**REPUBLIC OF RWANDA**

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# ASSESSMENT OF OPERATIONAL FRAMEWORK RELATED TO CLIMATE CHANGE IN RWANDA

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# Contents

# 1. INTRODUCTION

## 1.0. General background

In recent years, climate change became the main domain of focus for many scientists, bureaucrats, professionals, politicians, civil societies, NGOs etc. However it is better to recall the meaning of climate, climate variability, climate change and climate system referring to the definitions from 3rd Assessment Report of Intergovernmental Panel on Climate Change (IPCC, 2001). It is also important to notice the difference between climate change and climate change impacts. Finally, we wish to introduce the main functions of IPCC as an international organization very close to climate change and climate impacts, but not very known as United Nation Framework Convention on Climate Change (UNFCCC), Kyoto Protocol (KP) and Global Environment Facility (GEF).

Scientific based knowledge on climate variations in Rwanda is limited, but it is fully recognized that the country is one of the most *vulnerable* nations in the world in regard to climate changes. Many of the specific resources (e.g. water, land, soils) and the ecosystems (e.g. the natural forests, the marshlands and lakes and the highlands) are furthermore overused, very fragile and geographical fragmented (limited in space and not connected). Thus, climate change preparedness for Rwanda is essential both in a local, national and international context.

Rwanda is planning to develop the low carbon economy. In 2009, the cabinet meeting approved the new structure of REMA. This structure includes climate change department to address the issues of climate change and coordination of the implementation of regional and international agreements. However staffs have not yet been recruited for this department and the staff job description does not cover all activities related to the needed climate change preparedness for Rwanda.

## 1.1. Objective of study

The main objective of this study is to assess climate change activities in order to provide a framework of climate change institution focusing mainly on capacity building of climate change management and climate information and communication system.

## 1.2. Methodology

The methodologies used in this study are follows:

- Analysis of current state of climate change in Rwanda in terms of availability and gaps of data and information;
- Identification of climate change response/adaptation initiatives underway on national and international levels;
- Suggest how climate change adaptation/response activities should be organized with priority actions and day toy activities;
- Suggest how the climate change department should be restructured referring to defined tasks and desks with appropriate role and responsibilities;

- Suggest the job description of Climate change staff with relevant information and communication system.

## 1.3. Expected key assessment

Apart this introduction, Chapter 2 summarizes the recent climate change observed in Rwanda, the cost of climate change impacts both for business as usual and for adaptation measures to climate change, the recent inventory of Greenhouse Gases (GHG) emission in Rwanda, the cost of mitigation options (low carbon economy) compared baseline and finally, this chapter highlights the current available opportunities of Climate change in Rwanda.

Chapter 3 includes availability of data related to climate change, initiatives underway at national and International levels. In chapter 4, it is suggested how activities should be reorganized taking into account the national context described in chapter 3. Chapter 5 is REMA position as national coordinator for climate change. This chapter presents the existing structure in charge of climate change in REMA and recommends the new department and staffing structure. Chapter 6 is concluding summary with clear defined tasks and desks.

The role and responsibilities allocated to each desk as well as the strategic plan of climate Change Department are presented in Annex.

## 1.4. Definitions of key Climate change terminologies

### Climate

Climate in a narrow sense is usually defined as the “average weather” or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the *climate system*.

### Climate variability

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all *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). See also *climate change*.

### Climate change

Climate change refers to a statistically significant variation in either the mean state of the *climate* or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or *external forcings*, or to persistent *anthropogenic* changes in the composition of the *atmosphere* or in *land use*. Note that the *United*

*Nations Framework Convention on Climate Change* (UNFCCC), in its Article 1, defines "climate change" as: "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." The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes. See also *climate variability*.

## Impacts of Climate change

Impacts of Climate change are consequences of *climate change* on natural and *human systems*. Depending on the consideration of *adaptation*, one can distinguish between potential impacts and residual impacts. Potential impacts: All impacts that may occur given a projected change in *climate*, without considering adaptation. Residual impacts: The impacts of climate change that would occur after adaptation.

## Climate system

The climate system is the highly complex system consisting of five major components: the *atmosphere*, the *hydrosphere*, the *cryosphere*, the land surface and the *biosphere*, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions, solar variations, and human-induced forcings such as changing composition of the atmosphere and *land-use change*.

## Intergovernmental Panel of Climate Change (IPCC)

The Intergovernmental Panel of Climate Change is the leading body for the assessment of climate change, established by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences.

The IPCC is a scientific body. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. Differing viewpoints existing within the scientific community are reflected in the IPCC reports.

The IPCC is currently organized in three working groups and one task force namely:

**(i)** **Working Group I:** deals with "The Physical Science Basis of Climate Change";
**(ii)** **Working Group II:** deals with "Climate Change Impacts, Adaptation and Vulnerability";
**(iii)** **Working Group III:** deals with "Mitigation of Climate Change";

(iv) **Task Force on National Greenhouse Gas Inventories**: The main objective of the Task Force is to develop and refine a methodology for the calculation and reporting of national GHG emissions and removals.

# 2. HIGHLIGT OF FACTS, COST AND OPORTUNITIES OF CLIMATE CHANGE IN RWANDA

This chapter summarizes the recent climate change observed in Rwanda according to the few available meteorological data, the cost of climate change impacts both for business as usual and for adaptation measures to climate change, the recent inventory of Greenhouse Gases (GHG) emission in Rwanda, the cost of mitigation options (low carbon economy) compared baseline (GHG emission without care). Finally, this chapter highlights the current available opportunities if Rwanda opts for climate change mitigation measures and low carbon economy.

## 2.1. Recent trends of monthly and annual rainfall

From the bellow table 1, the total monthly and annual rainfall recorded during the last six years is generally below average from 1961 to 1990. More specifically, the rainiest month of April saw rainfall equivalent to 27%, 48%, 88%, 70% and 52% respectively in 2000, 2001, 2002, 2003 and 2005.

It is to mention but a few months have recorded rainfall above normal including July which is the driest month of year.

These examples are following: July 2001 (1441%), July 2006 (173%), September 2003 (189%), September 2005 (144%), December 2006 (153%) and November 2006 (165%). It is noteworthy that these excessive rainfall are not well distributed during the month, they fall in less than 3 days and sometimes in a single day and are followed by floods and landslide areas.

| | **Mean 1961-1990** | **2000** | | **2001** | | **2002** | | **2003** | | **2004** | | **2005** | | **2006** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm | mm | % | mm | % | mm | % | mm | % | mm | % | mm | % | mm | % |
| **JAN** | 72,8 | 22,1 | 30 | 80,3 | 110 | 155 | 213 | 60,3 | 83 | 67 | 92 | 64,6 | 89 | 22.7 | 31 |
| **FEB** | 108,9 | 58,2 | 53 | 64,8 | 60 | 65,7 | 60 | 29,8 | 27 | 71,8 | 66 | 41,8 | 38 | 90.6 | 83 |
| **MAR** | 113,6 | 100,7 | 89 | 257 | 226 | 98,9 | 87 | 74,6 | 66 | 114,3 | 101 | 134,3 | 118 | 112.2 | 99 |
| **APR** | 176,4 | 48,1 | 27 | 84,3 | 48 | 156 | 88 | 124 | 70 | 201,4 | 114 | 91,6 | 52 | 218 | 124 |
| **MAY** | 101,6 | 51,3 | 50 | 61,4 | 60 | 145,6 | 143 | 49,9 | 49 | 23,1 | 23 | 88 | 87 | 117.8 | 116 |
| **JUN** | 21,2 | 0 | 0 | 0,2 | 1 | 0 | 0 | 0 | 0 | 4 | 19 | 10,3 | 49 | 5.3 | 25 |
| **JUL** | 8,4 | 0 | 0 | 120,8 | 1441 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.5 | 173 |
| **AUG** | 29,2 | 5,4 | 18 | 21,8 | 75 | 0,2 | 1 | 65,1 | 223 | 15,1 | 52 | 41,6 | 142 | 25.1 | 86 |
| **SEP** | 78,2 | 32,6 | 42 | 86,1 | 110 | 34,6 | 44 | 147,5 | 189 | 74,6 | 95 | 112,4 | 144 | 35.4 | 45 |
| **OCT** | 99,9 | 129,2 | 129 | 225,9 | 226 | 99,7 | 100 | 106,7 | 107 | 70,7 | 71 | 128,2 | 128 | 57.4 | 57 |
| **NOV** | 127,0 | 144,2 | 114 | 185 | 146 | 116,5 | 92 | 101,1 | 80 | 75,8 | 60 | 55,3 | 44 | 210.2 | 165 |
| **DEC** | 92,1 | 76,3 | 83 | 98,9 | 107 | 131,7 | 143 | 48,5 | 53 | 82,8 | 90 | 68,8 | 75 | 141.4 | 153 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Annual Totals** | **1029,3** | **668,1** | **65** | **1286,5** | **125** | **1003,9** | **98** | **807,5** | **78** | **800,6** | **78** | **836,9** | **81** | 1050.6 | 102 |

**Table 1. Recent rainfall change at Kigali Airport, expressed in mm of rain and a percentage of average (1961-1990**
Data Source: National Meteorological Service

## 2.2. Recent trend of number rain day

Considering the same conditions of rain days as considered in 1.1.3 above, the annual number of rain days was determined from 1971 to 2006. The figures bellow shows that the number rain day were gradually decreased from 150 days in 1971 to 125 days in 2006.

We note that since 1971, the number of raindays was always greater than 120 days. However from 1991 to 2006, the number of raindays was 5 times bellow 120 days respectively in 1992, 1993, 2003, and 2005.

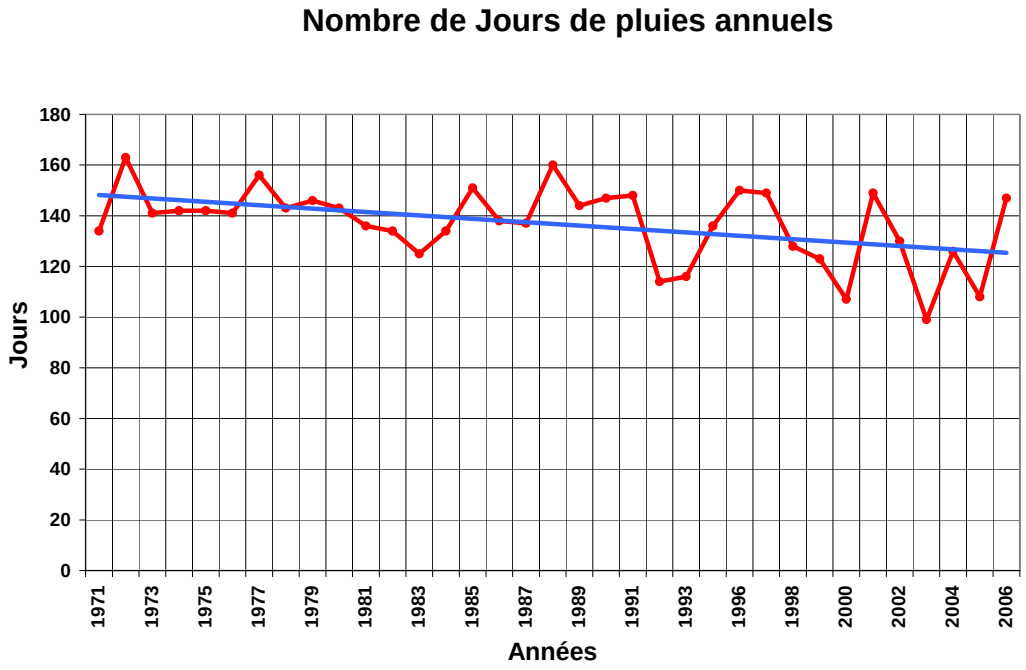



**Figure 1. Annual number of rain days**
Data Source: National Meteorological Service

## 2.3. Tendency of mean annual temperature

The mean annual temperature has increased gradually from 1971 to 2007. The average value was 19.8 ° C in 1971 and 20.7 ° C in 2007, making an increase of 0.9 ° C in 27 years (Fig. 4 below). We note that the Rwada case is alarming as the increase of mean worldwide temperature since 1850 up to date is only 0.8 ° C

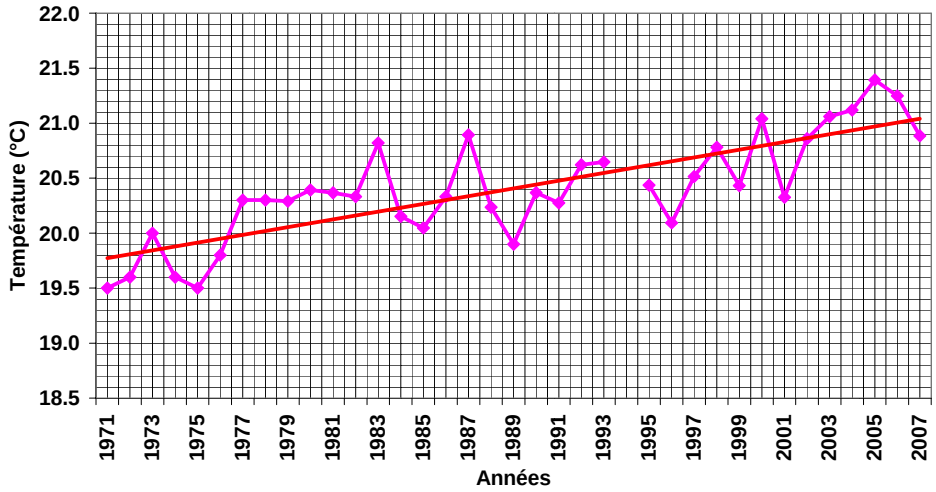



**Figure 2 Variability of the annual mean temperature in ° C (1971-2007) at Kigali airport Station.**
Data Source: National Meteorological Service

## 2.4. Tendency of warm days (tropical days)

Annual numbers of warm days on which recorded temperature exceed 30°C were gradually increased since 1971. The figure bellow shows that the average number increased from about 5 days in 1971 to about 80 days in 2006. The high frequency of warm days confirmed by tendency of increasing temperature is likely to increase malaria cases mainly in the highland regions of North and West.

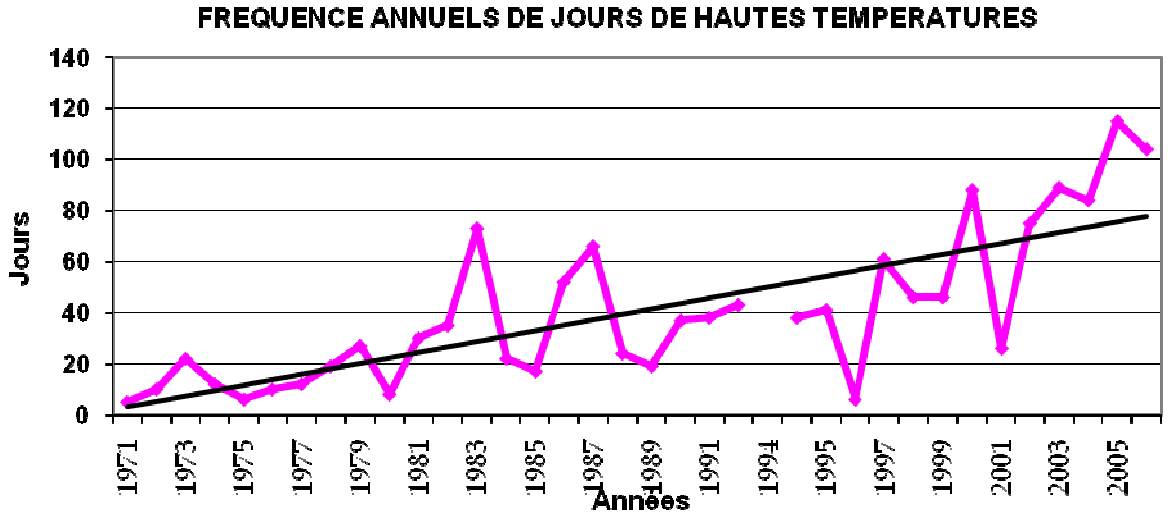



**Fig. 3 Variability of annual frequency of warm days**

## 2.5. Observed impacts of Climate change in Rwanda

Major Climate Change related impacts already observed include the lowering of lakes' and rivers' water levels, as well as a loss of associated biodiversity. A significant decrease in agricultural productivity caused by changing climatic conditions is leading to poor performance of crops. This has triggered a worsening food security situation, malnutrition and poor health throughout the country. Especially the southern part of the country is already rainfall constrained, and prone to aggravating dry spells and prolonged droughts. In the past five years alone, crop failures and poor performance of traditionally cultivated species were observed.

Extreme floods in western Rwanda have led to the death of dozens of people and have destroyed roads and other infrastructure, as well as significant amounts of agricultural production and houses, leaving many people homeless. Auto-adaptation is already ongoing, with people flood proofing their homes through stone walls, and road construction companies investing into stronger canalization and run-off management, established river channels are being strengthened and partially reinforced through cementation and local authorities invest in drainage systems.

The spreading of diseases, esp. of malaria and waterborne threats have been observed. The worsening food security situation has negative impacts on health esp. of already vulnerable groups such as children, pregnant women, elderly people and the poor. Linkages to the effects of HIV/Aids have not been formally established, however may be significant.

In terms of water availability (drinking water, production incl. irrigation, hydro-electricity), overall Rwanda is believed to have sufficient water resources, characterized by a good hydrological network (with the sources of the Nile originating in Rwanda's highlands), and 101 lakes and 860 wetlands covering 16% of the surface area of Rwanda. However, a lowering of water tables as well as impacts of reduced water flows have been observed especially, but not only, in eastern Rwanda. These impacts are at least partially attributed to climate change stresses (other drivers are related to non-climatic causes such as sub-optimal water resource and watershed management), which limit water availability. Rainfall variability is related to overall impacts on hydrological flow, water storage and availability, leading to more floods and dry spells while ground water recharge diminishes.

In other extreme climate related incidences following torrential rainfall events, flash floods occur and flood water accumulates in low laying valleys and forms ponds, which impede on settlements and production land. Mostly negative impacts are observed on (i) irrigation potential for agricultural production, (ii) availability of good drinking water, and (iii) feasibility of hydro-electrical schemes in place/planned in Rwanda. For example, lower water flows or more extreme flash floods often carrying high sedimentation loads, lead to increasingly high levels of siltation, worsened by the severe erosion problem. These may adversely impact on micro-hydropower schemes, which will have to deal with more erratic water supplies, as well as higher maintenance costs, which need to be factored into designs.

## 2.6. Cost of Climate change impacts in Rwanda

The study of Stockholm Environment Institute entitled "**Economics of Climate Change in Rwanda**" (2009) analyzed the impacts of climate change events and found that they are economically significant. The most severe of the recent events was the 2007 flood. The study has estimated that the direct measurable economic costs of this event were $4 to $22 million (equivalent to around 0.1 – 0.6% of GDP) for two districts alone. However, this only includes the direct economic costs of household damage, agricultural losses and fatalities. It does not include the wider economic costs from infrastructure damage (including loss of transport infrastructure), water system damage and contamination, soil erosion and direct and indirect effects to individuals. The total economic costs of the 2007 floods are therefore much larger and would increase further when other national level effects are considered. It is clear that these events have economic costs that would be very significant in terms of national GDP. The continued annual burden of these events leads to reductions in growth over time.

The study estimated also the costs of adaptation in Rwanda and found that this cost will rise in future years. The aggregated estimates provide a possible range, with implications for the source and level of finance required. Estimates of medium-term costs to address future climate change are typically of the order of $50 – 300 million per year for Rwanda by 2030, focused on enhancing climate resilience. Note that the investment in 2030 builds resilience for future years when potentially more severe climate signals occur. However, higher values (in excess of $600 million /year) are plausible if continued social protection and accelerated development are included, noting that these are primarily development activities.

## 2.7. Emission and Mitigation of Greenhouse Gases

Drafts of national communication including inventory Greenhouse Gases emission and Mitigation of Greenhouse Gases emission are available at Rwanda Environment Management Authority (REMA, 2010). For 2005 selected as reference year, theses drafts provide data and information on quantification of Greenhouse Gases emission and mitigation measures supported by quantification of futures emissions for Rwanda and cost analysis.

### 2.7.1. Inventory Green house gases (GHG) emission

The GHG emission quantified are direct gases namely: carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) and indirect gases including carbon monoxide (CO), oxides of nitrogen (NOX) and Non-Methane Volatile Organic Compounds (NMVOC) emissions. Sulfur oxides (SOx) were also quantified. The unit used for quantification of GHG emission is Giga-gram which is equivalent to 1,000 tons (1 Gg = 1000 tons)

For 2005, chosen as the base year, the results of studies on the inventory of Greenhouse gases show that Rwanda has contributed to the emission of 530.88 Gg of carbon dioxide (CO2); 71.31 Gg of methane (CH4); 10 Gg of nitrous oxide (N2O); 14 Gg of sulfur oxides (NOx); 2,327 Gg of carbon monoxide (CO); 42 Gg of Non methane Volatile Organic Compounds (NMVOC) and 18 Gg of sulfur oxides (SOx).

For direct gases emissions, carbon dioxide (CO2) is the largest amount with 530.88 Gg followed

by methane (CH4) with 71.31 Gg and thirdly, nitrous oxide (N2O) comes with 10 Gg .

Regarding indirect gas, emissions of carbon monoxide (CO) is the largest amount with 2327 Gg and those of other gases follow these steps: NMVOC with 41.78 Gg, the oxides sulfur (SOx) with 18.07 Gg and oxides of nitrogen (NOx) with 14 Gg

As required by decision 17/CP.8 and the IPCC, emissions from combustion of biomass (firewood, charcoal, agricultural residues) and those from international bunkers are reported separately from emissions of CO2. The quantity of these emissions are 722 Gg CO2 and 17 Gg of CO2 respectively for the combustion of biomass and international bunkers.

Table below provides the 2005 overview of GHG emissions for Rwanda

| Greenhouse gas source and sink categories | $CO_2$ emissions (Gg) | $CO_2$ removals (Gg) | $CH_4$ (Gg) | $N_2O$ (Gg) | $NO_x$ (Gg) | CO (Gg) | NMVOCs (Gg) | $SO_x$ (Gg) |
|---|---|---|---|---|---|---|---|---|
| **Total national emissions and removals** | **531** | **-8,545** | **71** | **10** | **14** | **2,327** | **42** | **18** |
| **1. Energy** | **380** | **0** | **20** | **0** | **14** | **361** | **42** | **18** |
| **2. Industrial processes** | **151** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **3. Agriculture** | | | **49** | **10** | **0** | **9** | **0** | **0** |
| **4. Land-use change and forestry** | **0** | **-8,545** | **0** | **0** | **0** | **1,957** | **0** | **0** |
| **5. Waste** | | | **3** | **0** | **0** | **0** | **0** | **0** |
| **Memo items** | | | | | | | | |
| **International bunkers** | **17** | | **0** | **0** | **0** | **0** | **0** | **0** |
| **CO2 emissions from biomass** | **7,228** | | | | | | | |

**Note: 1 Gg = 1000 tons**

## 2.7.2. Mitigation of GHG emissions

According to the Mitigation Assessment Report (REMA, Draft, 2010), the 2005 energy demand in Rwanda from households, industry and transport sectors was estimated to 24,300 Gigawatt-hours using Long term Energy Alternative Planning (LEAP) software. This energy demand was linked to GHG emissions equivalent to 2,047,600 tons of $CO_{2e}$

Taking in account government programs including EDPRS and vision 2020 as baseline scenario (or business as usual scenario), the said energy demand is predicted to grow up to 240,700 Gigawatt-hours in 2030 linking with 17,786,700 tons of $CO_{2e}$.

In this draft report, the mitigation scenarios consist of following measures:

- The increase in users of biogas countrywide;
- The introduction of improved stoves on a large scale;
- Replacing incandescent bulbs with low energy consumption;

- Reducing the cost of electricity;
- Quality control of imports of vehicles;
- Store fuel according to its original of import or according to the quality required by Rwanda Bureau of Standards and Rwanda Environment Management Authority;
- Installing a fuel economy (FuelMax) on each motor vehicle and/or installing a catalytic converter on each motor vehicle;
- Encouragement of public transport by improving transport conditions and the intensification of the public transport system;
- The quota regulation of vehicle emissions.

Introducing these measures in LEAP software, it was found that energy demand may grow up to 140,700 Gigawatt-hours in 2030 (instead of 240,700 Gigawatt-hours for baseline scenarios). This energy demand is linked with 11,543,800 tons of CO2e (instead of 17,786,700 tons of $CO_2e$ for baseline scenarios).

Plantation of forests direct related to regeneration of natural forestry, agro-forestry, biodiesel forestry and high income related forestry are suggested for significant quantity of Carbone sequestration.

The total of Carbon emission reduction from Clean Development Mechanism projects registered by Rwanda Designated National Authority is estimated to more than 335,000 tons of $CO_2e$ per year.

## 2.8. Opportunities of Climate change

Trough Climate change they are many opportunities for investments through the grants from developed countries, trough Clean Development Mechanism (CDM) projects and trough Voluntary Carbon Market.

Among available opportunities, the UNDP project entitled “Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa - Building a comprehensive national approach in Rwanda” or UNDP-AAP project. The main objective of this project is “institutional, individual and systemic capacity to address climate change risks and opportunities through a national approach to adaptation” and it has a program period for 3 years with US$ 2,588,300 of budget.

Another relevant opportunity is mentioned in the report of the Sida-supported Natural Resources and Environment Program in Rwanda (REMA, 2009). Among suggested activities in this report, it is emphasized that the capacity building aspect (human and technical capacity) for climate change preparedness should be the core focus for the envisaged Sida supported program. Key activities and inputs included are: short term technical assistance and training on climate change information and database establishment; equipment, material and technical capacity inputs for assessing vulnerability and addressing identified issues; skills development at all levels (staff, private sector, communities); and the required funds for training and information campaigns of prioritized stakeholders (e.g. community training or public media campaigns on specific core issues for adaptation or mitigation).

# 3. AVAILABILITY OF DATA AND INITIATIVES UNDERWAY

## 3.1. Availability of data related to climate change

### 3.1.1. Inadequacy of needed meteorological data for climate change

**(i) Meteorology Sector**

In Rwanda, the first rain gauge station was installed in 1906 at save catholic mission in current southern province. The systematic observation of rainfall and temperature started in 1930s and the Rwanda Meteorological Service has been created in 1962 with main objectives of assistance to aviation. Therefore synoptic observing station network has been established since 1967.

In 1988, Rwanda established the network of observing agro-meteorological stations with World Meteorological organization project. This enabled the edition of ten days agro-meteorological bulletin. The annual climatological book is already edited since 1940s.

Before the Tutsi genocide and war of 1990-1994 Rwanda has reliable network of more than 150 observing stations including five synoptic (main) stations, six agro-meteorological stations and the rest were dedicated to climatology (rainfall and temperature).

The data collection, processing, analysis, general weather forecasting and meteorological application such as assistance to aviation and agro-meteorological forecasting were operated by around 60 meteorological staff including observers, technicians, forecasters and other meteorological professionals.

The 1990-1994 Tutsi genocide and war in Rwanda destroyed more than 80% of meteorological infrastructures and the more than 90% of staff were lost.

Although very few meteorological stations reopened since 1998 and currently about ten are operating, the actual climate change analysis can rely on the only one meteorological station of Kigali Airport as it is the only one having historic data which continue between 1990 and 2000. However, this is not adequate due to very high spatial variability of climate elements connected to the topographic, vegetation and water body features of Rwanda. As of now, the country wide rainfall and temperature analysis can be done only for the period of 1990 or before. This situation handicaps the needed current knowledge of climate change in Rwanda and input data for future projections is missing.

Although the impacts of climate change are everywhere visible and sensible, the scientific analyses of climate change impacts for any sector require reliable climate change data and predictions. For the case of Rwanda, the minimum input data required for numerical simulations is three-hourly meteorological parameters from at least 30 main stations. However, the rainfall and temperature measurements should be done on 10 times more sites.

### (ii) Water Resources Sector

Hydrological observations started since 1934. Up to 1990, Rwanda had 47 stations and after the Tutsi genocide and war there is nonoperational station. Water resources occupy 8% of national territory. However due to lack of data, it is hard to prove at what extend climate change impacted on water resources. In water resource, meteorological data such as temperature, humidity, wind or at least minimum and maximum temperature are needed for estimation of evapotranspiration. Data of rainfall quantity and intensity is also needed for river flooding

### (iii) Health and human comfort

Epidemic diseases such as malaria, cholera, meningitis etc are climate related. It is observed some cases of new diseases in some regions or weather born diseases transformation due to climate change. Data disease cases, epidemic duration and other related data are available in Ministry of Health. Meteorological data and prediction are needed to assess climate related disease as well as their future change due to climate change.

Concerning the human comfort, the maximum temperature higher than 30°C is more frequent in last years according to the observed temperature at Kigali station. This high temperature is generally uncomfortable for human even for some animals. If in addition the humidity is higher than 80%, the human comfort is worse. Data of temperature, humidity and their prediction are needed to assess current and future change of human comfort due to climate change

### (iv) Energy Sector

Energy data is available in the Ministry of Infrastructure, the Ministry of Trade and Industry (MINICOM), National Bank of Rwanda (BNR), Civil Aviation Authority (CAA), and oil companies including Kobil which manages public warehouses.

The Rwanda Meteorological Service must be in position to provide the necessary information of rainfall, wind and solar data for renewable energy development and the future prediction of these parameters may guide in future of energy resources planning in connection to climate change.

### Agriculture and food security

Data related to agriculture is available at the Ministry of Agriculture and Animal Resources and related institutions such as ISAR.

Meteorological information such us agro-meteorological forecast, seasonal rainfall forecast and other data such as soil temperature and soil moisture are needed for adaptation to climate change as it helps in harvest prediction, measures for crop diseases, and agriculture planning.

## 3.1.2. Data from Meteosat 2nd Generation collected by National University of Rwanda

In 2006, the National University of Rwanda installed receivers and software to collect and to process data from "Meteosat Second Generation (MSG)".

The MSG is the European satellite MSG-1 (also called Meteosat-8) launched in 2002. It scans the Earth continually in 12 spectral channels, from visible to thermal infrared (including water vapor, ozone and carbon dioxide channels), at 15-minute intervals, and at spatial resolution from 1 to 3 kms.

The overall objective was to use and provide timely geo-information databases, allowing operational and near real time applications, free of charge for educational and research activities.

**(i) Meteorology, weather forecast**

- Nowcasting and Very Short Range Forecasting;
- Climate Monitoring;
- Numerical Weather Prediction;
- Land Surface Temperature;
- Downwelling Surface Short-waves Fluxes;
- Downwelling Surface Long-wave Fluxes;
- Surface Albedo;
- Etc

**(ii) Hydrology, water ressources management**

- Soil Moisture;
- Evapotranspiration;
- Water resource mapping and monitoring for the optimization of irrigation management and herds displacement.

**(iii) Vegetation monitoring, forestry, fires**

- Land Surface Analysis;
- Vegetation Index; Leaf Area Index
- Fraction of green vegetation
- Fraction of absorbed photosynthetic active radiation
- Leaf Area Index;
- Forest mapping and change detection
- Forest and bush fires monitoring.
- …

**(iv) Agricultural monitoring, agro-statistics**

- Land cover map to be used for zoning processes and the elaboration of resource management plans;
- Crop monitoring, crop production quantification, yields forecasting, agricultural pest prediction and monitoring;
- Early warning systems to prevent food shortage, improve decision support tools and optimise the actions of governments, food aid agencies, international financing &/or cooperation agencies towards food security;

**(v) Environment**

- Environmental degradation phenomena, natural hazards and disaster mapping and monitoring (floods, burnt scars, desertification) for damage evaluation, emergency preparedness and risk management;
- Characterization of terrestrial ecosystems and their seasonal dynamics, representing critical information in the framework of international conventions (biodiversity, desertification, …)
- Carbon sinks and sources estimation through extraction of vegetation parameters (biomass, Leaf Area Index - LAI - , Net Primary Productivity - NPP -) for climate change studies;
- Etc.

### 3.1.3. Rainfall data from MINAGRI/FAO Project

The project "Système National d'information et d'alerte Rapide (SNIAR)" of MINAGRI/FAO installed 90 rain gauges in all districts of Rwanda and trained 90 agronomists to record daily rainfall data. However, as this project ended in December 2009 and the promised allowances to these agronomists have never delivered, data is still not recorded and not available.

### 3.1.4. Current status of data collection, control, processing and archiving

The report on Poverty-Environment indicator (REMA, March, 2007) indicates existing data, its quality and data collection systems in Rwanda. This data can be used for climate change assessment. However it is collected, controlled, processed and archived not for the purpose of climate change assessment and reporting. Although data can be found easily with the best quality, it may be not sufficient for climate change analysis. For example in agriculture sector, it is needed number of dairy cows, in forestry sector it is needed the total tree shaded surface, in waste sector it is needed the percentage of papers, textile, grass and wood contained in solid waste. This kind of data is simply estimated using expert judgment or by comparison with default values.

The main sources of data according to REMA report include:

**(i) Demographic and Health Survey (DHS):**

This gathers data on women's fertility and health and the health of their children. The most recent one was carried out in 2005 and the results released in late 2006; National Institute of Statistics of Rwanda.

(ii) **The Household Living Conditions Survey** (HLCS), National Institute of Statistics of Rwanda, (also known by its French acronym EICV):

This gathers a comprehensive set of information on a large sample of households, covering consumption, income, education, health and other dimensions. While information on PE aspects like energy, food production/ consumption are scantily included in the summary preliminary

results of the HLCS 2006 provided, it was difficult to assess all the data captured and to what extent it can be disaggregated, because the detailed results could not be released.

(iii) **Participatory Poverty Assessment (PPA)**

It was undertaken to develop a comprehensive and fairly accurate poverty profile; diagnose and stratify poverty from a social, economic, cultural and spatial dimension; and to generate and evaluate the policies proposed for addressing the identified poverty concerns. The voices of the poor have not directly been captured in the ongoing EDPRS preparation but it has gone through extensive consultations at national level. It was not clear from interviews, whether at some point in the EDPRS a second PPA will be conducted. Alternatively, one can be done specifically looking at how the poor relate to the ecosystems (as was done with PPA 2 for Uganda).

(iv) **The *Core Welfare Indicators Questionnaire (CWIQ)***

It collects data on households' living conditions and use of public services, and is conducted annually by National Institute of Statistics of Rwanda.

(v) **Multiple Indicator Cluster Survey (MICS)**

It collects data on further aspects of education, water supply and nutrition, from a subset of the households covered in DHS.

(vi) **Agricultural surveys**

This is done annually but mainly covers crop production and marketing, with limited information about access to land, the poor's share of the agricultural production, and land degradation.

**(vii) The Food Security Survey**

It gathers detailed information on crop production from a subsample of households from the sample used for the EICV.

(viii) **The Public Expenditure Tracking Study (PETS),**

It examines the flow of funds to various sectors. PETS is currently limited to health and education sectors but would be extended to other sectors as well.

(ix) **Other systems that are sector-based include:**

*a.* ***Health management information system*** *(HMIS)*, which is currently being enriched with community health information;

*b.* ***Education management information system*** (EMIS) which covers water, sanitation and feeding in schools. It would be better if energy use was included (particularly as it relates to intensive use of firewood).

*c.* ***State of environment reporting*** (NSOER) is expected to be a biennial activity, in which REMA collects data, analyses and submits a comprehensive report on the current status and trends of all aspects of environment, natural resources in the country.

For most of these methodologies, available data was collected around 2000-2001 during the preparation of the PRSP. However, for some indicators, the data has been updated in the *Enquête Sur Les Indicateurs de base du Bien-être during* 2003 and published in March 2004. Even with recent data sets (like the DHS III) 2005), data is disaggregated only up to provincial level, making it difficult to do detailed analysis.

(ix) **Other sources of according to the same report**:

a. UNICEF – nutrition, water and sanitation – specifically the child survival program
b. WFP – food security monitoring/ early warning systems (FEWS).

Apart this source of information indicated in REMA report, the climate change assessment and reporting requires much more source of information. Any conducted study, report or any other information including informal from specific government institution, organization, and private is valuable. Here is some source of information not included in REMA report and used for Greenhouse gases inventory and Mitigation Assessment for the Second National Communication.


1. City of Kigali, Management plan for the Nyanza waste management site, City of Kigali, Kigali 2007
2. City of Kigali, Rapport du projet Décharge Nyanza, City of Kigali, Kigali 2005
3. City of Kigali, Kigali sewage system, City of Kigali, Kigali 2007.
4. Mbateye Francine Aimée: Assessment of Waste Watr Management Practice in Kigali City. M. Sc. Thesis, National University of Rwanda, Huye, 2007.
5. MINECOFIN (2003) 3ème Recensement Générale de la population et de l'habitat (RGPH), Service National de Recensement, Ministère des Finances et de la Planification Economique, (MINECOFIN) Kigali, août 2002.
6. MINECOFIN (2006), Rapport Economique Annuel 2005, Ministère des Finances et de la Planification Economique, (MINECOFIN), Kigali, 2006.
7. Ernest Ruzindaza et al., 2006: Self Evaluation of of the PRSP by Agriculture SWG of Rural Cluster. 2006 Joined Sector Review/EDPRS Self Evaluation.
8. MINIRENA &ISAR 2006 Inventaires nationales des forets
9. REMA, 2008 : Etablissement d'un inventaire national rapide des marais et élaboration de 5 avant projet d'arrêtés ministériels relatifs aux marais.
10. FAO: Guide pour les enquêtes sur la demande, l'offre et l'approvisionnement en combustibles ligneux ,2000-2002, Programme de gestion durable des Fôrets GCP/RAF/35G4/CE, GCP/RLA/133/CE.
11. Banque Nationale du Rwanda: Bulletin Trimestriel, Septembre 2005, pp111-112
12. Banque Nationale du Rwanda: Bulletin Trimestriel, Juin 2006, pp104-105.
13. Ministère des Ressources Naturelles(MINRENA)/Banque Mondiale: Biomass energy safeguarding, an update, 2000.
14. Ministère des Travaux Publics et de l'Energie(MINITRAPE): Bulletin des Statistiques Energétiques du Rwanda, Février 1993.
15. Ministère du Commerce, de l'Industrie, de la Promotion des investissements et du Tourisme(MINICOM): Rapport du département chargé des produits pétroliers, Mars2007.
16. Office Rwandais des Recettes(RRA), Rapport du département chargé de l'immatriculation des véhicules, Véhicules immatriculés de 2002à 2006, Février 2007.
17. ELECTROGAZ (Etablissement public de production, transport et distribution d'électricité, d'eau et de gaz), Rapport du département des centrales thermiques, Août 2007.

## 3.2. Initiatives underway at national level

### 3.2.1. National Communications

According to decision 17/CP.8 of UNFCCC[1], the principal objectives of national communications from Parties not included in Annex I to the Convention (non-Annex I Parties) shall be:

(i) To meet reporting requirements under the Convention on Climate Change;
(ii) To present information in a consistent, transparent and comparable, as well as flexible, manner, taking into account specific national circumstances;
(iii) To serve as policy guidance to the operating entity of the financial mechanism for the timely provision of financial support needed by developing country Parties in order to meet the agreed full costs of complying with their obligations;
(iv) To ensure that the Conference of the Parties (COP) has sufficient information to carry out its responsibility for assessing the implementation of the Convention by Parties.

National Communication includes following main parts:

- National Circumstances;
- National Greenhouse gases inventory;
- Measures to facilitate adequate adaptation to climate change;
- Measure to mitigate climate change;
- Other relevant information to achieve the objectives of the convention (Transfer of technologies, research and systematic observation, Education training and public awareness, capacity building, information and networking);
- Constraints and gaps, and related financial, technical and capacity needs

Through the climate change project (REMA), Rwanda formulated it Initial National Communication in 2005. The second national Communication is underway and will be soon available.

### 3.2.2. National Adaptation Programs of Action (NAPA)

National adaptation programs of action (NAPAs) communicate priority activities addressing the urgent and immediate needs and concerns of the least developed countries (LDCs), relating to adaptation to the adverse effects of climate change.

In 2006, Rwanda formulated a National Adaptation Programs of Action to Climate Change (NAPA). The preparation for the NAPA had the participation of a wide range of stakeholders and sectors. The NAPA report outlines overall actions, strategies, approaches and priority projects.

The NAPA specifically highlights the following strategic priority responses to addressing climate change (adaptation):

1. An Integrated Water Resource Management – IWRM;

[1] http://unfccc.int/resource/docs/cop8/07a02.pdf

2. Setting up an information systems to early warning of hydro-agro meteorological system and rapid intervention mechanisms;
3. Promotion of non agricultural income generating activities;
4. Promotion of intensive agro-pastoral activities;
5. Introduction of species resisting to environmental conditions;
6. Development of firewood alternative sources of energy; and
7. A National Plan for Disaster Management (Emergency Plans).

### 3.2.3. Clean Development Mechanism

The Government of Rwanda ratified the Kyoto Protocol in 2003 (Law No. 36/2003 of December 29, 2003) and the Cabinet Meeting of January 13, 2007 approved the Presidential Order Authorizing final approval of the Protocol.

Through the application of Article 12 of the Kyoto Protocol on the Clean Development Mechanism (CDM), the Designated National Authority (DNA) in Rwanda was created in September 2005. Due to lack of personnel operating budget this institution hosted by REMA was not fully operational until August 2009.

Nevertheless, from 2007 to 2008, REMA made efforts which led to the formulation of some Project Idea Notes (PINs) in collaboration with government institutions and private operators. However, most of these projects have remained at the PIN level.

In 2009, the Japanese Government and the United Nations Development Programme (UNDP) allocated a grant to support the activities of Rwanda Designated National Authority and to promote CDM projects. In August 2009, an International Expert and a National Coordinator were hired.

Currently, there are 3 Project Design Documents (PDDs) which have been developed for CDM projects in Rwanda. The "Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution Project" was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in February 2010. The "Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (Shyira and Fawe)" and "Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (Mugonero Esepan, Rwesero, Nyagasambu)" projects began validation in November 2009. Other CDM projects that are up-and-coming include: "Rwanda 19.95MW Small and Micro Hydro Project Bundle", "27.5 MW Nyabarongo Hydro Power Project in Rwanda", "Nuru Design Lighting Programme", and the Contour Global Lake Kivu Methane Project.

In addition to CDM projects, there are also currently ongoing voluntary carbon market projects in Rwanda; these projects are at various stages of advancement. The projects include a reforestation project by the Clinton Foundation, a Ministry of Infrastructure (MININFRA)/HIVOS National Domestic Biogas Programme and the K-Light in Rwanda Project.

### 3.2.4. The Sida-supported Natural Resources and Environment Program in Rwanda

The governments of Rwanda and Sweden have agreed to implement a Natural Resources and Environmental Support Program. The program will support Rwanda in achieving its Economic Development and Poverty Reduction Strategy (EPDRS), Millennium Development Goals (MDGs) and Vision 2020. The program consists of four components, designed to strengthen the capacity of MINILA and key national institutions to improve (i) land administration and management; (ii) forestry resources development and management; (iii) water resources management; and, (iv) environmental management.

The immediate objective of the environmental management component is:

- The capacity of MINIRENA and REMA is strengthened to secure effective pollution control for sustainable development;
- mainstream environment in different sectors, strategies, programs and policies;
- Climate change issues.

The draft report of the Sida-supported Natural Resources and environment Program (July, 2009) highlight six main activities for climate change preparedness:

(i) Revise and update of relevant National Strategies and Plans for climate change preparedness, adaptation and mitigation with focus on technology development and transfer, and human capacity building;
(ii) Engagement and support to the UNFCCC process, and any relevant follow up to international or regional initiatives;
(iii) Investigate and target present or new opportunities for support and partnerships on climate change oriented mechanisms (technology transfer, the NAMA mechanism, CDM etc);
(iv) Prepare information and database system;

(v) Skills development at all levels on climate change related fields;
(vi) Initiate and coordinate implementation of Multilateral Environmental Agreements (MEAs) and other development programs.

### 3.2.5. Climate change study of Stockholm Environment Institute (Draft report)

This study has assessed '*the Economics of Climate Change in Rwanda'*. It was funded by DFID and undertaken by the Stockholm Environment Institute (in Oxford) working together with local partners. The study has covered:

1. The impacts and economics costs of climate change;
2. The costs of adaptation; and
3. Pathways for low carbon growth.

The report recommends that further work is needed to improve the initial estimates and to give a degree of confidence in the analysis.
According to this report, there are a number of urgent priorities for building adaptive capacity in Rwanda that should be fast-tracked, notably in relation to meteorological monitoring, forecasting

and information (as these underpin future prediction and analysis), as well as information provision, monitoring (indicators) networks and focal points. These early priorities also include increasing the knowledge base, education and training.

Furthermore, the report point out following key recommendations:

- Building of Climate change risk screening into all aspects of development and planning;
- Access to substantial adaptation funds;
- Switch to a low carbon pathway;
- Revisit Rwanda Vision 2020 in light of the potential effect of climate change.

Finally the report highlights priority action for adaptation to climate change and recommended action for mitigation of climate change in following tables:

| Adaptation Strategies | Priority Actions |
|---|---|
| **Immediate needs & capacity building** | • Expanded research assessment into effects, adaptation and economics. Early capacity building, e.g. meteorological data/systems.<br><br>• Develop national climate change strategy including revision of Vision 2020, knowledge management, and screening of sectoral and regional plans for climate risks and adaptation opportunities<br><br>• Prepare plans for a national adaptation authority to improve sectoral coordination, link to international finance, and support private sector |
| **Climate resilience** | • Develop climate resilience strategies for immediate concerns (e.g. malaria and vector-borne health risks, similar in other sectors)<br><br>• Develop prototypes of sectoral actions (pilots) and pathways for scaling up to cover all vulnerable regions and populations |
| **Social protection** | • Protect vulnerable livelihoods and implement measures to reduce poverty |
| **Accelerated development** | • Adapt existing development projects to include 'no regret' measures to reduce climate risks and opportunities to develop adaptive capacity<br><br>• Scale up successful prototypes to sectoral development plans |

| Mitigation Strategies | Recommended Actions |
|---|---|
| **Low-Carbon Growth (LCG)** | • Full analysis of low carbon options, costs and potential for prioritisation and development of strategy for mechanisms.<br><br>• Develop national strategies to mainstream LCG in planning, including a revised Vision 2020 and EDPRS<br><br>• Facilitate carbon finance opportunities in voluntary and compliance carbon markets (VCM, CDM)<br><br>• Prioritize agriculture, transport and electricity generation low carbon measures, considering short-term opportunities but also longer-term areas where potential 'lock-in' and identify alternatives<br><br>• Look for synergistic adaptation – low carbon project opportunities, e.g. agro-forestry and sustainable land-use |
| **Climate resilience & co-benefits** | • Climate risk screening of low carbon growth pathways<br><br>• Consider opportunities to achieve robust development, e.g. in planning hydropower (large reservoirs, small in-stream turbines), biofuels, on-farm carbon management (e.g. zero grazing, woodlots) |

### 3.2.6. Study on climate change impacts in Bugesera District

The Poverty and environment Initiatives, a UNEP/UNDP project implemented by REMA conducted a study on Pilot Integrated Ecosystem Assessment of Bugesera (REMA, 2009). This report indicates that climate induced drought has blamed as the main driving factor of food insecurity in Bugesera region.

While the causes of food insecurity in other area of Rwanda identified as land degradation, in Bugesera, the main factor is unpredictable and inadequate rainfall, which is linked to prolonged drought. According to the same report, the region of Bugesera has faced chronic food insecurity since 1999 linking with El-Nino southern Oscillation (ENSO) of 1997-2000.

### 3.2.7. Projects and other planned activities

Other initiatives concern underway or planned project and government action plan related to climate change. Some projects have been initiated following the recommendation of NAPA. Following tables show these initiatives. Information about these initiatives collected from the Ministry of Finance and Economics Planning.

## Table : Main Climate change projects in Rwanda

| Project title | Implementing agency | Area | Period | Resources needed | Donors |
|---|---|---|---|---|---|
| **1. Reducing Vulnerability to Climate Change by Establishing Early Warning and Disaster Preparedness Systems and Support for Integrated Watershed Management in flood prone areas.** | UNDP | North and West of Rwanda | 2009-2012 | US$ 6,986,000 | LDCF +Co-financing |
| **2. Reducing Vulnerability of Rwanda's energy sector impacts of climate change** | KIST | Bulera-Musanze Districts | Phase II: 2009-2010 | To check with MININFRA. | UNEP |
| **3. Supporting Integrated and Comprehensive Approaches to Climate Change Adaptation in Africa: Inter-Regional Technical Support Component1** | UNDP | Countrywide | 2009-2011 | US$ 8,963,000 | Japan Government |
| **3. Building capacity and rising awareness for a sensitive community on climate change adaptation in Rwanda a CC DARE Project (UNEP/UNDP).** | NBDF (Nile Basin Discourse Forum) and RENGOF (Rwanda Environmental NGO Forum) | Countrywide | August-2009-January 2010 | US$150,000U | CC DARE/ UNDP-UNEP |
| **4. Study on Economic Impacts of Climate Change in Rwanda** | Department for International Development (DFID) | Countrywide | Initial Phase: November 2008- January 2009 | DFID | DFID |

## Table: Climate change adaptation related budget in the national budget 2009/2010

| Ministry | Program or Sub-program | Budget (2009) Frw | Observations |
|---|---|---|---|
| **MINICOM** | Support to Small &Medium enterprise Development | 250 049 700+ 1650 497000 | Dev. budget |
| **MINISTR** | Food processing | 44 967 029 | Recurrent budget |
| **MININFRA** | Diversification of energy sources and supply security | 820 Mios+854 Mios | Dev. budget |
| | Promotion of Imidugudu | 14 961 790 | Recurrent budget |
| | Weather forecasting | 600 Mios | Dev. budget |
| | Access to drinking water &sanitation | 4.9 Mrd+ 11.9Mrd | Dev. Budget |
| **MINIRENA** | Land Planning, Management &Administration | 2.03 Mrd | Dev. Budget |
| | Water resources management | 967.4 Mios+ 900Mios | Dev. Budget |
| **MINISANTE** | Fight against Malaria | 4,2 Mios | Recurrent budget |

| | | | |
|---|---|---|---|
| | Fight against malnutrition | 17 Mios | Recurrent budget |
| | Promotion of Hygiene& environmental health | 17 Mios | Recurrent budget |
| | IEC for health | 27,5 Mios | Recurrent budget |
| **MINAGRI** | Sustainable management of Natural resources and soil conservations | 2.055 Mrd +3.27 Mrd | Dev. Budget |
| | Marshland development | 150 Mios + 4.59 Mrd | Dev. Budget |
| | Irrigation development | 1.15 Mrd + 3.101 Mrd | Dev. Budget |
| | Food security and vulnerability management | 440 Mios | Dev. Budget |
| | Promotion of research for development | 198 Mios+500 Mios | Dev. Budget |
| | Commodity chain promotion and horticulture development | 608 Mios+2.5Mrd | Dev. Budget |
| **MIFOTRA** | Employment promotion | 17.505+116,850Mios | Dev. Budget |
| **MININTER** | Risks &Disaster Management | 79.7Mios | Recurrent |

### 3.2.8. Congo Basin Forest Fund

During the last COP 15 held at Copenhagen in December 2009, it has been created the Congo Basin Forest Fund (CBFF) to support innovative proposals to make the forest worth more as living resource than it will be cut down. The CBF covers 200 million hectares and constitute the second largest rainforest in world.

Concerned countries are: Burundi, Cameroon, the Central African Republic, Chad, Equatorial Guinea, the democratic republic of Congo, Gabon, republic of Congo, Rwanda, Sao Tome and Principe.

Four area concerns Congo Basin Forest Fund Grants:

(i) Forest Management and sustainable Practice;
(ii) Liverhoods and economic development;
(iii) Monitoring, assessment and Verification;
(iv) Benefits from international regime on REDD and payment for ecosystem services.

Eligible institutions include:

(i) Government, Civil society organization;
(ii) Community based organization;
(iii) NGO;
(iv) Private forestry sector operators and institutions.

### 3.2.9. Multilateral Environmental Agreements and other Conventions

Rwanda has ratified and signed more than 10 International Conventions and Protocols on or related to environment. Rwanda is an active participant in major international multilateral conventions relating to environmental governance, most notably the Convention on Biological

Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention to Combat Desertification and Drought (UNCDD).

The references of all International Environmental Convention (IEC) signed or ratified are the following:

(i) International Convention on Biological Diversity and its Habitat signed in RIO DE JANEIRO in BRAZIL on 5 June 1992, as approved by Presidential Order n° 017/01 of 18 March 1995;

(ii) United Nations Framework Convention on Climate Change, signed in RIO DE JANEIRO in BRAZIL on 5 June 1992, as approved by Presidential Order n° 021/01 of 30 May 1995;

(iii) STOCKHOLM Convention on persistent organic pollutants, signed in STOCKHOLM on 22 May 2001, as approved by Presidential Order n° 78/01 of 8 July 2002;

(iv) ROTTERDAM International Convention on the establishment of international procedures agreed by states on commercial transactions of agricultural pesticides and other poisonous products, signed in ROTTERDAM on 11 September 1998 and in New York from 12 November 1998 to 10 September 1999 as approved by Presidential Order n° 28/01 of 24 August 2003 approving the membership of Rwanda;

(v) BASEL Convention on the Control of Transboundary Movements of Hazardous wastes and their disposal as adopted at BASEL on 22 March 1989, and approved by Presidential Order n° 29/01 of 24 August 2003 approving the membership of Rwanda;

(vi) MONTREAL International Convention on Substances that Deplete the Ozone Layer, signed in LONDON (1990), COPENHAGEN (1992), MONTREAL (1997), BEIJING (1999), especially in its Article 2 of LONDON amendments, and Article 3 of COPENHAGEN, MONTREAL and BEIJING amendments as approved by Presidential Order n° 30/01 of 24 August 2003 related to the membership of Rwanda;

(vii) CARTAGENA protocol on Biosafety to the Convention of Biological Biodiversity signed in NAIROBI from May 15, to 26, 2000 and in NEW YORK from June 5, 2000 to June 4, 2001 as authorised to be ratified by Law n° 38/2003 of 29 December 2003;

(viii) KYOTO Protocol to the Framework Convention on Climate Change adopted at KYOTO on March 6, 1998 as authorised to be ratified by Law n° 36/ 2003 of 29 December 2003;

(ix) RAMSAR International Convention of February 2, 1971 on Wetlands of International importance, especially as waterfowl habitats as authorised to be ratified by Law n° 37/2003 of 29 December 2003;

(x) BONN Convention opened for signature on June 23, 1979 on conservation of migratory species of wild animals as authorised to be ratified by Law n° 35/2003 of 29 December 2003 ;

(xi) Washington Agreement of March 3, 1973 on International Trade in endangered species of Wild Flora and Fauna as authorised to be ratified by Presidential Order n° 211 of 25 June 1980;

As part of the implementation of the 3 Rio Conventions, commonly referred to as Multilateral Environmental Agreements (MEAs), the GoR developed National Strategies and Action plans for each convention viz: the National Biodiversity Strategy and Action Plan (NBSAP) 2003, National Plan of Action (NAPA) for climate change adaptation (2006/7), and National Action Plan (NAP) for combating desertification. These strategies and action plans reflect national priorities for ENR sector that are online with the EDPRS priorities.

# 4. RECOMMENDED ACTIVITIES TO ADRESS NEEDS

In chapter 3 above, it is detailed the current status of climate change in Rwanda. Mainly, it is analyzed the relevance of climate change with view to existing data and activities, the missing data and activities from different information sources including reports and studies. Taking into account the national context of climate change described in chapter 3 as guideline, we suggest a new reorganization and update of main activities which are harmonized with strategic plan for Climate Change Department.

## 4.1. Strategic plan for Climate Change Department

A strategic plan for Climate Change department has been developed and validated by REMA's professionals during Kibuye retreat from 4$^{th\ to\ 8th}$ January 2010. The objective of the strategic plan is to achieve the goal of Low Carbon Economy and adaptation to climate change.

The strategic plan includes following outputs:

- Climate change vulnerability monitored to support socio-economic development
- Integrated National Climate Change management policy and strategy developed and implemented
- Private sector involvement in climate change management promoted

Detailed activities illustrate following points:

- Roles of each sector to achieve the targets;
- Reinforcement plan of climate change data collection;
- Concrete action plans up to 2014 for GHG emission reduction;
- Concrete action plans up to 2014 for creation of adaptation plans;

The detailed strategic plan is on Annex 2.

## 4.2. Basis and scientific knowledge of climate change

| **Priority Actions** | **Daily routine work** |
|---|---|
| • In collaboration with Rwanda meteorological Service (RMS) and National University of Rwanda (NUR): Generation of missing rainfall and temperature data (1991-2010) using downscaling technique (High resolution climate models) with Rwanda historic data (1961-1990), satellite data (NCEP, USA, 1998-2010), Normalized Difference Vegetation Index (*NDVI*) (USGS, USA, 1979-2010) and NUR satellite data (2006-2010);<br>• In collaboration with RMS and MINAGRI: operationalize 90 rainfall stations with observation, collection, control, processing and archiving;<br>• In collaboration with NUR: Specify satellite data related to climate change and environmental degradation to be achieved by REMA;<br>• In collaboration with DMU and NISR, conduct a regular survey on economic valuation of Climate Change in Rwanda.<br>• In collaboration with high learning institutions prepare a comprehensive action plan for research in climate modeling;<br>• Capacity building. | • Climate change related data collection, processing and update;<br>• Coordination and/or participation in research related to science of climate change;<br>• Follow up the publication and meeting of IPCC Working Group I: Science of Climate change;<br>• Follow up all issues related to basic and scientific knowledge of climate change in Rwanda;<br>• Provide relevant information to be updated on climate change website. |

## 4.3. Greenhouse gases Inventory

| **Priority Actions** | **Daily routine work** |
|---|---|
| • Capacity building in inventory of GHG emission using 2006 IPCC methodology; | • Regularly update the database for inventory of GHG emission include the protocol of confidence level of data;<br>• Initiate and follow up the issue related to Collaboration between REMA and the concerned institutions in order to improve the quality and quantity of basic data;<br>• Coordination and/or participation in f research related to determination of specific emission factors for Rwanda from ;<br>• Provide relevant information to be updated on climate change website. |

## 4.4. Vulnerability and adaptation to climate change

| **Priority Actions** | **Daily routine work** |
|---|---|
| • In collaboration with RMS and Disaster Management Unit (DMU): prepare a project of Early Warning System (EWS) including data processing, forecasting, Early warning and dissemination<br>• Develop national strategy to mainstream adaptation to climate change in planning including a revision of vision 2020 and EDPRS;<br>• Include adaptation to climate change where is possible in environmental impact assessment<br>• Adapt existing development projects to reduce climate risks and opportunity to develop adaptive capacity;<br>• Lock for synergy adaption-Low carbon project opportunity;<br>• Capacity building. | • Regularly update the database for vulnerability and adaptation to climate change;<br>• Periodically update or guide in climate change vulnerability and adaptation assessment for general interest or for specific project;<br>• Coordination and/or participation in research related to vulnerability and adaptation to climate change;<br>• Follow up the publication and meeting of IPCC Working Group II: Vulnerability and adaptation to Climate change;<br>• Follow up and/or management of projects related to vulnerability and adaptation to climate change;<br>• Provide relevant information to be updated on climate change website. |

## 4.5. Mitigation of climate change

| **Priority Actions** | **Daily routine work** |
|---|---|
| • In collaboration of Rwanda National Police and the MININFRA, prepare a project of measurement of Greenhouse gases emission from vehicles and its standards development;<br>• Develop national strategy to mainstream Low Carbon Growth (LCG) in planning including a revision of vision 2020 and EDPRS;<br>• Include LCG where is possible in environmental impact assessment;<br>• Capacity building. | • Regularly update the database for climate change mitigation assessment;<br>• Periodically update or guide on climate change mitigation assessment for general interest or for specific project;<br>• Coordination and/or participation in research related to climate change;<br>• Follow up the publication and meeting of IPCC Working Group III: Mitigation of Climate change;<br>• Follow up and/or management of projects related to Low Carbon Growth;<br>• Provide relevant information to be updated on climate change website. |

## 4.6. Secretariat of Designated National Authority

The Designated National Authority (DNA) is a multisectoral national council. The DNA fulfils its daily operations trough its Permanent Secretariat. The DNA is primarily responsible for regulatory optional functions. Among these functions, the most important are:

- The written approval stating that the project is voluntary and that the project helps achieve the objectives of sustainable development. The approval process must be clear and transparent (made public, requires coordination with all stakeholders );
- Disseminating relevant and necessary information to stakeholders (milestones, technical aspects necessary for the implementation of CDM projects, or opportunities of the international carbon market);
- Provide information to potential project developers to help in development or implementation of projects;
- Provide technical assistance (preparation PIN and PDD);
- Disseminating current information from various stakeholders.

| **Priority Actions** | **Daily routine work** |
|---|---|
| • Development of the national strategy for the implementation of the Clean Development Mechanism in Rwanda ;<br>• Establishment of the national sustainable criteria for CDM projects ;<br>• Establishment of the national approval and registration procedures of CDM projects ;<br>• Promotion of the Rwanda's potential of CDM projects nationwide and development of international partnership for CDM project ; | • Official reception of CDM projects<br>• Organization RDNA meetings;<br>• Facilitate contacts between carbon credits buyers and Rwanda economic operators and any other contacts which may be useful for CDM projects development;<br>• Publicise at national and international levels the procedures and organization of CDM projects as well as the Rwanda CDM projects portfolio ;<br>• Follow the evolution of international regulations, procedures and strategies related to CDM projects and inform RDNA members;<br>• Collection and update all documentation related to CDM projects;<br>• Assessment of the needs and organize workshops, seminars and conferences related to CDM projects.<br>• Monitoring of the project activities implementation<br>• Preparation of monthly, quarterly and annual reports<br>• Update a network and database of relevant stakeholders and experts as regards CDM project development;<br>• To provide reference materials to guide in CDM project development;<br>• Provide relevant information to be updated on climate change website. |

## 4.7. Multilateral Environmental Agreements

| **Priority Actions** | **Daily routine work** |
|---|---|
| • Memorandum addressed to Hon Minister of Lands and Environment requesting the coordination of Focal Points by REMA<br>• Skills development of focal points for international conventions and obligations, and regional partnerships for effective participation in negotiations;<br>• Develop guidelines and a strategy paper to support national position on international negotiations. | • Prepare and monitor programs and plans for the implementation of Multilateral Environmental Agreements and other International Environmental Obligations (MEA-IO).<br>• In collaboration with national focal points for different Environmental Agreements and Obligations assess convention decisions and recommendation to update the conventions implementation plans by integrating relevant institutions<br>• In collaboration with national focal points for different MEA-IO initiate and coordinate the preparation of the national reports<br>• Provide technical input in negotiating and implementing regional and international conventions, protocols and treaties relating to environmental management.<br>• Review national policies and legal framework to ensure compliance with international obligation and assist in the domestication procedures of international obligation<br>• Review Global Environmental Facility GEF projects proposals and other climate related projects and provide technical advice for their endorsement of projects<br>• Prepare and disseminate guidelines and other tools related to the GEF and other environmental funding mechanisms;<br>• Provide relevant information to be updated on climate change website. |

# 5. REMA POSITION AS NATIONAL COORDINATOR FOR CLIMATE CHANGE

REMA was established by the organic law No 04/2005 of 08/04/2005 determining the modalities of protection, conservation and promotion of environment in Rwanda, in its article 65 as a public establishment with legal personality and shall enjoy financial and administrative autonomy for the implementation of the organic law on environment. The department entitled **"Climate change and international obligations"** was created under REMA. In this chapter it is reviewed the structure and staffing of the existing climate change institution under REMA. Therefore:

- With reference to suggested reorganization and update of main activities in chapter 3, a new structure and staffing of climate change institution is proposed;

- In order to facilitate stakeholders to get all information and data related to climate change, a Rwandan Climate Change Website is proposed to be created. On this website, Stakeholders will found all relevant documents, data and any other climate change information or links to them. The website should be interlinked with REMA's website.

## 5.1. Existing of climate change institutions under REMA

In 2009, the cabinet meeting approved the new structure of REMA. This structure includes climate change department to address the issues of climate change and coordination of the implementation of regional and international agreements. Its main function includes:

- Developing the capacity of REMA in clean development mechanism
- Assuring the secretariat of the National Designated Authority under the Kyoto Protocol's Clean Development Mechanism,
- Coordinating the preparation and implementation of policy, strategy and regulatory frameworks and instruments towards mitigation and adaptation of the country on climate change.
- Advising on opportunities and emerging issues related to climate change and climate change responses measures.
- Coordinating implementation of MEAs and other Regional and international Agreements in the field of environment.
- Provide technical input in negotiating and implementing regional and international conventions, protocols and treaties relating to environmental management.
- Initiate and coordinate the drafting of the national reports and assess convention decisions and recommendation to update the plan by integrating those that are relevant
- Coordinate the work of the Conventions Focal Points
- Provide technical advices related to GEF endorsement of projects
- Ensure national compliance with international and regional agreements related to environment.

The staffing of the department is as follow:

- Director: 1 desk;
- CDM specialist : 1 desk;
- Climate data manager : 1 desk;
- Conventions coordination officer: 1 desk.

## 5.2. Recommendation for restructuration of Climate change department and staffing

(i) The title of existing department is "*Climate change and international obligations*"**.** International obligations are very vague as it includes other obligations such as

human rights etc. We suggest modifying title as: "**Climate Change and Environmental International Obligations".** One desk of the Head of Department is proposed.

(ii) The main activities of "*Basis and scientific knowledge of climate change*" and "*Greenhouse gases Inventory*" (from 4.1 and 4.2 above) are suggested to be grouped into one task entitled: "**Climate and Greenhouse Gases Data Management**" or "**CGDM**".

This task has 2 Desks, 1 permanent and 1 provided within the UNDP AAP project (2 years). Following are collaborative institutions: Meteorological Service, MINICOM (Industry), National Police (Controle Technique Automobile), MININFRA (Energy and Transport), MINAGRI (Agriculture and Animal Resources), NAFA (Forestry), ISAR (Agriculture and Forestry), REMA (Wast Management), and two representatives from Universities.

(iii) The main activities of "*Vulnerability and adaptation to climate change*" (from 4.3 above) is suggested to be a task entitled: **"Vulnerability Adaptation Assessment and Project Management"** or **"VAPM".**

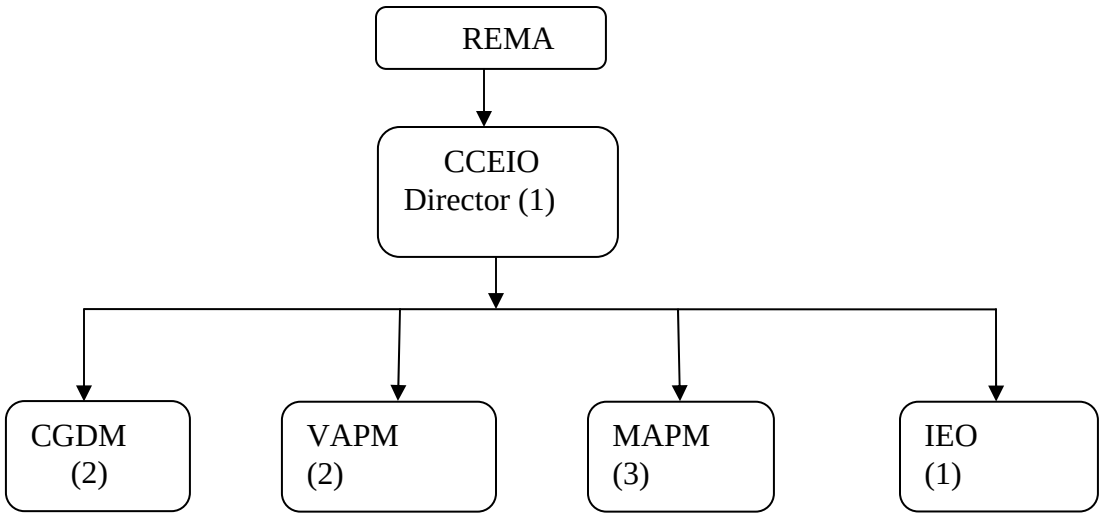
This Task has 2 Desk, 1 permanent and 1 provided within the UNDP AAP project(2 years) Following are collaborative institutions: Meteorological Service, MININFRA (Energy), MINISANTE (Epidemiology), Water Resource, MINAGRI (Agriculture and Animal Resources), NAFA (Forestry), ISAR (Agriculture and Forestry), and two representatives from Universities.

(iv) The main activities of "Mitigation of Climate change" and "Secretariat of Designated National Authority" (from 4.4 and 4.5 above) are suggested to be a task entitled: "**Mitigation Assessment and Project Management**" or "**MAPM**" dealing with CDM, VCM and non Carbon market mitigation projects.

This Task has 3 Desk, 1 permanent (*to be recruited*), the second 1 in charge of Designated National Authority for CDM project (*already in place*) and the third 1 is a permanent technical expert for CDM project (*already recruited within UNDP project*) Following are collaborative institutions: Private Sector Federation, MINECOFIN, MININFRA, ISAR,NAFA, IRST, MINICOM, and representatives from Universities.

(v) The main activity of "*Multilateral Environmental Agreements*" (from 4.6 above) is suggested to be a task **"International Environmental Agreements"** or **"IEA"** to include all agreements not only Rio Conventions and regional agreements as they are also international.

This task has one desk. Collaborative Focal Points are those representing International Environmental Convention (IEC) signed or ratified by the Government of Rwanda as provided in 3.2.9 above.




## 5.3. Recommendation for collaborative structure between REMA, RMS and National Police

Collaborative structure of Climate Change Department acting through Rwanda Environment Management Authority (REMA), Rwanda Meteorological Service and Disaster Management Unit acting trough National Police is suggested.

Conjoint activities of these 3 institutions are suggested to be coordinated by Climate Change department. The conjoint activity is quarterly report on Climate Change, Early Warning and disaster management. However, the main conjoint activity of these institutions is to prepare a cabinet paper on the status of Climate Change, Early Warning and disaster management atleast once a year.

The conjoint report should include followings:

- Observed climate hazards and climate change tendency;
- Early warning and application of climate information to key sectors (energy, agriculture, health, water resources etc…);
- Disaster preparedness and management;
- Progress of adaptation to climate change projects;
- Progress of carbon trade and other mitigation projects;
- Status of International Environmental Obligation of Rwanda.

# 6. CONCLUDING SUMMARY

This study:

- Highlighted the fact, cost and opportunities of climate change in Rwanda;
- Analyzed the inadequacy of needed meteorological data for climate change including the role of this data in key socio-economic sectors;
- Analyzed the available but not used or not collected meteorological data for climate change purpose;
- Analyzed the current status of data collection, control, processing and archiving in all sectors and highlighted other not collected sectoral data but needed for climate change;
- Reviewed the initiative underway including the national adaptation program of action (NAPA), the National Communication (NC) and Clean Development Mechanism (CDM);
- Highlighted the main points of Sida, DFID and PEI studies;
- Presented ongoing climate related projects financed by international organizations and government budget dedicated for climate change action plans;
- Presented a strategic plan for Climate Change Department;
- Recommended priority actions and daily routine work to address needs for: Basic and scientific knowledge of climate change, Greenhouse gases inventory, Vulnerability and adaptation to climate change, Mitigation of climate change and Multilateral Environmental Agreements;
- Following the above information, recommended the restructuration of climate change department and staffing as follow:

*a.* The title of department is "**Climate Change and Environmental International Obligations"** and this department is headed by Director: **1 desk**

*b.* In order to facilitate stakeholders to get all information and data related to climate change, a **Rwandan Climate Change Website** is proposed to be created

*c.* The main activities of "*Basis and scientific knowledge of climate change*" and "*Greenhouse gases Inventory*" will be grouped into one task entitled: "**Climate and Greenhouse Gases Data Management**" or "**CGDM**".

*d.* The main activities of **"***Vulnerability and adaptation to climate change***"** will be a task entitled**: "Vulnerability & Adaptation Assessment and Project Management"** or **"VAPM".**

*e.* The main activities of "*Mitigation of Climate change*" and "*Secretariat of Designated National Authority*" will be grouped into one task entitled: "**Mitigation Assessment and Project Management**" or "**MAPM**" dealing with CDM and VCM and with non carbon market mitigation projects.

*f.* The main activity of ***"Multilateral Environmental Agreements"*** will be a task entitled **"International Environmental Agreement" or "IEA"** to include all agreements not only Rio Conventions and regional agreements as they are also international.

- Recommended the collaborative structure between REMA, Rwanda Meteorological Service and National Police

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# Annex 1: Role and responsibility of allocated desks

1. **Desk 1:** Director of Climate Change and Environmental International Obligations

- Periodically coordinate, verify, review available literature, specific data and other sources of information, and update on climate change web site;
- Organize and coordinate multi-stakeholder climate change working group;
- Coordinate the preparation and implementation of policy, strategy and regulatory frameworks and instruments towards mitigation and adaptation of the country on climate change.
- Provide technical advice on opportunities and emerging issues related to climate change and climate change responses measures.
- Coordinate activities related the implementation of Multilateral Environmental Agreements (MEAs) and other International Environmental Obligations.
- Provide technical input in negotiating and implementing regional and international conventions, protocols and treaties relating to environmental management.
- Provide technical advice related to Global Environmental Facility endorsement of projects
- Identify, develop, implement and administer loan and technical assistance (TA) projects and non lending products and services related to climate change mitigation and adaptation activities.
- Identify, develop, implement and administer loan and technical assistance (TA) projects and non lending products and services related to the implementation of international conventions;
  Contribute to efforts to mobilize additional resources from the carbon market, special climate change funds, Global Environmental Facilities and other potential funds; Cooperate with other directorates and institutions to integrate climate change in national programs;
- Assist in developing internal REMA and stakeholders capacity in the area of climate change, by preparing training packages and specific presentations, organizing trainings and conferences; etc
- Participate in substantive research on climate change issues
- Keep REMA informed of trends and issues related to climate change
- Provides of timely quality information and technical advice on climate change issues and policies
- Draft briefing notes, policy and discussion papers and prepare presentations on climate change related matters

2. **Desk 2 and 3:** Climate and Greenhouse Gases Data Management

- Climate change related data collection, processing and update;
- Coordination and/or participation in research related to science of climate change and Greenhouse Gases Inventory including statistical and dynamical climate modeling and specific emission factor for Rwanda;

- Follow up the publication and meeting of IPCC Working Group I: Science of Climate change;
- Follow up all issues related to basic and scientific knowledge of climate change in Rwanda;
- Regularly update the database for inventory of GHG emission include the protocol of confidence level of data;
- Initiate and follow up the issue related to Collaboration between REMA and the concerned institutions in order to improve the quality and quantity of basic data;
- Provide relevant information to be updated on climate change website;
- Provide support in the design and implementation of national programm**e** on Climate Change Adaptation and Mitigation;
- Provide support and monitoring implementation of on-going projects in climate change adaptation and mitigation.

3. **Desk 4 and 5:** Vulnerability & Adaptation Assessment and Project Management

- Regularly update the database for vulnerability and adaptation to climate change;
- Periodically update or guide in climate change vulnerability and adaptation assessment for general interest or for specific project;
- Coordination and/or participation in research related to vulnerability and adaptation to climate change;
- Follow up the publication and meeting of IPCC Working Group II: Vulnerability and adaptation to Climate change;
- Follow up and/or management of projects related to vulnerability and adaptation to climate change;
- Provide relevant information to be updated on climate change website.

4. **Desk 6, 7 and 8**: Mitigation Assessment and Project Management Officer

- Regularly update the database for climate change mitigation assessment;
- Periodically update or guide on climate change mitigation assessment for general interest or for specific project;
- Coordination and/or participation in research related to climate change;
- Follow up the publication and meeting of IPCC Working Group III: Mitigation of Climate change;
- Follow up and/or management of non CDM and non VCM projects related to Low Carbon Growth;
- Provide relevant information to be updated on climate change website.
- Facilitate contacts between carbon credits buyers and Rwanda economic operators and any other contacts which may be useful for CDM projects development;
- Publicise at national and international levels the procedures and organization of CDM projects as well as the Rwanda CDM projects portfolio;
- Follow the evolution of international regulations, procedures and strategies related to CDM projects and inform RDNA members;

- Assessment of the needs and preparation workshops, seminars and conferences related to CDM projects;
- Monitoring of the project activities implementation;
- Provide reference materials to guide in CDM project development;
- Provide relevant information to be updated on climate change website;
- Preparation and dissemination carbon market and CDM national strategy and guidelines;
- Provide technical support for initial CDM assessment of projects and provide feedback to the REMA management for taking appropriate decisions regarding next steps on projects;
- Coordinate activities related to the approval, validation and registration process for CDM projects;
- Provide technical inputs in the registration of national CDM specialists, drafting of contracts, MOU/Aide Memoirs etc. related to CDM projects; Contribute to efforts to mobilize additional resources from the carbon market, special climate change funds, etc;
- Official reception of CDM projects
- Preparation meetings and reporting of Rwanda Designated National Authority;
- Collection and update all documentation related to CDM projects;
- Update a network and database of relevant stakeholders and experts as regards CDM project development;
- Preparation of monthly, quarterly and annual reports
- Identify CDM eligible projects through updating Clean Energy and Environment Database System and consultation with operational departments;
- Provide relevant information to be updated on climate change website.

5. **Desk 9:** International Environmental Agreement Officer

- Prepare and monitor programs and plans for the implementation of Multilateral Environmental Agreements and other International Environmental Obligations (MEA-IO).
- In collaboration with national focal points for different Environmental Agreements and Obligations assess convention decisions and recommendation to update the conventions implementation plans by integrating relevant institutions
- In collaboration with national focal points for different MEA-IO initiate and coordinate the preparation of the national reports
- Provide technical input in negotiating and implementing regional and international conventions, protocols and treaties relating to environmental management.
- Review national policies and legal framework to ensure compliance with international obligation and assist in the domestication procedures of international obligation
- Review Global Environmental Facility GEF projects proposals and other climate related projects and provide technical advice for their endorsement of projects
- Prepare and disseminate guidelines and other tools related to the GEF and other environmental funding mechanisms; Provide relevant information to be updated on climate change website.

# Annex 2: Strategic plan for Climate Change Department