengthening participatory forest management	Local communities/chiefs, Forestry Department (MTENR), ZDA	5 year programme Output: 1 Public Private Partnership (PPP) forest enterprise strategy developed; At least one PPP established in plantation-sawmilling enterprises; At least one Joint Forest Management (JFM) declared in each province	398,800	Information from the Forestry Department
		Sustainable Forest Management: forest protection and management	Forestry Department (MTENR), ZFC, CBU,	5 year programme Output: 100 management plans developed for Local and National forests; 10 collection points created to collect revenue online	398,800	Information from the Forestry Department
		Sustainable Forest Management: conducting forestry demarcations in Protected Forest areas	Forestry Department (MTENR)	5 year programme Output: 100 protected areas with clear boundaries	398,800	Information from the Forestry Department

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				established		
		Sustainable Forest Management: reservations of new protected areas	Forestry Department (MTENR)	5 year programme Output: 15% of total land area of Zambia reserved	398,800	Information from the Forestry Department
		Sustainable Forest Management: promotion of sustainable wood fuel management	Forestry Department (MTENR), Local Communities/Traditional Chiefs, NGOs, Private Sector	5 year programme Output: At least 50 hectares of fuel wood woodlots established per district in 15 highly urbanized towns	398,800	Information from the Forestry Department
		Climate change adaptation and mitigation: forest monitoring and assessment	Forestry Department (MTENR), FAO, UNEP, UNDP, Academic and Research Institutions	5 year programme Output: A Monitoring, Reporting and Verification system put in place	1,000,000	Information from the Forestry Department
		Climate change adaptation and mitigation: REDD+ Programme	Forestry Department (MTENR), FAO, UNDP & UNEP, MEWD, the Private Sector, NGOs, Local Communities	5 year programme Output: REDD+ Strategy developed; 7 management plans developed	3,000,000	Information from the Forestry Department. 4.9 Million USD has been allocated towards this programme for the next 3 years
		Forest Research and Development: rehabilitation of research infrastructure	Forestry Department (MTENR)	5 year programme Output: 7 research	10,000,000	Information from the Forestry Department

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				laboratories rehabilitated in Kitwe, Choma, Kalulushi; 3 Research laboratories & 1 library equipped; Research master plan developed		
		Forest Research and Development: generation of and maintaining up-to-date forest data	Forestry Department (MTENR)	5 year programme Output: system for maintaining up-to-date data and information in place	5,000,000	Information from the Forestry Department
	Sub-Total				30,534,000	
Total					418934000	
Housing and Community Amenities	Water Supply and Sanitation	Improvement of water supply and sanitation in Lusaka City	The City Council of Lusaka, Development Partners, the Private Sector	5 year programme Output: The city water resources management plan established; drainage and sanitation/sewage infrastructure improved; clean tap water supply enhanced	167,000,000	The Lusaka City Development Plan (JICA, 2009)
	Housing	Appropriate infrastructure development: Living Environment Improvement in Lusaka	The City Council of Lusaka, Development Partners, the Private Sector	5 year plan Output: communal taps, drainage and sanitation improved; microfinance for housing development and upgrading of sub-standard	15,500,000	The Lusaka City Development Plan (JICA, 2009)

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				housing established		
		Enforcement of regulations and laws: Laws and regulations enforcement and proper urban planning for the City of Lusaka	The City Council of Lusaka, Development Partners, the Private Sector,	5 year plan Output: Capacity to properly plan and enforce urban development enhanced	3,100,000	The Lusaka City Development Plan (JICA, 2009)
	Social Protection	Climate insurance protection: Establishing insurance schemes to make reparations to persons and communities affected by climatic disasters (e.g., to rural farmers)	MoFNP, the Private Sector (e.g. Insurance Firms, Banks) and Social Entrepreneurship Institutions, MCDSS	By 2012 Output: climate disaster insurance scheme created	100,000,000	This is roughly estimated based on similar schemes elsewhere, e.g. the Equity Bank Kenya/UAP Kenya/ILRI Drought Insurance Scheme
		Gender: Developing gender-responsive strategies, e.g. creating special lending schemes for women and youth to engage in SMEs	MGWD, Development Partners, CBOs, CSOs and Social Entrepreneurship Institutions	By 2012 Output: Special lending scheme for women and youth created	10,000,000	Estimated based on international practice
		Strengthening disaster management structures: Strengthening disaster preparedness, e.g. financial and technical support to units concerned with disaster mitigation and	DMMU, MoFNP, Development Partners	By 2012 Output: Capacity of the DMMU strengthened (more trained personnel, additional equipment purchased,	5,000,000	Figures estimated based on international practice ⁹⁶

⁹⁶ E.g., a single toolkit may cost over a million USD

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		management (DMMU)		disaster management toolkit purchased/developed); disaster management plans developed		
Total					300,600,000	
Health/Sanitation	Public& Medical Health Services	Strengthening disease surveillance support systems	MOH, Development Partners, Research Institutions	5 year programme Output: Response to disease outbreaks improved	700,000	Information from MoH. 300,000 has been allocated to the programme for the next 5 years
		Renovation and rehabilitation of health infrastructure to minimum standards to enable them cope with expected increase in disease incidences under climate change	MoH, MW&S, MLGH, ECZ, Local Authorities, Development Partners	5 year programme Output: Health infrastructure improved across the country	2,000,000	Information from MoH
		Strengthening existing public health programmes, e.g. the "Roll Back Malaria" Programme	MOH, Development Partners, WHO	5 year programme Output: Public health programmes such as the "Roll Back Malaria" Programme strengthened (malaria cases reduced by half by 2016)	700,000	Information from MoH. 300,000 has been allocated to the programme for the next 5 years
		Research on the interaction of climate variability/change impact on disease incidences	MoH, Development Partners, CBOs, CSOs, MTENR	5 year programme Output: Knowledge in/understanding of climate change-disease interactions	1,000,000	Information from MoH

MTEF Function	Sector	Activities/Projects/Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
				improved with target to two types of diseases: vector-borne (malaria) and water-borne (cholera/dysentery)		
		Mainstream climate change adaptation into the National Health Policy and the Environmental Health policy	MOH, Development Partners, CBOs, CSOs, MLGH, CPs, Private Sector	5 year programme Output: climate change issues mainstreamed into the National Health Policy and the Environmental Health policy	400,000	Information from MoH
		Promotion of healthy living: creation of 'green spaces' in urban centres	MTENR, MOH, Development Partners, CBOs, CSOs, CPs, Private Sector	5 year programme Output: One green space or recreational open space created/rehabilitated in each of the major cities/towns	2,500,000	Information from MoH
		Promotion of healthy living: public health awareness programmes to promote healthy living, e.g. non-motorized transport (NMT)	MOH,MOE,MOID, MLGH,MTENR, CSOC, CBOs, NGOs, Development Partners the Private Sector	5 year programme Output: Awareness on healthy living improved	800,000	Information from MoH
		Introduction of approved and appropriate Health Care Waste Management interventions e.g. solid waste utilization-energy through CDM Projects	MOH, MTENR, MEWD, CSOC, CBOs, NGOs, the Private Sector, Local Authorities	5 year programme Output: Improved/sustainable solid waste management systems introduced in all hospitals	3,000,000	Information from MoH

MTEF Function	Sector	Activities/Projects/ Programmes	Responsible/Key Institutions	Present Status, Proposed Timeline and Expected Outputs	Required Funds (USD)	Remarks/Notes
		Vaccinations and immunizations against diseases as a result of climate change effects	MTENR, MoH, Partners, CBOs, CSO, MLGH, Min. Of Justice, private sector, CPs	5 year programme Output: vaccination programmes against priority diseases whose incidences would increase with climate change put in place	5,000,000	Information from the MoH. 1,000,000 has been allocated for the next 5 years towards the programme
		Research on the interaction of climate change, gender and HIV/AIDS	NAC, MoH, Partners, Local Authorities etc	5 year programme Output: Knowledge in climate change, gender and HIV/AIDS issues interactions improved	160,000	Information from the MoH. 10,000 has been allocated for the next 5 years towards the programme
		Mainstreaming of climate change, gender and HIV/AIDS into all sectors	NAC, MoH, Partners, Local Authorities etc	5 year programme Output: climate change, gender and HIV/AIDS mainstreamed into all sectors	500,000	Information from the MoH. 10,000 has been allocated for the next 5 years towards the programme
Total					16,760,000	
Grand Total					6,558,000,000	