COORDINATION OF THE IMPLEMENTATION OF THE UNITED NATIONS CONVENTION ON CLIMATE CHANGE AND THE KYOTO PROTOCOL

NO.1 OF 2011

DEPARTMENT OF METEOROLOGICAL SERVICES

K. O Matambo (Hon)
Minister of Finance and Development Planning
Private Bag 008
Gaborone

22 September 2011

Dear Sir

I have undertaken a performance audit on the "Coordination of the Implementation of the United Nations Convention on Climate Change and the Kyoto Protocol" at the Department of Meteorological Services in pursuant to Section 29 of the Finance and Audit Act, 1997.

As you are aware, the Finance and Audit Act provides that the Auditor General should carry out performance audit in the public sector and that performance audit reports are to be laid before the National Assembly, by the Minister responsible for Finance.

Accordingly, I submit the Performance Audit Report No.1 of 2011 on the audit of the Coordination of the Implementation of the United Nations Convention on Climate Change and the Kyoto Protocol, to be laid before the National Assembly in accordance with Section 36 of the Finance and Audit Act.

Yours faithfully

R. B. Sebopeng
AUDITOR GENERAL

AUDITING FOR BOTSWANA GOVERNMENT

The Auditor General is the Head of the Office of the Auditor General, appointed under the Constitution. The Auditor General carries out his duties under the Finance and Audit Act 1997. He thereof, undertakes Performance Audits on the public sector bodies and submits reports, to the National Assembly. The aim is to improve the public sector administration and accountability.

Auditor General's reports are available from the Government's Department of Printing and Publishing Services Bookshops.

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ABBREVIATIONS

BCL	Bamangwato Concessions Limited
CFCs	Chloroflouro Carbons
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon dioxide
COP	Conference of Parties
DMS	Department of Meteorological Services
DNFP	Designated National Focal Point
GCC	Gaborone City Council
GHGs	Greenhouse Gases
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
MEWT	Ministry of Environment, Wildlife and Tourism
NCCC	National Committee on Climate Change
NGOs	Non-Governmental Organisations
NMT	Non-Motorised Transport
NMVOCs	Non-Methane Volatile Organic Compounds
NO_x	Oxides of Nitrogen
N_2O	Nitrous Oxide
SNC	Second National Communication
UNCED	United Nations Conference on Environment Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organisation

EXECUTIVE SUMMARY

The problem of climate change had been the subject of international debate and research. Whilst divergent opinions existed, scientific evidence had shown that anthropogenic activities were contributing to increased concentrations of greenhouse gases (GHGs) in the atmosphere. The six GHGs covered under the Intergovernmental Panel on Climate Change (IPCC) were carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). These were classified by the IPCC as direct greenhouse gases. The indirect GHGs were carbon monoxide (CO), oxides of nitrogen (NO_X) and non-methane volatile organic compounds ($NMVOC_S$). Greenhouse gases in the atmosphere allowed short wavelength energy from the sun to pass through but interacted with long wavelength energy from the earth's surface and the lower atmosphere; hence warming the earth's surface.

Studies had since shown that increasing the concentrations of GHGs in the atmosphere to the levels equivalent to double CO_2 would increase ambient temperatures by about 2.5^0C to 4.5^0C. This would have significant implications to the global climate systems including changes in parameters such as precipitation, cloudiness, soil moisture, snow cover and might, eventually, result in significant expansion of the oceans and the melting of the mountain glaciers and hence lead to a rise in sea level. Climate change would have wide-ranging environmental and socio-economic effects. As a result, the universal potential impacts of climate change were:

- Reduction in quality and quantity of freshwater supplies
- Flooding due to sea level rise and extreme weather events
- Low crop yields and increased demands for irrigation.
- Damage to ecosystems and loss of biodiversity.
- Weather related mortality, infectious diseases and air quality respiratory illnesses.
- Disturbance to settlement patterns

The reality of climate change called for urgent actions if the irreversible build-up of greenhouse gases and global warming at a potentially huge cost to the economy and society were to be avoided. That called for concerted efforts to mitigate and adapt to the impacts and effects of climate change.

As a response, Botswana was among the countries which signed the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations Conference on Environment and Development (UNCED), the "Earth Summit" that was held in Rio de Janeiro, Brazil in June 1992. Botswana went on to ratify the Convention on 27th January, 1994 and it came into force on 27th April 1994.

The Climate Change Convention was followed by the Kyoto Protocol. The Protocol legally binds industrialised Country parties to reduce their emissions. Botswana became a party to the Kyoto Protocol on 3rd August 2003. The Protocol came into effect in February 2005. Botswana's obligations under the Climate Change Convention was to report on the anthropogenic sources and sinks of greenhouse gases and identify measures to minimise the impacts of global warming and climate change. As a result, the Department of Meteorological Services (DMS) was designated the focal point of all climate change issues in Botswana. The Office of the Auditor General therefore carried out a performance audit to assess how the DMS had been able to coordinate the implementation of the obligations, as provided for in the United Nations Framework Convention on Climate Change.

The audit covered the period from the year when Botswana issued its Initial National Communication to the Conference of Parties (COP) Secretariat, in 2001, until the previous financial year (2009/10). Some of the significant issues unearthed, alongside their recommendations, were that:

(a) There was absence of an over-arching policy on climate change, to harmonise the different pieces of legislative frameworks that impacted on climate change. The Policy would assist in better integration of climate change objectives in relevant policy areas aimed at the energy, business, transport, households, agriculture, forestry and land use, and the public sectors.

The Department of Meteorological Services should fast track efforts to develop a Policy on Climate Change. Such a policy should seek to address critical areas as outlined in the Convention on Climate Change and the Kyoto Protocol. Climate change concerns should be integrated in all areas of public policy, particularly economic and social policies by addressing possible conflicts and defining trade-offs between policy objectives, as well as identifying and strengthening policies with potential 'co-benefits'.

(b) There was no established long-term Action Plan to successfully implement the Commitments under the Convention. The Plan, if developed, would provide specific objectives and detailed performance indicators for achieving climate change commitments as well as to state the targets to be attained under each commitment and the cost-benefit analysis of implementation.

The DMS, with the assistance of the NCCC should develop a National Framework of Actions, and ensure that relevant stakeholders integrate climate change into their development Plans, thus making Climate Change risk reduction a priority.

(c) Climate change activities were not adequately coordinated because the DMS struggled to convince other Government Ministries and Departments to own up to issues of climate change.

The National Committee on Climate Change should be fully empowered to efficiently deliver on their core mandates, thereby better coordinating climate change activities in Botswana.

(d) There had been delays in the production of Botswana's National Communications to the UNFCCC Secretariat.

The DMS should produce the National Communications on a bi-annual basis, as required under the UNFCCC.

(e) The Department of Meteorological Services had struggled to periodically update and publish national inventories of anthropogenic emissions by sources, and removals by sinks of all greenhouse gases, leading to a direct breach of the provisions of Article 4.1(a) of the Convention on Climate Change.

The DMS should make an effort to periodically update and publish inventories of anthropogenic emissions by sources, and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies agreed upon by the Conference of Parties.

(f) There were gaps observed in the meteorological database kept by the DMS, caused by malfunctioning instruments.

The DMS should ensure that all its meteorological instruments were well serviced and kept in a good condition. This would help to provide a reliable and continuous data for future reference.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Climate Change refers to 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'[1]. In the 1980s, scientific evidence linking greenhouse gas emissions from human activities with the risk of global climate change started to arouse public concern. Governments held a series of international conferences that echoed this concern by issuing urgent calls for a global treaty to address the problem. The United Nations General Assembly responded in 1990 by establishing the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change.

The ultimate objective of the Convention was to achieve, in accordance with the relevant provisions of the Convention, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level had to be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production was not threatened and to enable economic development to proceed in a sustainable manner.

Botswana was among the countries which signed the United Nations Framework Convention on Climate Change (UNFCCC) at the United Nations Conference on Environment and Development (UNCED), the "Earth Summit" that was held in Rio de Janeiro, Brazil in June 1992[2]. Botswana went on to ratify the Convention on 27th January, 1994 and it came into force on 27th April 1994.

The Climate Change Convention was followed by the Kyoto Protocol. The Protocol legally binds industrialised Country Parties to reduce their emissions. Botswana became

[1] Article 1(2), United Nations Framework Convention on Climate Change
[2] Botswana's Initial National Communication to UNFCCC, 2001

a party to the Kyoto Protocol on 3rd August 2003. The Protocol came into effect on February 2005. By signing and ratifying the Convention, Botswana is committed among other things, to;

- Provide a national inventory of sources and sinks of greenhouse gases
- Develop national programmes for reducing emissions of greenhouse gases and development of strategies to combat the impacts of global warming and climate change.
- Develop and elaborate appropriate and integrated plans of adaption to the impacts of global warming and climate change.
- Take account of global warming and climate change in all social, economic and environmental policy and action.
- Promote public awareness and cooperation with Non Governmental Organisations and reporting steps taken to implement the Convention to the Conference of the Parties.

1.2 THE SCIENCE OF CLIMATE CHANGE

The problem of climate change which is caused mainly by infrared-active gases known as greenhouse gases present in the atmosphere, and the consequent climate change are the subject of international debate and research[3]. Scientific evidence has shown that anthropogenic activities are contributing to increased concentrations of greenhouse gases (GHGs) in the atmosphere. The six GHGs covered under the Intergovernmental Panel on Climate Change (IPCC) are classified into direct and indirect gases. The direct gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The indirect GHGs are carbon monoxide (CO), oxides of nitrogen (NO_X) and non-methane volatile organic compounds ($NMVOC_S$). Greenhouse gases in the atmosphere allow short wavelength energy from the sun to pass through but interact with long wavelength energy from the earth's surface and the lower atmosphere; hence warming the earth's surface. This is referred to as the 'greenhouse effect'.

1.2.1 Impacts of Climate Change

Computer modeling of the response of the earth's climatic system to the increases in atmospheric CO_2 has been active since the 1980s[4]. Furthermore, studies have since shown that increasing the concentrations of GHGs in the atmosphere to the levels

[3] Department of Mines (1995) Botswana Country Study: Inventory of Greenhouse Gas Emissions and Sinks.
[4] Mason, J (1980) The Meteorological Effects of increasing the Carbon dioxide Content of the atmosphere: The proceedings of a Conference on Environmental Effects of utilizing more coal.

equivalent to double CO_2 would increase ambient temperatures by about 2.5^{0}C to 4.5^{0}C. This will have significant implications to the global climate systems including changes in parameters such as precipitation, cloudiness, soil moisture, snow cover and may, eventually, result in significant expansion of the oceans and the melting of the mountain glaciers and hence lead to a rise in sea level[5]. Climate change will have wide-ranging environmental and socio-economic effects, some of which included:

- Reduction in quality and quantity of freshwater supplies.
- Flooding due to sea level rise and extreme weather events.
- Low crop yields and increased demands for irrigation.
- Damage to ecosystems and loss of biodiversity.
- Weather related mortality, infectious diseases and air quality respiratory illnesses.
- Disturbance to settlement patterns.

At a country level, available climate change projections and impact studies that have been carried out suggested that Botswana was highly vulnerable to climate change. A variety of climate simulation models predicted that temperatures in Botswana would on average rise by 1-3^{0}C by around 2050[6]. This was due to emissions of greenhouse gases into the atmosphere, dominated by CO_2 followed by CH_4 then N_2O and some other Chloroflouro Carbons (CFCs). The emission of the above greenhouse gases was from the following sectors; Energy, Industrial, Agriculture, waste, land use change and forestry. The predominant greenhouse gas emitted in the energy sector was CO_2, emitted at the Morupule Power Station where coal was being combusted to generate electricity and in mines such as BOTASH and BCL. Nitrous oxide emissions dominated in the industrial sector while methane was dominant in the agricultural sector.

The reality of climate change called for urgent actions if the irreversible build-up of greenhouse gases and global warming at a potentially huge cost to the economy and society were to be avoided. That called for concerted efforts to mitigate and adapt to the impacts and effects of climate change.

1.2.2 Mitigation

Mitigation involves reductions in the concentrations of greenhouse gases, either by reducing their sources or by increasing their sinks[7]. That includes reducing demand for emissions-intensive goods and services, increasing efficiency use and development of low carbon technologies, and reducing non-fossil fuel emissions.

[5] Bryan Cartledge (ed) Monitoring the Environment. Oxford University Press; 1992
[6] National Conservation Strategy Coordinating Agency (2002) State of the Environment Review Report.
[7] http://en.wikipedia.org/wiki/Climate_change_mitigation (accessed 09/08/2010)

1.2.3 Adaptation

Adaptation to climate change consists of initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Adaptation is a necessary strategy to complement climate change mitigation efforts. The ability of human systems to adapt and cope with climate change depends on such factors as wealth, technology, education, infrastructure and socio-political will. Populations and communities are highly variable in their endowments of these attributes, with developing countries typically worst-placed to adapt to the effects of climate change.

1.3 AUDIT MOTIVATION

Climate change scenarios signaled greater warming and aridity over the central land mass of Southern Africa, extending over the already semi-arid lands of Botswana, with projections of 2^0 Celsius rise in temperature and 5-10% decline in rainfall by 2050[8]. Botswana, like the rest of Africa, is vulnerable to climate change. The general population of Botswana is increasingly becoming aware of changes in climate, such as shifts in seasonal patterns, increased aridity and extreme events like the 1983 to 1987 and 1991/92 droughts as well as the 1999/2000 floods. The unfolding impacts of climate change to Botswana and measures to address those had been captured in the local Media. Some of the notable publications[9] included the following;

- Climate Change Impacts on Mophane Worm.
- Global warming to worsen weather, climate disasters.
- Botswana paces to mitigate global warming effects.
- Mogae envisions green technology.

Even though there was a general appreciation of climate change being 'real' and its impacts being felt at a local and national level, there was a feeling that the Government was doing little to curtail the impacts of climate change. "Botswana had to invest in pro-active disaster reduction measures from climate hazards such as droughts and floods and aim to direct market demand away from goods and services with high embedded emissions"[10].

Furthermore, there had been suggestions that the DMS, as a Coordinator, had not succeeded in its role of advocating for climate change issues to be embedded across

[8] Dube, O.P (2007) Post-Kyoto Policy Agenda for Climate Change Mitigation and Adaptation: A perspective from Botswana in Southern Africa.
[9] www.dailynews.gov.bw; accessed on 6th April 2010.
[10] Dube, O.P (2008) Environmental Sustainability: Climate Change and Global Environmental Issues.

all Government Ministries and Departments (Draft Institutional Analysis Report for Poverty Environment Initiative for Botswana, 2009:p46).

Considering the above, the Office of the Auditor General carried out a performance audit to assess how the Department of Meteorological Services (DMS) coordinated the implementation of the necessary obligations under the Convention.

CHAPTER TWO

2.0 DESCRIPTION OF THE ORGANISATION

The Department of Meteorological Services (DMS) is one of the seven departments under the Ministry of Environment, Wildlife and Tourism. The other departments are Forestry and Range Resources, Wildlife and National Parks, Tourism, Waste Management and Pollution Control, Environmental Affairs and Corporate Services.

The DMS monitors and analyses Botswana and regional weather, providing weather forecasts, bulletins and an extensive range of meteorological and climatological data and reports.

2.1 DEPARTMENT OBJECTIVES AND FUNCTIONS

The overall objective of the DMS is to provide weather, climate and related information and advice for the socio-economic development, in relation to its functions. The under-listed are the DMS' specific objectives;

2.1.1 Specific Objectives

The DMS aims specifically at:

- Formulating, coordinating, implementing and monitoring policies and strategies on meteorology.
- Establishing, implementing and monitoring an effective operational meteorological observing network for the provision of meteorological data and information for operational and planning purposes.
- Monitoring and providing watch on weather conditions affecting the country, providing various forecasts and issuing advice and warnings on hazardous weather for operational and planning purposes.
- Developing and providing weather forecasts, aviation forecasts and evaluating forecast performance, and providing advice and warning on hazardous weather for operational and planning purposes.
- Validating, analysing/processing and archiving meteorological data for use in the planning and determination of policy, to advice on sustainable utilisation of natural resources and in the selection of appropriate technologies.
- Providing formal training in meteorology to pre-service and in-service personnel from the public and private sectors, to attain and maintain

proficiency and knowledge in providing accurate and timely service for the socio-economic development of Botswana.

- Undertaking research in meteorology to improve the understanding of atmospheric processes and interactions, providing and applying research results and information in order to contribute to the achievement of socio-economic development goals.
- Providing meteorological expertise for the development and implementation of methodologies for the management of data in the national climate archive.
- Providing services to the Department's data acquisition and distribution systems in order to ensure availability of data in line with World Meteorological Organisation (WMO) and other agreed standards and guidelines for the suitability of telecommunications and computer networks for the collection and exchange of data and weather information at national, regional and global level.
- Coordinating administrative functions of the Department.

2.1.2 Functions

In order to achieve the above stated objectives, the DMS performs the following functions:

- Policy formulation, implementation and coordination
- Weather forecasting
- Climatology
- Training and Research
- Data and information management
- Engineering
- Departmental management

2.2 VISION AND MISSION

2.2.1 Vision

A model of an efficient, professional, scientific and technical leadership in the provision of quality weather and climate data and information.

2.2.2 Mission

The DMS exists to provide user oriented meteorological service through monitoring and predicting weather and climate and the use of up-to-date technology to enable optimal utilisation of resources.

2.3 COORDINATION STRUCTURE

2.3.1 National Committee on Climate Change

The National Committee on Climate Change (NCCC) was established to coordinate the implementation of Botswana's obligations as agreed to, under the United Nations Framework Convention on Climate Change. The Deputy Permanent Secretary (Environmental Affairs) in the Ministry of Environment, Wildlife and Tourism chairs the Committee. As an advisory body, the NCCC has representation from Non-Governmental Organisations, Government Ministries/Departments and Private Sector Organisations.

The NCCC Secretariat, located within the DMS, has four professional officers[11] and meets on a quarterly basis, even though the Chairman could call for emergency meetings before the prescribed duration. The responsibilities of the NCCC, as stated in its Terms of Reference are to;

- Oversee the preparation of the National Communication to the Climate Change Secretariat and the Conference of the Parties and ensure the formulation of appropriate national responses to climate change issues.

- Coordinate and oversee the establishment of compatible and properly networked data bases on issues of climate change, its impacts and response strategies.

- Provide guidance in the development of the areas of concern and facilitate development of national research programmes and projects on climate change issues, its impacts and response strategies, and advise on further studies for which funding may be sought from the Global Environment Facility or any other financial mechanism.

- Recommend and review lists of preselected/identified scientists who could undertake specific research projects on climate change issues, its impacts and response strategies.

[11] Initial Communication, page41

- Advise Government on any other issues relating to other relevant Conventions particularly on issues related to climate change, its impacts and response strategies.

- Provide guidance and identify areas of need for the development of national public awareness and public education programmes and the development and mobilisation of human resources and preparation of teaching materials on climate change issues, its impacts and response strategies.

- Advise Government on implications of commitments under the United Nations Framework Convention on Climate Change.

CHAPTER THREE

3.0 AUDIT DESIGN

3.1 AUDIT OBJECT

The audit object is the Department of Meteorological Services (DMS), which is the Designated National Focal Point (DNFP) for all climate change issues in Botswana.

3.2 AUDIT OBJECTIVE

The audit sought to assess whether the Government of Botswana, through the Department of Meteorological Services, appropriately coordinated the implementation of the United Nations Framework Convention on Climate Change and its associated Kyoto Protocol.

3.3 AUDIT SCOPE AND LIMITATIONS

The audit focused on assessing the role of the Government, through the DMS, in coordinating the implementation of the Convention on Climate Change and its associated Kyoto Protocol. The areas of particular focus related to the attainment of Botswana's commitments to the Convention as captured at *para 1.1*.

The audit covered the period from the year when Botswana issued its Initial National Communication to the Conference of Parties (COP) Secretariat, in 2001, until the year 2009/10. This period was necessary because it presented an opportune time when all interventions geared at addressing climate change were beginning to take shape. Though the audit managed to cover a wider scope in terms of the time factor, there was a limit on the extent to which the implementation of climate change projects was covered. In fact, the audit only looked into one project, Non-Motorised Transport Facilities (NMT), to have a general appreciation of how it progressed under the auspices of the Gaborone City Council (GCC).

3.4 METHODS OF DATA COLLECTION

The audit was conducted in accordance with the International Organisation of Supreme Audit Institutions (INTOSAI) Working Group on Environmental Auditing (WGEA) Guidelines on Auditing Government Response to Climate Change.

The following methods were used to collect data:

3.4.1 Interviews

A total of twenty-two (22) interviews were conducted at the Department of Meteorological Services, in order to understand how the Department performed its role as the designated focal point for all climate change issues in Botswana. The following Officers were interviewed:

- Director, Department of Meteorological Services
- Head, Division of Climatology
- Head, Weather Forecasting division
- Head, Data and Information Management
- Principal Engineer, Engineering Division
- Principal Meteorologist, Training and Research Division
- Performance Improvement Coordinator
- Officers-In-Charge of all the seven (7) Synoptic stations visited
- A total of eight (8) Field Assistants

Interviews were also held with some primary stakeholders in climate change work. These were;

- Non-Governmental Organisations (Kalahari Conservation Society and Somarelang Tikologo)
- United Nations Country Office
- Gaborone City Council
- Botswana Global Environmental Change Committee, University of Botswana

3.4.2 Document Review

The following documents were reviewed in order to better understand climate change scenarios in Botswana, regulatory and institutional frameworks, and the achievements that have been done so far, in terms of responding to the impacts of climate change.

- United Nations Framework Convention on Climate Change (The Convention)
- The Kyoto Protocol to the Convention on Climate Change
- Minutes of the National Committee on Climate Change (1998-2009/2010)
- Minutes of the Tripartite review meetings
- Botswana's Initial National Communication, 2001
- Draft Botswana's strategy for addressing climate change: Policy Paper, 2007
- Project file: BOT/00/G4 Photovoltaic solar energy project
- Project file: Non-motorised transport facilities in Gaborone
- Baseline Study on Non-Motorised Transport Facilities In Gaborone
- Mid-Term Review of the UNDP/GEF Project: Incorporating Non-motorised Transport Facilities in the City of Gaborone

- Departmental Strategic Plan Documents
- Departmental Organogram
- Correspondence files on climate change since the signing and ratification of the Convention.

3.4.3 Observations

Observations were made on seven (7) visited synoptic stations out of sixteen (16), to assess the condition of observing meteorological instruments. These stations were Jwaneng, Tsabong, Maun, Shakawe, Francistown, Mahalapye and Sir Seretse Khama International Airport (Gaborone).

CHAPTER FOUR

4.0 CLIMATE CHANGE COMMITMENTS

The ability of the Government to respond to climate change issues was guided by Articles 4 (Commitments) and 12 (Communication of information related to implementation) of the United Nations Framework Convention on Climate Change. It stated, "All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances"[12] shall undertake the following:

4.1 NATIONAL COMMUNICATION

Parties to the Convention are expected to submit national reports to the Conference of the Parties (COP) on the implementation of the Convention on Climate Change. That should be in accordance with the principle of "common but differentiated responsibilities" as indicated at *para 4.0* above.

The core elements of the National Communications for both Annex 1 (developed countries) and Non-Annex 1 (developing countries) Parties are information on emissions and removals of greenhouse gases (GHGs) and details of the activities a Party has undertaken to implement the Convention. National Communications usually contain information on national circumstances, vulnerability assessments, financial resources and transfer of technology, and education, training and public awareness.

For developing countries like Botswana, a National Communication has to be submitted three (3) years after ratification of the Convention. Thereafter, subsequent communications had to be submitted consistently after every two (2) years.

The process of producing a National Communication involves the DMS collating all available and relevant information on climate change work in Botswana. Where such information is lacking, studies are commissioned and undertaken by Consultants and other competent bodies to feed into the National Communication. Once all the information has been compiled, a draft report is issued to the NCCC for verification and approval. A finalised copy is then sent to the Minister of Environment, Wildlife and Tourism for final approval to be then sent to the UNFCCC Secretariat.

[12] UNFCCC, Article 4 (1)

4.2 PROGRAMMES

Parties to the Convention have to formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change.

The programmes have to be proposed through the National communications for possible funding by the United Nations. Once the project is approved, funds could then be released for implementation. In Botswana, the DMS entered into an agreement with the United Nations Country Office to the effect that the latter shall administer the projects finances.

Botswana, through private and/or public entities may propose climate change projects for possible financing under the General Environment Facility (GEF). Such projects are submitted to the DMS, who then consolidate the proposals and forward them to the GEF after thorough assessment on their feasibility.

4.3 TECHNOLOGY

Parties to the Convention have to promote and cooperate in the development, application and diffusion, including transfer of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors.

As a process, a developing country has to propose a development project (through the involvement of private and/or public entities) that will be implemented by a developed country, through the application of environmentally friendly technologies. By doing so, a developing country will benefit from project activities resulting in certified emission reductions. On the other hand, a developed Party may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol.

Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of Parties on the basis of:

(a) Voluntary participation approved by each Party involved;
(b) Real, measurable, and long term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

The Clean Development Mechanism Executive Board shall assist in arranging funding of certified project activities as necessary. The Conference of the Parties elaborates modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

4.4 IMPACT ASSESSMENT

Parties to the Convention have to take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example, impact assessments, formulated and determined nationally, with a view to minimising adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change.

Furthermore, several studies are conducted to determine the impact of climate change on especially vulnerable sectors of the economy such as agriculture. In circumstances where the DMS does not have the capacity, Consultants are often brought in to undertake such studies.

Though outside the mandate of the DMS, the Environmental Impact Assessment (EIA) Act of 2005 provides for a series of procedures that must be fulfilled before any project is given development consent. Such procedures involve inter alia: undertaking a screening exercise for all proposed projects, scoping all the impacts from the projects, assessing the significance of the impacts, prioritizing and mitigating the impacts based on their severance on the environment.

4.5 DATA ARCHIVES

Parties had to promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various response strategies.

4.6 EDUCATION AND TRAINING

Parties to the Convention had to promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process, including that of non-governmental organisations.

CHAPTER FIVE

5.0 FINDINGS

5.1 POLICY ON CLIMATE CHANGE

A Draft Climate Change Policy Paper (DMS, May 2007) indicated that there was need for a climate change policy to be developed. In justifying the need for the policy, a number of issues were considered to be important. These were outlined as follows:

(i) Botswana had to be dependent on effective global action if it was to manage the risks of climate change.
(ii) It was desirable that Botswana engaged internationally to secure effective global action, and that Botswana positioned itself to promote its national interests in the design of international agreements to address climate change.
(iii) There was no international agreement on how to deal with climate change post-2012.

On the contrary, it was noticed that there was absence of an over-arching policy on climate change, to harmonise the different pieces of legislative frameworks that impacted on climate change. Some of those frameworks include; the Revised Road Traffic Act of 1987, Waste Management Act of 1998, Mines, Quarries, Works and Machinery Act of 1978, and Forest Act of 1980. Such frameworks did not provide for ways and means of reducing atmospheric greenhouse gases through, for instance, carbon sequestration. The existing regulatory frameworks were also not synergetic with each other, hence the need for them to be codified with a view to consolidating the climate change aspects.

The existence of a Climate Change Policy would give the National Committee on Climate Change explicit and mandated powers, and authority to coordinate the activities of all stakeholders relevant to climate change, and ensure that stakeholders understand their roles pertaining to climate change. Furthermore, the promulgation of the policy will invigorate all stakeholders to be committed to an array of realistic strategies for future climate change considerations. Moreover, the existence of the policy would assist in guiding the involvement of both private and public entities, more especially the private sector which is deemed as the engine of growth in the implementation of Conventions and Protocols.

However, the Auditor General is well aware that the development of a Climate Change Policy is not an end in its self but rather a means to achieving ends. After

developing the policy, there will be a need to better integrate the objectives of the climate policy into various sectoral policies such as the energy, business, transport, households, agriculture, forestry and land use, and the public sectors. Climate change concerns have to be integrated in all areas of public policy, particularly economic and social policies. That means addressing possible conflicts and defining tindicated that rade-offs between policy objectives, as well as identifying and strengthening policies with potential 'co-benefits'. For instance, the co-benefits of greenhouse gases mitigation actions could include improved energy security, urban air quality and human health benefits.

The effect of lack of integration was that, varying emphasis had been placed on environmental considerations and specifically on climate change, within different policy sectors. Mainstreaming climate change issues into all relevant areas of public policy had not been accorded an equal share of priority, thus resulting in lack of inter-sectoral planning and a fragmented approach to the implementation of specific climate change mitigation and adaptation options.

The benefits of integration are such that there will be an efficient, effective and well coordinated planning (as shall be discussed at 5.2) and implementation of climate change policy objectives by all relevant stakeholders. The move would also ensure that there is consistent and accurate measurement of greenhouse gases emissions sector-wise and that the information was continually updated.

RECOMMENDATION

The Department of Meteorological Services should fast track efforts to develop a Policy on Climate Change. Such a policy should seek to address critical areas as outlined in the Convention on Climate Change and the Kyoto Protocol.

To ensure a well coordinated planning and efficient implementation, the DMS should assist the various sectors to better integrate the objectives of the climate change Policy into their existing policies. This would be done in cognizance of the fact that those sectoral policies and legislation are able to drive the transition to a low carbon economy, create opportunities and demarcate risks to which all the sectoral players would have to respond to succeed

In integrating the climate change objectives into sectoral policies, policy makers would have a particularly important role to ensure that the reviewed policies provide the necessary incentives and tools for an effective and equitable abatement. These would include considerations aimed at accelerating the cost-effective reduction of emissions; and support for market-based mechanisms, provided that the measures are efficient, broad-based and are progressively introduced.

Management Comment

The DMS indicated that the Department had a draft Climate Change Strategy which would be finalized in 2011. They further, indicated that the Department had approached the World Bank to provide expertise to develop a Climate Change Policy which would be over-arching. They also stated that the World Bank acceded to their request. The aim is to infuse climate change in the country's Development Plans.

5.2 NATIONAL ACTION PLAN

A National Action Plan could be viewed as a comprehensive document which identified measures which promoted a country's development objectives while also yielding co-benefits for addressing climate change effectively (deduced from India's 1998 National Action Plan on Climate Change). Thus, a planning framework to facilitate measures relating to the actions for Botswana to implement the United Nations Framework Convention on Climate Change, are fundamental for the fulfillment of the obligations contained therein.

Botswana had to draw its National Action Plans to adapt to climate change while at the same time enhancing the ecological sustainability of the country's development path.

According to the National Action Plan Proposal submitted to the Regional Workshop on National Action Plans in Nairobi (Kenya) on February 1998, Botswana's National Action Plans had to take into account some of the following issues:

- Identify main sectors of interest.
- Identify main areas of priority and immediate measures.
- Prepare implementation strategies.
- Integrate National Action Plan with National Development and other Development Plans.
- Implement the National Action Plans by identifying human and technological resources to implement the plans.

The audit revealed that there was no established long-term Action Plan to successfully implement the Commitments under the Convention. The Plan, if developed, would in addition to the above bulleted issues, provide specific objectives and detailed performance indicators for achieving climate change commitments. It would also state the targets to be attained under each commitment as well as the cost-benefit analysis of implementation.

The plan would be a powerful tool to assist the DMS to achieve the goals and objectives of the climate change policy that would have been cascaded to the various sectors. It would be relatively easy to get all the stakeholders to account for their performance on specific targets related to their assigned activities.

RECOMMENDATION

The DMS, with the assistance of the NCCC should develop a National Framework of Actions, and ensure that relevant stakeholders integrate climate change into their development Plans, thus making Climate Change risk reduction a priority.

Management Comment

The DMS agreed to the recommendation.

5.3 COORDINATION

The Department of Meteorological Services, through the National Committee on Climate Change had to ensure that all climate change activities in Botswana were properly coordinated. According to the Draft Institutional Analysis Report for Poverty Environment Initiative (PEI) in Botswana, "a key challenge for DMS, a primarily science based Department, is for it to take on the mantle of Coordinator and advocate for climate change across Government so that it becomes embedded". That translated to managing all the stakeholders involved in climate change issues.

It was observed that the DMS had not been able to effectively execute its coordination role mainly because the Department had struggled to successfully convince all its stakeholders to own up to the responsibilities directed at developing objectives, implementation strategies as well as monitoring and evaluation criteria for climate change work. This thinking position is also captured in the Draft Institutional Analysis Report for Poverty Environment Initiative in Botswana (September 2009) which states,

"The DMS has strived to convince Sector Ministries that Climate Change is an issue which will impact significantly upon all sectors but to date, there is still a perception in some Ministries that climate change is an environmental issue and the sole responsibility of MEWT. This emphasises a need to work across Government to ensure that Politicians and Senior Civil Servants recognize the importance of climate change across all Government portfolios. The challenge is ensuring that other Ministries recognize their need to take action with regard to adaptation and mitigation".

Besides, the situation had also been aggravated by the inefficient operation of the NCCC. The Committee had not been able to meet consistently as planned. The NCCC had to meet on quarterly basis to deliberate on issues at hand and to make constructive decisions well on time. From the review of available Minutes of the Committee Meetings, it was evident that the NCCC seldom convened to deliberate

and report progress on the implementation of the UNFCCC. For instance, the Committee met only during the first and last quarters (January 26th and October 24th) of 2006 and could not meet during the second quarter. Furthermore, the Minutes of the Meeting of the NCCC held on September 23, 2003 at the DMS Conference Room, revealed that the meetings of the Committee were postponed on two occasions because Committee members had not turned up. At times, there was delayed start to the Meetings because the Committee members turned up late for such Meetings. That was reflected in the Minutes of Meetings of the NCCC held on June 26, 2003 at the UNDP Conference Room.

The information from the documents reviewed was further corroborated by an interview conducted with Somarelang Tikologo. They revealed that they were unable to participate in the Meetings of the NCCC because the Meetings were not taken seriously as some of the members either came late or were absent, leading to unfruitful discussions and/or postponement of such Meetings.

The inefficient functioning of the NCCC was thought to be caused by the institutional arrangements within which it operated. For example, an interview with the Kalahari Conservation Society turned the opinion that climate change issues had to be synergised with disaster management issues and had to be coordinated from a higher authority such as the Office of the President. The contention was that, in the absence of such an arrangement, the NCCC was seen as a 'mere' Committee with limited powers to influence the direction of change in climate change policy. Furthermore, the DMS virtually had no control over the activities of members and stakeholders.

Besides the opinion from the Kalahari Conservation Society, the OAG's view was that the NCCC's inefficiency might have also been exacerbated by the absence of a dedicated policy (as at 5.1) to explicitly state the Committee's roles and legal powers to compel stakeholders to provide the necessary support as opposed to urging them to play their part. For instance, some team leaders would be compelled to provide the necessary information on time to enable preparation of subsequent National Communications.

The effect is that, the current arrangement in operation at the time of audit in August 2010, impacted negatively on the coordination of climate change issues in Botswana. The Committee had not been efficient in terms of delivering on its core mandate, namely;

(i) Overseeing national policies on climate change and the implementation of the UNFCCC at a national level.
(ii) Ensuring that national climate change policies and programmes were consistent with national development priorities and objectives.

(iii) Ensuring that all relevant stakeholders were kept informed and consulted on the development of climate change issues and policies.
(iv) Developing the National Communications required by UNFCCC well on time.

RECOMMENDATIONS

- The National Committee on Climate Change should be fully empowered to efficiently deliver on its core mandate, thereby better coordinating climate change activities in Botswana.
- The DMS with the assistance of the Ministry of Environment, Wildlife and Tourism should consider engaging other stakeholders, more especially the NGOs and the private sector on ways of breaking institutional barriers to the efficient functioning of the NCCC and the subsequent coordination of climate change issues in Botswana.

Management Comment

Management stated that at the time of audit in November 2010, the Officers who dealt with Climate Change issues had other responsibilities. As such, in recognising that climate change issues were not efficiently coordinated, they embarked on restructuring so that there is a dedicated Climate Change Unit. The DMS further indicated that they hoped that climate change issues would be taken seriously by other sectors, with the formation of a Parliamentary Climate Change Committee.

5.4 NATIONAL COMMUNICATION

Article 12 (1), in accordance with Article 4(1) of the Convention on Climate Change stipulates that each Party shall "communicate to the Conference of the Parties (COP), through the Secretariat, the following elements of information:

(i) A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of Parties.
(ii) A general description of the steps taken or envisaged by the Party to implement the Convention.
(iii) Any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculations of global emission trends".

In addition, Parties had to submit their National Communication according to the time frame as indicated at *4.1(para.3)*. Taking that into consideration, it was noted that there

were delays in producing Botswana's National Communications to the UNFCCC Secretariat. A further elaboration is presented as follows:

5.4.1 Initial National Communication (INC)

Botswana's Initial National Communication to the UNFCCC Secretariat was produced in October 2001, signaling a delay of four years and six months beyond the expected delivery period (27th April 1997). The delays are highlighted in Table 1.

Table 1 below best captures the time and reasons for the delays.

NOS	PSD	PCD	ACD	Var	RFD
A.1	Mar 1997	Oct 1999	Nov 1999	1 month	Not stated.
A.2	Feb 1997	Mar 1997	Nov 1999	32 months	Ongoing debate within Subsidiary Bodies for Implementation and for Scientific and Technological Advice regarding the format of national communications. The delay was also experienced due to the fact that the Consultant wanted to ensure that the correct methodologies were applied in accordance with the IPCC guidelines.
A.3	Mar 1997	Jun 1997	Nov 1999	29 months	Not stated.
A.4	Aug 1999	Nov 1999	Mar 2000	4 months	The Management change that the Forestry Association of Botswana underwent as well as its Director being on leave for most of the time.
A.5	Aug 1999	Nov 1999	Feb 2000	3 months	-The project was a new field and as such, the constraints were time and lack of data. -Soliciting informed opinions from professionals with particular expertise had its own delaying tactics because the professionals were not there for most of the time.

Source: DMS documents

Key: NOS- Name of Study; PSD- Planned Start Date; PCD- Planned Completion Date

ACD- Actual Completion Date; Var- Variation; RFD- Reasons for the Delay

A.1 – Mitigation analysis for the Non-Energy Sector

A.2 – Updating of greenhouse gases inventories

A.3 – Review of Climate Change Policies in Botswana

A.4 – Vulnerability of the Forestry Sector to Climate Change

A.5 – Vulnerability and Adaptation Assessment of the Health Sector to Global Warming and Climate Change.

Using the variance, Table 1 indicates that on average, it took 13.8 months for the Consultants to finally complete the work assigned to them. The "most efficient" Consultant was able to complete work one month after the planned completion date. In a worst case scenario, it took one consultant 32 months (2 years and 8 months) to complete the work assigned to them.

Whilst the issues outlined on the right column of the table were viewed as reasons for the delay to complete consultancies on time, it was also worth noting that three of the five consultancies were awarded to one consulting firm (EECG Consultants). While this audit could not state in clear terms, the effect that arrangement had on the delivery of work, the situation could, in a way, be a prototype of inefficiency in meeting proposed deadlines.

5.4.2 Second National Communication (SNC) verification

Subsequent to the production of the Initial National Communication in October 2001, Botswana was expected to produce its Second National Communication around October 2003. However, that did not happen. The SNC was still being developed at the time of audit (October 2010), signaling a delay of seven (7) years from the time when it was expected to be released. Ideally, Botswana could have produced five National Communications by the year 2009, if it had stuck to the bi-annual reporting, as required by the UNFCCC Secretariat.

The delay to develop the SNC resulted from the DMS' inability to secure funding on time. For instance, the funds for the stock-taking exercise were only sourced in March 2005. Furthermore, the draft proposal for the SNC was to be validated at a stakeholder workshop that was scheduled for 4th August 2005 before being submitted to UNDP for approval, which happened later in October 2005.

On the overall, it was clear that Botswana delayed in meeting its reporting obligations under the Convention. Hence, Botswana's commitment to continual improvement had remained questionable mainly because it became difficult to monitor progress over the years, on how the country performed in terms of the implementation of climate change activities and other planned interventions. It was worth noting that the National Communications were a medium through which governments could propose climate change projects for possible funding consistent with Article 12 (4) which states,

"Developing country Parties may, on a voluntary basis, propose projects for financing, including specific technologies, materials, equipment, techniques or practices that would be needed to implement such projects, along with, if possible, an estimate of all incremental costs, of the reductions of emissions and increments of removals of greenhouse gases, as well as an estimate of the consequent benefits".

As a result, the country might have missed on the opportunities to propose projects which support its financial and technological needs to effectively reduce greenhouse gases emissions.

RECOMMENDATION

The DMS should fast-track the production and submission of Botswana's SNC to the COP Secretariat and ensured that the subsequent communications were planned and budgeted for on time to avoid huge delays. The move would place Botswana within a global web of partnerships to amongst others;

> *"promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors".*
>
> *[Article 4 (1c) of the Convention]*

Management Comment

Management concurred with the observation and indicated that there had been some delays in completing the National Communications. They highlighted that the delays were caused mainly by the Consultants, capacity constraints and poor project management. However, they promised that Botswana will present its Draft Second National to stakeholders locally as well as at COP17 billed for Durban, South Africa this

year (2011). The objective will be to get as much opinion as possible before submitting to the UNFCCC Secretariat.

5.5 INVENTORY

Article 4.1(a) of the Convention on Climate Change states that all Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:

"Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties"

The DMS developed an inventory of greenhouse gases in 1994 and it was used as a baseline when the Initial National Communication was prepared. Since then, the Department of Meteorological Services had struggled to periodically update and publish national inventories of anthropogenic emissions by sources, and removals by sinks of all greenhouse gases.

The failure by the DMS to periodically update and publish national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases was a direct breach of the above quoted Article. Furthermore, the absence of periodically updated database meant that analysts had not been able to have access to reliable and sufficient data that would have assisted to map realistic trends in the production of greenhouse gases in Botswana. Consequently, that would compromise any targeted response measures to the potentially observed upward trends in GHGs emissions.

RECOMMENDATION

The DMS should;

- Make an effort to periodically publish inventories of anthropogenic emissions by sources, and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies agreed upon by the Conference of Parties.

- Periodically update the inventories of greenhouse gases to facilitate the availability of current information for all stakeholders.

Management Comment

The DMS agreed to the recommendation.

5.6 RESEARCH AND SYSTEMATIC OBSERVATION

Article 4 (1.g) of the Convention on Climate Change states that all Parties shall;

"Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various responsive strategies".

Owing to the above, Botswana's Initial National Communication to the UNFCCC acknowledged that 'considerable research was still needed to reduce uncertainties in the emissions inventory, particularly in the land use change and forestry sector' (p.14). Furthermore, it was stated that the investigation of the vulnerable sectors revealed a common need for baseline information to be improved. A comprehensive investigation into the proposed mitigation options was also suggested in which costs, benefits, feasibility and cultural acceptance were carefully considered. Support for systematic observations which provided climate information was also needed.

The DMS is commended for identifying the above areas that helped to shape the direction for future work concerning climate change. Indeed, this audit exclusively revealed that a lot of research into climate change work had been undertaken overtime, especially by the University of Botswana and private researchers.

However, a concern worth noting was that the DMS had not been able to fully utilise the findings and recommendations of ample climate change research work to guide policy formulation and review. When interviewed, the Kalahari Conservation Society lamented that research work on climate change was not service-oriented and that it was mainly used at the university and other institutions as reference material as opposed to being used in the development of policy instruments that would address concerns emanating from climate change.

Consequently, there were doubts concerning Botswana's commitment to;

"support and further develop, as appropriate, international and intergovernmental programmes and networks or organizations aimed at defining, conducting, assessing and financing research, data collection and systematic observation, taking into account the need to minimize duplication of effort".

Article 5(a)

RECOMMENDATION

The DMS should ensure that the findings and recommendations of all research work on climate change were synchronised, consolidated and systematically communicated to policy-makers to sensitise them of the need to develop policies that were relevant to the challenges presented by climate change.

Management Comment

The DMS highlighted that the Department had a jointly funded Capacity Building Project with the Swedish Meteorological and Hydrological Institute; and the next phase of this project will entail Climate Change, that is, modeling and research. All the outputs will be used to inform policy on Climate Change.

5.7 METEOROLOGICAL DATA

As one of its specific objectives, the DMS had to 'monitor and provide watch on weather conditions affecting the country, providing various forecasts and issuing advice and warnings on hazardous weather for planning and operational purposes'. The meteorological data collected through this process had to be validated, analysed and archived for use in the planning, development and review of policies aimed at promoting sustainable use of natural resources and in the selection of appropriate technologies.

An interview with the Head of Data and Information Management Division as well as the review of the Meteorological Observation Diaries at the visited synoptic stations, revealed gaps in the data more especially in relation to variables like temperature, wind, relative humidity and upper air. Some factors were mentioned as contributing to the observed data gaps. One such factor involved power cuts/failures which often rendered the electronic system for transmitting data to be dysfunctional. The other factor involved negligence of Officers who often broke some instruments, more especially thermometers.

In addition to the two factors mentioned above, the audit also observed that the gaps in the data might have been caused by the following factors:

(i) Malfunctioning instruments
(ii) Under-utilised instruments
(iii) Neglected agrometeorological / climatological stations

These factors are further elaborated, by examples, as follows:

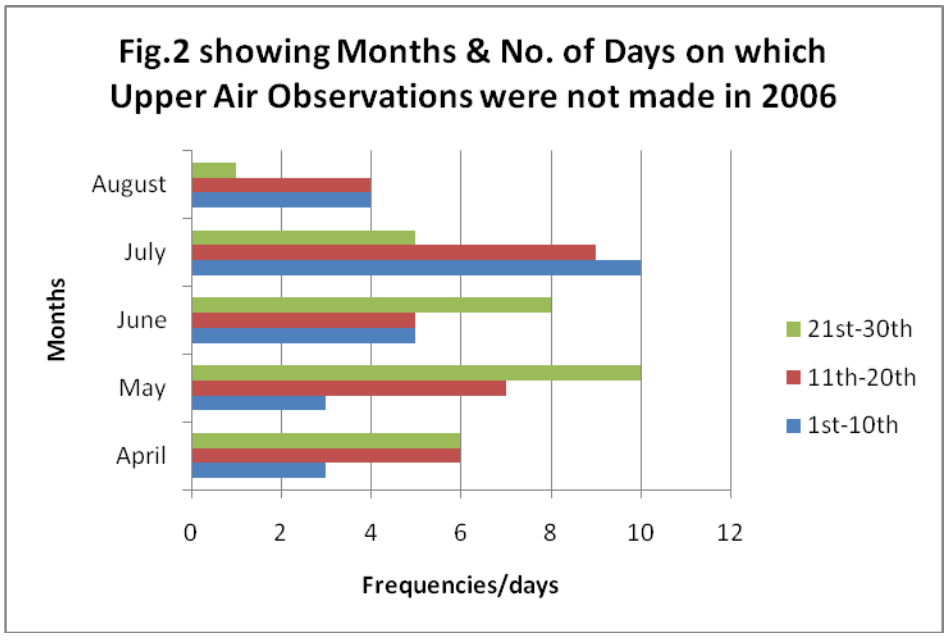
5.7.1 Malfunctioning Instruments

A visit to the selected synoptic stations revealed that a number of different observing instruments did not function at the time of audit. Some of those instruments were reported to have been redundant for quite some time. The information is captured in ***Appendix 1***.

Fig 1(a). Showing an evaporation pan without water inside (Source: Fieldwork)

Fig 1(b) showing a dysfunctional evaporation pan(Source: Fieldwork)

To further demonstrate the severity of the dysfunctional instruments, a specific case of inefficient Upper Air Observations in Maun is presented below, for the years 2006 and 2008 respectively.



Source: Field work, 2010

Fig.2 showed that upper air observations were not efficiently recorded from April through to August 2006, with July being the worst affected month. It was stated that upper air observations were not done and transmitted on those days because of the following reasons:

(i) The Digicora failed to track the balloon.
(ii) An upper air observer was not available.
(iii) There was no hydrogen gas.

The Digicora was then reported to be completely out of order from 19th to 30th September 2006.

Fig 3 Showing a Digicora at SSKA, reported to have not worked since October 2009.

For the year 2008, the information was tabulated as follows:

Table 2, showing the number of days on which Upper Air Observations were not made in 2008

Dates on which Observations were not made	**Number of days**	**Reasons provided**
10/07/08 – 12/07/08	3	The Digicora failed to track a balloon.
17/07/08 – 31/07/08	15	Digicora unable to detect satellites

11/08/08 – 16/08/08	6	Digicora rejecting surface observations
21/08/08 – 31/08/08	11	Digicora could not locate station position
03/09/08 – 16/09/08	14	No hydrogen gas
18/09/08 – 20/09/08	2	Officer on duty was not familiar with the operation of GC5 and RS92
24/09/08	1	Power failure after the launch of the balloon
05/10/08	1	Balloon was tracked for 16 minutes and then it was lost
07/10/08	1	Digicora lost track
19/10/08 – 20/10/08	2	No power connection to the Digicora
31/10/08	1	Power failure during sounding, data was lost
04/11/08	1	No hydrogen gas

Source: DMS documents, Maun

In summary, Table 2 indicates that observations were not made for eighteen (18) days during July, seventeen (17) days for August, another seventeen (17) days for September, four (4) days for October and a day for November 2008.

5.7.2 Under-utilised Instruments

Some instruments remained under-utilised at the following stations:

(a) MAUN

Despite being designated an Ozone Observing Station, the spectrophotometer used to observe the levels of ozone was not being used, albeit being reported to be in a good working condition. An interview session with the Acting Officer-in-Charge revealed that the three Officers who were trained to operate the machine were transferred to other stations. Subsequent to that, no other capable Officer(s) were brought to Maun to operate the machine.

(b) JWANENG

A sunshine recorder had not been used ever since it was installed at Seepapitso Senior Secondary in Kanye (which is a sub-station of Jwaneng) on September 2005.

5.7.3 Neglected Stations

Based on the interviews conducted with Officers-In-Charge at Jwaneng, Mahalapye, Tsabong and Maun as well as the observations made to the agro-meteorological and climatological stations under their authority, it was evident that such stations were neglected. The stations were in a bad condition, with majority of instruments not operating at all. These are shown at ***Appendix 2***:

Overall effects of data gaps

The effects of data gaps had not been explicitly stated. However, the importance of using complete data sets in climate change could not be exaggerated. *Stooksbury, et al (1999)*[13], with reference to the temperature variable, opined that the use of stations with as few as two missing days of data could introduce a departure away from the true monthly maximum and minimum temperature. That scenario would likely affect the reliability and validity of data being analysed.

RECOMMENDATIONS

The DMS should:

- Ensure that all the required meteorological observing instruments at all the synoptic stations are fully functioning and maintained on a regular basis.
- Ensure that all under-utilised equipment have to be used fully. The Staff with specific skills for operating complex instruments should be deployed to areas where such instruments are located.
- Give all the neglected agrometeorological and climatological stations a face-lift so that they operate to their full potential.

[13] Stooksbury, D.E., Idso, C.D. and Hubbard, K.G. 1999. The Effects of data gaps on the calculated monthly mean maximum and minimum temperatures in the continental United States: A spatial and temporal study. Journal of Climate, **12**: 1524-1533.

- Fully orientate its Staff, more especially the Field Assistants, on the proper handling of observation instruments such as thermometers.

Management Comment

In their response Management gave the following as reasons for failure of different equipments:

- **The Digicora is a satellite based equipment, there must be communication between the Digicora and the responsible satellites for it to successfully operate. It is therefore not necessarily the equipment failure that results in a failed launch. The failure to track the balloon, detect the satellites and to locate the station position could all be resulting from either faulty satellites or switched off satellites for maintenance purposes. This is normal and expected. The Department of Meteorological Services does not have any control over these satellites. The old Digicoras were declared absolute in the year 2006. The new Digicoras replaced the old type during the year 2007 at upper air station in Maun and Gaborone.**

- **As for the balloons being tracked for a short time, say 16 minutes, it could be a combination of failed satellites communication or usage of the batch of radiosondes (RS80) that have expired due to having been kept in stock for a long period of time.**

- **Management further indicated that the Department did not have standby generators at all upper air stations, as a result, the equipment would abort the ascend in the event of power loss due to power shedding. Moreover, the Instruments used in the Climate/Agro met stations were very expensive to procure. Over the years the maintenance Team realised that there was gross mishandling of instruments at such stations resulting in frequent breakages of such. As a result, the Division responsible for data (Climatological Division) disqualified the data from these stations and declared it unusable. As a result, the DMS embarked on finding ways to properly run those stations by including the number that would be properly managed. As soon as the final decisions had been made in this regard, proper equipping of the stations would be started and the others would be closed.**

According to Management, the Engineering Division was operating from Gaborone at the time of audit. Therefore, they decided that its services be decentralised to Maun, Francistown and Tsabong during the financial year 2011/2012. It is anticipated that the move will improve the response time to faults and the general maintenance of the

equipment in the DMS network of stations. The Engineering team resolved to replace the Automatic rain gauges with the more user friendly logging type rain gauge. The currently used Automatic Rain gauges will be faced out during the year 2011/2012 and they will be removed from the DMS network of stations.

Management also concurred that the rate of breakages of the thermometers in the synoptic stations was at unacceptable levels. Sometimes that resulted in finishing the spare items in stores. That was compounded by the restrictive budget allocated to the procurement of spares. In view of the above, the DMS Management was currently in discussions on how to deter Officers from making those breakages and to decide on measures to be taken for those responsible.

5.8 PROJECT MONITORING AND REVIEW

The Terms of Reference for the National Committee on Climate Change stipulated that the Committee had to undertake the following responsibilities:

(i) Monitor and review the progress of the project against its stated outputs, including progress and financial reports, prepared by the Project Manager.
(ii) Make executive management decisions for the project when guidance is required by the Project Manager, including approval of project revisions.
(iii) Review and approve the project work plan.
(iv) Review and approve the monitoring and evaluation timetable.
(v) Ensure the realisation of project benefits from the perspective of project beneficiaries.

The Office of the Auditor General commends the DMS, together with the NCCC, for effectively performing some of the above stated responsibilities, notably; providing guidance required by the Project Manager, reviewing and approving the project work plan.

However, even though the DMS was part of the Projects Steering Committee (a forum where the progress of the projects, projects achievements and challenges were regularly reported), the Department had not been pro-active in terms of ensuring that the implementation of climate change projects was efficiently monitored. For instance, the DMS had not kept documents on the progress of projects activities. That is, the DMS could not, on request, avail projects monitoring and review reports. Instead, the OAG was referred to the implementing entities (GCC and Department of Energy Affairs) as they were reported to be the ones handling such information.

The lack of an efficient project monitoring was caused by the DMS' inability to realise its obligations and understand its role during the projects life cycle. The Department felt not obliged to monitor implementation of the projects, opting to delegate the monitoring responsibility to the implementing entities.

As a result of the lack of monitoring, the DMS had not been able to effectively appraise the progression of project activities throughout their implementation. That had further resulted in failure to identify barriers to an efficient project implementation and to recommend corrective measures.

RECOMMENDATION

The DMS should be actively involved in the monitoring of climate change projects by documenting all the phases of the project life, right from planning, execution and completion phases.

5.9 CAPACITY BUILDING

According to Botswana's Initial National Communication to the UNFCCC (2001:14), the issue of capacity building had been identified as a critical area of need. "The development of highly skilled human capacity, particularly in relation to the understanding of complex human-environment systems such as climate change was needed".

It was specifically stated that capacity support was needed to improve understanding of Botswana's vulnerability to climate change, understand the interaction between economic activities and emissions of greenhouse gases, improve models and observations specifically suited to Botswana, and to enhance the ability of policy makers to support a sustainable development pattern that took climate change into account.

The DMS was found lacking with respect to building the capacity of its own Officers (staff) on issues of climate change. Interviews held with Officers-In-Charge of the synoptic stations revealed that not much had been done to equip such Officers with substantial knowledge on fundamentals of climate change. Safe for the basic meteorology programme, Officers were rarely trained on climate change issues. Some of the Officers-In-Charge even acknowledged that they often appeared incompetent to address climate change concerns arising out of the districts under their jurisdiction. Instead, most of the issues were referred to Head Office, where an informed opinion had to be sought.

The above condition was caused by the fact that the DMS had not consistently conducted any formalised in-house training or organised refresher courses on climate change for its professional staff. In effect, the DMS Officials, especially the Officers-In-Charge had to rely on their own understanding of climate change. They had to use their limited understanding to try and address concerns that arose from members of the public at a district level. In the end, members of the community like interested groups, NGOs and researchers had not been able to benefit from climate change knowledge that was being generated at a district level.

In addition to lack of formalised training on climate change, the review of documents (tripartite) revealed that the Initial National Communication was prepared by the external Consultants. The purpose of the arrangement was to build capacity at all levels to the point that subsequent National Communications would be prepared in-house. However, it was observed that the DMS Staff or even members of the NCCC were not attached to the team of Consultants to gain valuable insight. As a result, there was no skills transfer from the Consultants to the DMS, to ensure that subsequent National Communications were appropriately produced to fulfill Botswana's commitments under the UNFCCC.

RECOMMENDATION

Taking into consideration the concerns from climate change and the interest they continued to generate from segments of the public, the DMS should provide specific training on climate change to its technical Officers. That will equip them with the knowledge and understanding to respond well to climate change issues emanating from the districts.

Management Comment

Management concurred with the observation that their ability to coordinate was compromised by the fact that the DMS did not have the capacity to lead on matters of climate change. As such, it was necessary for the Ministry (MEWT) to build capacities in terms of technical expertise and institutions.

5.10 EDUCATION AND PUBLIC AWARENESS

According to Article 6 of the Convention, Parties had to develop and implement educational and public awareness programmes on climate change and its effects. Furthermore, public access to information on climate change had to be availed. Eventually, there had to be increased public participation in addressing climate change and developing adequate response strategies.

In pursuing the above action, the DMS stated, "Increasing awareness of climate change in the general public is an additional capacity building that is currently conducted through radio programmes, school and University programmes, and general awareness campaigns (Initial National Communication, 2001:p.14).

In addition to the above, the OAG commends the DMS for undertaking a number of workshops aimed at raising the level of awareness of climate change issues amongst the different segments of the public. For instance, this audit had taken note of workshops conducted for Journalists and Public Educators on the UNFCCC, and another workshop on climate change and its likely impacts on Botswana, organised for school teachers. Atop that, the DMS used the Annual World Meteorological Day to raise public awareness on climate change.

OVERALL MANAGEMENT COMMENT

Management stated that they valued the audit report in that it had systematically identified areas that the DMS had to address. They therefore, promised that they will use the report to monitor progress of implementation and resolution of the issues raised.

OVERALL CONCLUSION

Climate change is real. There already had been observed changes to our climate. Available climate change projections and impact studies that had been carried out suggested that Botswana was highly vulnerable to climate change. A variety of climate simulation models predicted that temperatures in Botswana would, on average, rise by 1-3^{0}C by around 2050. There had also been increasing awareness of changes in climate such as shifts in seasonal patterns, increased aridity and extreme events like droughts and floods.

Thus, the impacts of climate change could be readily observed, and included: low crop yields and increased demands for irrigation, damage to ecosystems and loss of biodiversity, weather related mortalities, infectious diseases and air quality respiratory illnesses, disturbances to settlement patterns, flooding due to sea level rise and extreme weather events, and reduction in the quality and quantity of freshwater supplies.

Anticipating the above challenges, the Government of Botswana ratified the United Nations Convention on Climate Change in January 1994. That move, signaled a substantial milestone in laying the foundation to avoid the worst predicted impacts of climate change. In terms of planning both adaptation measures to respond to the predicted impacts of climate change and mitigation measures to avoid rapid increases in greenhouse gases emissions, nowhere in the world were coordinated responses as critical as in Botswana. Actions had to be decisive and informed, to transform greenhouse gas intensive business-as-usual practices.

By ratifying the Convention and establishing the DMS as the focal point of all climate change issues, Botswana recognised an urgent need for significant progress in building institutions for better governance and good management. That provided a somewhat conducive environment to better coordinate climate change work in Botswana so as to produce positive results reaching far beyond regional and international borders.

Furthermore, establishing the National Committee on Climate Change was a welcomed development because the Committee had to ensure that climate change activities were well coordinated. That had been so, in spite of the operational inefficiency facing the NCCC. Botswana had done well to develop and submit its Initial National Communication to the COP Secretariat, even though there had been significant delays experienced. Despite a number of existing policies that bore relevance to climate change, there was need for better integration of the objectives of such policies such that possible conflicts were addressed.

Funding and cooperation to support adaptation and risk management efforts would need to be substantially increased to meet the existing and emerging challenges of climate change. That called for service oriented research that would aim to improve policy. Mapping trends in climate change scenarios depended largely on continuous data. As such, the DMS ought to have its observing instruments in good condition for better provision of data. There was a need to further enhance the capacity of the staff of DMS, so that they are able to deal with climate change issues at all levels. This would come in recognition of the fact that human labour was a major force effecting change in society.

Notwithstanding the above adverse comments, the OAG appreciates and commends the DMS for undertaking a number of workshops aimed at raising the level of awareness of climate change issues amongst the different segments of the public such as Journalists and Public Educators. In addition, the OAG commends the DMS for reviewing and approving project work plans, as well as to provide guidance to Project Managers.

Appendix 1. MULFUNCTIONING INSTRUMENTS

Name of Station	Redundant Instruments	Redundancy Period
Jwaneng Climatological Station (Seepapitso Sen. Secondary)	- Automatic Raingauge - 10, 30 and 60 centimeters thermometers - evaporation pan - Stevenson Screen (Maximum and Minimum thermometers)	- Not working since 2007 All the instruments had not been working for an undisclosed number of years
Tsabong	- Upper air observing Instrument. - Grass Minimum thermometer - Automatic raingauge	- Not working since 2008 - Undisclosed period - Undisclosed period
Maun Matsaudi Agromet Station	- Automatic raingauge - 10,30,60 and 120 cm soil thermometers - Wind Vane	
Francistown	- 10 and 60 centimeters thermometers - Automatic raingauge	- Undisclosed period - Never worked ever since installed.
Mahalapye	- Stevenson Screen (Maximum thermometer) - 60 cm thermometer - Automatic raingauge - Wind (Roll chart Recorder)	- Not working since 1999/2000 - Not disclosed
Sir Seretse Khama Airport	- Upper air instruments (Hydrogen Plant, Digicora)	- Had not been working since 2008

Appendix 2, NEGLECTED STATIONS

Station	Condition of Instruments
Jwaneng (Seepapitso Secondary)	- 10, 30 and 60 cm soil thermometers were broken. - Evaporation pan not working - Stevenson Screen (Minimum and Maximum thermometers not available) - Sunshine recorder installed but not being used.
Francistown (Tutume Agromet Station)	- Evaporation pan (measuring ruler not legible and a dysfunctional hook gauge) - All soil thermometers (5, 10, 20, 60 and 120cm) have not been working since 1999. - Stevenson Screen (Maximum thermometer not available since July 2009) - The station was recommended to be relocated in 2000 away from buildings to avoid interference but that had not been done at the time of audit. - Wind system not working since 1998 when the Field Assistant who was interviewed took over.
Serowe climatological station	- Evaporation Pan (decayed wooden stand and a rusty pan) - 120 cm soil thermometer not working properly. - Cup anemometer not responsive to the speed of wind. - Sunshine recorder not being used because the Field Assistant was not being paid overtime.

	- Stevenson Screen (Maximum thermometer not available) - Grass Minimum Thermometer not inserted. - The station was reported to have not been inspected since 2002.
Mahalapye (Ratholo Station)	- 20cm soil thermometer broken since August 2009 - Evaporation Pan not working. The wooden stand had completely decayed and the pan was placed upside down. - Sunshine recorder (Chart not inserted) - 20 cm soil thermometer not available since January 2010
Dibete Station	- Cup Anemometer stopped working since 2008 - Evaporation Pan had not been used since 2007 after the tap broke. The wooden stand had also rotten.