ANGOLA

ANGOLA'S INITIAL NATIONAL COMMUNICATION TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

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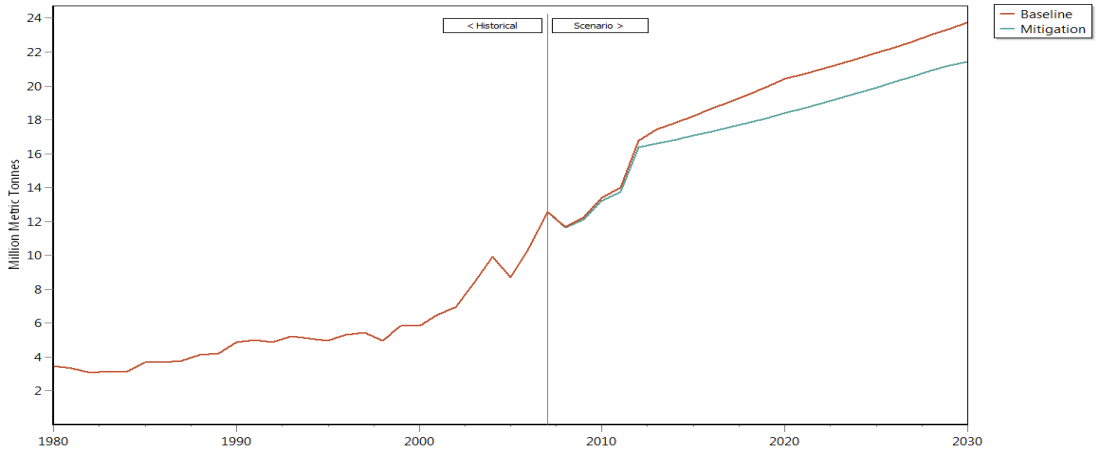

Abbreviations

ADRA – Angolan Action for Rural Development and the Environment
AWS – Automatic Weather Stations
CDI – Information and Documentation Centre
CDM – Clean Development Mechanism
CEF – Carbon Emission Factors
CERs – Certified Emission Reductions
CNPC – National Commission on Civil Protection
CNRF – National Centre of Genetic Resources
CPLP – Community of Portuguese Language Countries
CREFORMA – National Centre for the Formation of Experts in Meteorology and Environment
CTA – Technical Evaluation Commission
CTI – Science, Technology and Innovation
CTMA – Technical Multisectorial Commission for the Environment
DNA – Designated National Authority
DNER – National Directive on Renewable Energy
DNTA – National Directive on Environmental Technologies
DRC – Democratic Republic of the Congo
DWA – Development Workshop Angola
ECP – Poverty Reduction Strategy
EIA – Environmental Impact Assessment
EIS – Environmental Impact Study
ELISAL – Cleaning and Sanitation Company of Luanda
ENE – National Energy Company
ENSO – El Niño-Southern Oscillation
EPANB – National Biodiversity Strategy and Action Plan
FAO – Food and Agriculture Organization (United Nations)
FP – Oil Fund
GAMEK – Cabinet for the Use of the Mid-Kwanza
GEF – Global Environmental Facility
GHG – Greenhouse Gases
GSA – Environmental Security Cabinet
GTS – Global Telecommunication System
GWP – Global Warming Potential
IDF – Forestry Development Institute
IEA – International Energy Agency
IIA – Agronomic Investigation Institute
INAMET – National Institute of Meteorology and Geophysics
INIDE – National Educational Investigation and Development Institute
INIP – National Fishing Investigation Institute
IPCC – Intergovernmental Panel on Climate Change
IPR – Intellectual Property Rights
ITCZ – Inter/tropical Convergence Zone
JEA – Angolan Ecological Youth
LAI – Industrial Activities Law
LEAP – Long-range Energy Alternative Planning Systems
LNG – Liquefied Natural Gas
MAT – Ministry of Territorial Administration
MINADERP – Ministry of Agriculture, Rural Development and Fishing
MINAMB – Ministry of the Environment

MINCO – Ministry of Commerce
MINERGA – Ministry of Energy and Water
MINESCT – Ministry of Superior Education, Science and Technology
MINGMI – Ministry of Geology, Mining and Industry
MINHOTUR – Ministry of Hotels and Tourism
MINPET – Ministry of Oil
MINPLAN – Ministry of Planning
MINSA – Ministry of Health
MINTRANS – Ministry of Transportation
MINUA – Ministry of Urbanism and Environment
MSS – Meteorological Messages Commutation System
NAFC – Environmental Department at the School of Science
NAMA – Nationally Appropriate Mitigation Action
NAPA – National Adaptation Programmes of Action
NGO – Non-Governmental Organization
NMVOC – Non-methane Volatile Organic Compounds
OECDCDE – Organization for Economic Cooperation and Development
PNFFSAC – National Forestry Policy
POOC – Coastal Zoning Plans
RSU – Urban Solid Waste
SADC – Southern African Development Community
SMN – National Meteorological Service
TWS – Traditional Weather Stations
UN – United Nations
UNDP – United Nations Development Program
UNEP – United Nations Environment Program
UNFCCC – United Nations Framework Convention on Climate Change

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The completion of this project reflects the efforts made by the Government to honour Angola's international commitments regarding climate change, and its responsibility in achieving sustainable development, poverty reduction and the Millennium Development Goals.

Executive Summary

This Initial National Communication under the UNFCCCC is a project of the Ministry of the Environment, with the following objectives: to establish a national GHG inventory; to create the conditions for the implementation of appropriate measures to facilitate the adaptation to the adverse impacts of climate change and to mitigate emissions of GHGs consistent with the sustainable development objectives of Angola; to initiate processes of transfer of environmentally sound technologies, systematic observation and integration of climate change related issues into development plans and programs; and to evaluate the country's capacity to deal with external climate events.

Among the commitments made by Angola when the country ratified the United Nations Framework Convention on Climate Change (UNFCCC), is to develop and periodically update through the National Communication, national inventories of GHG emissions and removals. This periodical updating also provides general indicators of the conditions in the country for the implementation of the Convention. This fact gives legal framing to the National Strategy for the implementation of the Convention and its Kyoto Protocol,

The Initial National Communication includes among others the following chapters

- National Circumstances;
- GHG Inventory;
- Climate Change Adaptation Measures;
- Climate Change Mitigation Measures;
- Development and Technology Transfer
- Research and Systematic Observation;
- Education and Public Awareness;
- Integration of Climate Change considerations into Development Plans and Programs;
- Capacities Needs Assessment;
- Information and Networking
- Constraints, Gaps, Financial and Technical Capacity

The preparation of National Communication required considerable effort, since it is still difficult to understand the issues related to climate change within the Angolan society. The state of conflict in which the country lived until 2002 caused deficiencies in the structural organization of most institutions, making it hard to obtain concrete data and information necessary for the preparation of the document; this difficulty was combined with lack of human resources capable of dealing with the issue of climate change.

This National Communication is in conformity with the provisions of the Convention and led to the motivation and active involvement of national experts as well as enhancing the capacities of such individuals and groups and the institutional involvement of several government agencies, academia and scientific entities, private sector and civilian organizations.

The Decision 17/CP.8 stipulates that the countries not included in the Annex I of the Convention must prepare their national inventories of GHG emissions using the year 2000 as the reference year the least developed countries are permitted to exercise their own discretion. Given that the armed conflict in Angola has lasted until 2002, it was decided in technical workshop that the base-year used in the preparation of this national communication should be 2005.

Angola is a multicultural and multilingual country, with a population of 18,082,000 people (Source: INE-2010). The population density is approximately 13,2 people per km^2. The country's population is extremely young, with 50% being under the age of 15, and 60% under the age of 20 while 93% of the population is less than 50 years old.

The average population growth rate is 3,5% and the life expectancy is 49 years of age. The infant mortality rate is 150 per thousand live births and the childhood/adolescent mortality rate is 250 per thousand live births. The birth rate is 7,2 children per woman.

Malaria continues to be the main cause of death in Angola, especially among those under the age of five. The disease has resulted in about 35% of all medical consultations, 20% of all hospitalizations, 40% of prenatal deaths and 25% of maternity deaths.

Educational indicators in Angola are among the worst in all of sub-Saharan Africa. The most recent statistical data reveal the Angolan educational system to have very low schooling rates, high rates of school drop outs, high rates of school-year repetition and low retention rates (students that remain in the system). However, this bleak picture is currently being reversed given recent investments made by the Government in education.

Angola's economy is growing rapidly, but remains essentially dependent on the Oil sector, which represents 55% of the GDP and 95% of all exports. The rural sector, comprising agriculture, forestry and livestock, is the second largest economic sector in the country, with 8% of the GDP, even though the existence of land mines as a result of the civil war remains an obstacle for rural development.

The roads, trains and telecommunication networks, as well as the industries and food distribution networks, destroyed during the armed conflicts, are currently benefitting from reconstruction efforts, with large investments being made by the government.

To improve the country's social and economic development, the Government has adopted a long-term development strategy called "Development Strategy 2025", with the following objectives:

- To promote employment and value human resources;
- To build a more just and equitable society;
- To ensure the sustainable use of natural resources protect the environment and Combating desertification;
- To build competitiveness and develop the private sector.

In order to achieve these goals, a series of preparatory measures, pertaining to all areas was approved, giving priority, in this initial phase, to basic infrastructure, such as access roads, energy production, technical networks of human settlements, telecommunications, new human settlements and social equipment for general, technical, superior and healthcare education.

The GHG inventory was focused in five areas were previously identified during the preparation of the Initial National Communication Project document, being in conformity with the decision 17/COP8 The inventory comprises the following sectors: energy, industrial processes, agriculture, forestry, land use and waste.

The data used to prepare the report were taken from official sources or calculated by experts from the respective fields, according to the existing level of knowledge or information in the area. On the other hand, a series of emission factors was used, some national, used in the Luanda refinery, as well as some present in the reference manual for the preparation of national communications and the IPCC.

Energy – In this sector, emissions resulting from combustion of fossil fuels, in activities such as transportation, electricity generation, lighting and residential use (generators), as well as the consumption of butane gas, used to produce food items in several sectors were estimated. Also, a country with a large Oil production must naturally generate a considerable amount of CO_2 and methane gas emissions. The amount of gas burned in flares was taken from the report released by the International Energy Agency, Angola – Development of an Energy Strategy, which estimated 10.336 million cubic meters in 2000 and predicted 27.700 million cubic meters in 2009, given the burning of 70% of the total gas produced. The figure for 2005 was estimated at 16.158 million cubic meters. In terms of gas, considering all the natural gas, with density of 0,86 kg/m^3 and carbon percentage of 62% of the total mass. The oxidation factor considered was 95%.

Industry –emissions were calculated for cement production, factories, it is worth recalling the practically paralyzing phase the sector went through during the inventory's years.

Land Use change and Forestry – Such Emissions were essentially calculated from deforested areas corresponding to the use of wood for direct burning and for the production of vegetal coal, as well as information from planted forests. Given the difficulty in obtaining concrete information, emissions derived from deforestation, the soil and abandonment of deforested areas were not calculated.

Agriculture – These emissions are basically associated with rice production, livestock and the burning of the savannahs, agricultural waste and use of fertilises.

Waste – Emissions derived from waste were calculated by the daily waste generation per capita, as well as sewage emissions estimated according to default values used to calculate methane gas and nitrous oxide emissions.

The estimated GHG emissions for 2000 and 2005 are reflected in the sectors described above. It is important to remember that the reference year adopted by the Conference of the Parties are 1994 for the initial communication and 2000 for the second one. Considering that during this period the country was engaged in armed conflict, the base year was set as 2005. An effort was made to obtain the greatest amount of information possible pertaining to the year 2000.

For the reference year, emissions was calculated in gig grams- Gg (or thousand tons) of CO_2 equivalent (CO_2eq), which is obtained by multiplying CO_2 emissions by 1, CH_4 emissions by 21 and N_2O emissions by 310, according to the GWP (Global Warming Potential) established by the IPCC and adopted for the inventories. For the present inventory, in 2000 CO_2 emissions totalled 13.243 Gg, methane emissions 15.953,39 Gg of CO_2eq and nitrous oxide emissions 13.944,01 Gg CO_2eq. For 2005, CO_2, CH_4 and N_2O emissions totalled 29.261, 20.158,32 and 14.098,37 Gg CO_2eq, respectively.

Emissions per capita were calculated for this inventory's reference year by dividing the total emission with Angolan population in those respective years. Therefore, for 2000 emissions were of 3,10 tons of CO_2eq per person and, for 2005, the total was 3,95 tons of CO_2eq per person.

The understanding of the factors that contribute to weather variations in Africa is limited, especially in the region where Angola is located. The development of models for the region is in its initial stages. The analysis of global weather historical data indicates that the ENSO has connections with the weather in several areas of the globe, such as eastern Africa. However, ENSO's impact is not so much felt in Angola, where climate variability are more closely tied to conditions in the Atlantic Ocean, such as changes in the Benguela Current, in the movements of the Inter-tropical Convergence Zone (ITCZ) and the atmospheric and sea temperature conditions in the South Atlantic.

There has been an increase of between 0,2 and 1,0ºC in the surface temperature between 1970 and 2004, at the coastal areas and the northern region of Angola, and an increase of between 1,0 and 2,0ºC at the centre and eastern parts of the country. The climate models indicate that there will be an increase of 3,0 to 4,0ºC in the surface temperature at the centre and eastern regions, as well as a slightly smaller one at the coastal and northern areas, in the next 100 years

Climate change makes existing vulnerabilities more severe and creates risks for a certain population's survival system. Extreme weather makes agriculture difficult, even though few people inhabit areas with extreme weather and those who do generally adapt their way of life accordingly. Climate variability is frequently a risk factor because a year without rain or too much rain in a certain period, without notice, will have an impact in production. Climate change could create other risks if, for instance, precipitation surpasses the limit that defines the possibility of cultivating something in particular or if its variability increases.

Areas identified as vulnerable are those where there is already vulnerability and serious challenges, but where climate change could intensify these challenges even more. The identified impacts refer to:

- Hydrology (changes in river basins, with additional effects to neighbouring countries)
- Forests and agricultural systems (given the changes in precipitation and hydrology, which affect agricultural practices)
- Soil erosion (due to higher precipitation levels)
- Coastal fishing (if there are changes to the Benguela Cold Current)
- River and lake fishing (if there are changes in hydrology or water temperature)
- Maritime coast currents and coastal erosion (due to the rise of the sea level as well as sedimentation and erosion alterations, if there are changes in hydrology)
- Industry and energy, Oil installations, ports (due to changes in hydrology and in the coastal area)
- Human settlements (due to temperature changes and the need to cool inhabited spaces; there is also the question of higher risks of flooding and erosion)

The uncertainties concerning precipitation tendencies make it difficult to evaluate the impact of climate change in Angola, but the analysis takes into account impacts already verified in other areas of Africa, as well as possible impacts of climate change in sectors such as hydrology and flooding, soil erosion, coastal zones, housing and human settlements, fishing, agriculture and

biodiversity. The analysis takes into account the possible risks derived from climate change, the existing vulnerabilities in these areas and the capacity to manage the effects of those risks.

Angola needs to consider the possible climate change in neighbouring countries, as dryer weather in Namibia and South Africa may give new regional importance to the Angolan hydrological, agricultural and energy resources. Regional climate models indicate that the weather in Namibia will be dryer in the future. In North of Botswana and south of Zambia the models indicate a tendency of decrease of precipitation. Climate models for Southern Africa don't include predictions for Angola and the Democratic Republic of the Congo, due to a lack of data, but there are some models that include borderline areas of Angola. In countries located south of Angola, the general prediction is that precipitation levels will decrease it is possible that these trends could affect southern Angola. Based on models pertaining to neighbouring countries, there are certain indications that eastern and north-eastern Angola could experience higher precipitation levels in the future, as well as more occurrences of heavier rainfall.

Precipitation, surface water and soil humidity projections are very uncertain. There is still not enough information about possible climate change in Angola and its impacts, so it is not appropriate to make recommendations regarding specific adaptation strategies. It will not be appropriate to assume that current climate and hydrological conditions will remain unchanged in the future. It is necessary to create capacities that would allow future adaptation needs. The strategies presented here aimed to reduce current risks that will increase with changes in temperature and precipitation patterns. Generating the capacity to face current situations (for instance, soil erosion and flooding) will be useful in dealing with future situations. It is important to reinforce the resilience capacities to these vulnerabilities that can become serious due to climate change. Such capacities can be created at the individual, communal, local or central government levels. Adaptation policies must enhance the capacity to manage risks and avoid fixed large-scale investments that rely on factors that have not yet been thoroughly studied.

It is necessary to incorporate climate change risks into the planning and investment strategies for infrastructure. This implies the gathering of information and resources, and the creation of specific institutions.

The analysis of meteorological data must take into account the variability trends in precipitation as well as other climate variables. It will be important to understand if they surpass critical points that would generate serious impacts and therefore obtain adequate information about meteorological, so that the best climate change predictions can be made.

In all areas of risk it is important to better understand the systems that can be affected by climate change and their vulnerabilities, and elaborate strategies for reducing these vulnerabilities in partnership with the people involved. For example, the number of rainfall data gathering spots declined from more than 500 to 20, making it more difficult to collect reliable meteorological information, which is a pretty vulnerable sector.

Angola posses an enviable energy potential that must be used in an articulate, long term 13 to 15 billion barrels of oil; 12 to 13 billion cubic meters of natural gas; hydroelectric potential superior to 1200 HW; coal (deposits of timber, peat, lignite – at the Lungué river basin in Bungo are evaluated at 3 million tons); solar energy, or hydrogen there is no single energy strategy or policy that integrates all energy sources and uses.

The majority of the Angolan population is concentrated in the coast, especially in Luanda. So it is necessary to create a common market for transportation and infrastructure and understand that

investments in this area shall have potential returns and grace periods determined by the characteristics of a common regional market.

The Angolan Development Strategy for 2025 includes:

- "Integrated Spatial Development Program" including: Mapping of Transportation Corridors; development corridors; and spatial development initiatives;
- "National Rural and Urban Mobility Program", including the development of rural and urban transportation;
- "National Infrastructure Repositioning Program", comprising: ports, railroads, highways, airports;
- "National Technical Capacity Reinforcement Program"

Among the measures discussed in the mitigation projects related to different sectors, there are:

Sector	Proposed Programme/Projects
Energy	Upgrade and reawakens creation of the electric energy distribution network Construction of renewable energy centres: hydro and wind Use of the natural gas from Oil exploration Domestic demand side management: promotion of more energy efficient appliances Improvements in transportation demands: reawakens creation of the mass and cargo transportation grid, incentives to the use of new generation cars (gas, photovoltaic energy, biofuels and electricity) as well as railroads reawakens creation
Waste	Implementation of selective collection and treatment of urban solid waste Promotion of the creation of landfill sites
Forestry	Reduction of deforestation; Increase in the offer of butane gas; Strengthening of legislation;

To reduce emissions from the forestry sector and mitigate the harmful effects of climate change, it becomes indispensable to combine environmental conservation and management measures and policies with social and economic development in that regard; Angola presents the following objectives, which guide forestry mitigation measures:

- Promotion of different ways of using and capitalizing on the forests, the wildlife and areas of conservation.
- Promotion of the role and participation of the private sector, community and cooperative sectors in managing and rationally using the resources from forests, wildlife and areas of conservation.
- Improvement of the forestry and wildlife protection, conservation and management systems, including the integrated management of natural resources and the emphasis on ecologically sensitive areas (arid, semi-arid and sub-humid zones, as well as mangrove swamps).

- Promotion of the involvement and full participation of local communities, social organizations and citizens, as direct players in the protection, conservation and rational use of forestry, wildlife and conservation areas resources.
- Improvement and harmonization of the central structures for forestry, wildlife and conservation areas management, ensuring an integrated and sustainable approach to handling these resources.

In Angola, the issue of protecting individual Intellectual Property Rights (IPR) has been for a long time handled by the Government. Industrial legislation protects the brand and the product created by innovation, respecting international legislation on the matter.

Under extreme circumstances, the country will make use of original or patented clean technologies in advantageous financial conditions in order to keep from compromising other national development efforts. However, the National Strategy for the implementation of the UNFCCC confirms Angola's involvement with the Clean Development Mechanism (CDM), based on a cycle of project identification, viability analysis and approval by the Designated National Authority (DNA), which is also responsible for the monitoring, verification and certification of emission credits.

The Country entry into CDM and the strategy's financial instrument – the Carbon Fund – can be used as tools and incentives to the transfer of the technology necessary, so that the country can adapt to the vulnerabilities identified in the Vulnerabilities Chapter.

The Angolan Government has evoked the need for public policies on science and technology that will promote innovation. Mandates and activities related to science, technology and innovation (STI) are linked to several ministries at the central government level, regional governments and social society organizations, with different coordination mechanisms. The transfer of adaptation and mitigation technology is associated with a great deal of potential for the following sectors: energy, industry, agriculture and livestock, forestry, urban waste and basic sanitation, transportation, climate monitoring, telecommunications, healthcare, human settlements and housing.

The Ministry of Science and Technology, holds the National Technological Centre, it's also responsible for the investigation and experimental development of technological areas, the National Scientific and Technological Development Fund, a financial institution that supports innovative and scientific projects.

The Ministry's program provide useful subsidies and incentives to Environmental Sound Technologies policies focusing in development of new policies that will foster a favourable environment in the areas of science, technology and innovation, as well as facilitate the development of human capacities and of a supportive infrastructure for investigation in partnership with Universities.

Meteorological information plays an important role in sustainable development, through prevention against extreme situations associated with the weather, climate and water, as well as mitigation of its most adverse effects.

Long-term climate records and sector information related to it constitute an essential tool for evaluating a community's sensitivity and vulnerability to meteorological and climatologic

situations of risk both in the short and long term in an effort to ensuring prevention, upfront planning and defining response strategies to enhance resilience to future extreme weathers.

Increased occurrence of extreme weathers associated with the climate and water, observed in every scale, demonstrates man's growing vulnerability. According to the World Meteorological Organization's guide on climatologic practices, data is more useful if it is edited, if there is quality control, and if it is stored in a national database or centre and then made available to users in an appropriate format.

Even though technological innovation occurs in an accelerated fashion, many climatologic records available to the National Institute of Meteorology and Geophysics (INAMET) are still in analogical format. Also, sequencing flaws in the country's climate records make it impossible to conduct a profound analysis of such records. Given all that, in this document, the climate vulnerability analysis shall be done for a few cities only, where data present a certain degree of reliability.

The analysis made in relation to the spatial distribution of precipitation in Angola shows that it diminishes from north to south and it is greater in the countryside than it is in the coastal areas. This standard distribution is sometimes altered due to altitude changes. Precipitation distribution is also influenced by the distribution of the pressure systems, being that there is a larger amount of rainfall in regions that are more affected by depressurization (north and countryside), and a lesser amount in those influenced by anticyclone conditions (south and coastline). The difference in precipitation between the coastline and the countryside is due not only to the distribution of the pressure systems, but also to the great difference in altitude.

The improvement of weather prediction, with the introduction of regional models for weather and state of the ocean, as well as midscale models, also named regional scale models, will allow for a better quality of predictions and the development of products to support several activities, particularly the development of a warning system connected to extreme climate events that can lead to natural disasters. This service would be integrated into the existing warning system run by the Civil Protection National Service. Broadening the modelling activity in order to encompass climate modelling makes it possible to establish regional scenarios for potential climate change.

Development in this specialized work area constitute a support tool for political and economic decision makers, who will have the means to define mitigation and adaptation policies pertaining to the adverse effects of climate change, generating an incalculable positive impact.

Areas that is necessary to improve the technical capabilities to foster better regional and international integration:

- Climatology and statistics applied to data management and quality control;
- Regional modelling for weather and state of the ocean;
- Development of conceptual models for several applications;
- Aeronautic Meteorology;
- Climate and its impact in development and public health, as well as future climate scenarios and adaptation/mitigation measures;
- Agro-meteorology, particularly aspects related to the optimization of earnings derived from cultures based on soil and climate conditions, water management and nitrogen fertilization;
- Biometeorology;
- Air quality and its impacts, especially in healthcare;

- Post-mortem analysis to evaluate model results;
- Development of forecasting techniques;
- Maritime meteorology;
- Relevant information related to weather and climate to support decision making;
- Influence of the Benguela Cold Current in variability and/or climate change and its relation to biodiversity, especially with maritime resources and the occupation of coastal zones;
- Renewable and alternative energy;
- Management of water resources, land occupation and use and their influence on climate change and vulnerabilities in Angola.

The issue of environmental education is a responsibility of all and must be dealt with from within the pedagogical orientation. As far as climate change is concerned, environmental education has been approached at the formal level, with government institutions and civil society working together.

In this sense, developed actions have been significant in terms of content, and constitute a valid base for the continuation of this approach to climate change; but, given the other priorities, allocated resources are limited for the development of a greater number of actions.

When it comes to the curriculum for Primary Education, Secondary Education, Teachers Education and Professional Technical Education, it can be assessed that almost all manuals contain sections on Nature Conservation and Preservation, touching on the elements that cause climate change. Only the Geography curriculum deals with this subject separately.

The ability to teach this subject still deficient since there are a very few teachers trained in Environmental Education (climate change). This is because the theme is still new and information is scarce. But graduated teachers with different expertise are capable of teaching this content because it can be taught using the inter-disciplinary methodology. To increase the presence of this content in school curriculums, the following is recommended:

- Create more policies pertaining to the insertion of inter-disciplinary content in school materials;
- Conduct more educational seminars and teaching programs on the appropriate methodology to teach environmental issues, including climate change;
- Conduct more workshops directed at themes related to climate change;
- Organize lectures in schools to discuss climate change with practical examples extracted from Angolan reality;
- Promote extracurricular activities, such as planting trees, reawakens creation and conservation of parks and natural reserves, visitation to factories with activities that emit polluting gases or are vulnerable to climate change;
- Post billboards in schools depicting climate change related themes, as well as photographs of catastrophes provoked by climate change events;
- Encourage activities connected to education that discuss climate change, such as stage plays, short stories, poems, songs, recycling art, games, film screening programs, radio and TV broadcasts, newspapers, magazines, among others;
- Conduct awareness raising campaigns within communities, considering the impact to their daily lives and their exposure to climate change;
- Involve mass media and opinion makers in publicizing information about climate change and its local impact;

- Make sure that public institutions, as well as the private sector, adopt and apply environmentally friendly measures, producing and promoting (within and outside of the organization) material related to environmental education and climate change;
- Prepare educational material, to be used for teacher training and community awareness creation, as well as to inform the international community;
- Improve incentives in order to stimulate the intensification of issues related to environmental education.

Taking into account the gravity of the climate change problem, it is necessary to intensify the awareness raising and dissemination of issues related to climate change, as well as actions to be developed at the formal and informal levels.

Issues related to climate change under the UNFCCC process have been debated in the Technical Multi-setoral Commission for the Environment (CTMA), created in 2000. CTMA is consultative in nature, presided by the Minister of the Environment and comprised of representatives from all the Ministries that handle activities with potential impact on environmental policy (MINAMB, MINADERP, MINERGA, MINPET, MINGEMIN, MINESCT, MINTRANS, MINTETI, MINCO, MINFIN and MAT). The Technical Evaluation Commission can request the participation of representatives from other Ministries or other relevant entities to execute specific tasks

Among its responsibilities, CTMA must issue opinions on:

- Sustainable development measures by several sectors of the national economy;
- Formulation and implementation of strategies, policies, programs and actions pertaining to environmental protection;
- Preparation of legislative projects related to the environment and the sustainable use of natural resources;
- Awareness rising of specialized personnel.

The National Commission on Civil Protection (CNPC) is the inter-ministerial entity that advises the Government in matters of civil protection and issue opinions about the organization and workings of civil protection agencies, sectors legislation and approval of the National Emergency Plan.

Province Governors participate in the Commission meetings that deal with subjects of interest to their respective provinces. The CNPC is the institution specialized in technical assistance and operational coordination of the activities conducted by all civil protection structures and organizations.

The Inter-ministerial Commission on National Energy Security was established by resolution 8/09 of January 30th, with the intent of coordinating all work related to the preparation of energy strategies and policies, as well as the energy security program, defining the institutional structure responsible for the coordination, follow-up and control of the implementation of these instruments and guiding the preparation of the energy balance and the energy matrix.

The Poverty Reduction Strategy (ECP in Portuguese), approved by Resolution 9/04 of June 4th, includes environmental considerations, in conformity with the Millennium Goals, some of which related to climate change. In fact, the measures presented about Sustainable Development of Natural Resources include: evaluating the state of degradation of natural resources with mapping studies of vulnerable areas, reforestation and promotion of pilot-activities against ravines using biological techniques.

The 2010-2011 National Plan, approved by way of Law 1/10 of January 15th, has the objective to implement a rural and suburban development policy that will mitigate the quality of life disparities between rural and urban areas, rehabilitate and develop the infrastructures necessary for the reconstruction and development of the country, promote an accelerated industrial development to replace imports, ensure the rapid urbanization of the shantytowns and the modernization of urban communities.

Same activities planned in 2010-2011 National Plan that are relevant to the issue of climate change and environment includes:

- Development of a National System for the Control of Environmental Indicators, awareness raising, meteorological observation networks with coverage to all the province capitals; awareness raising of the national network of seismic surveillance, with the goal to cover all areas that are sensitive to this natural phenomenon; initiation of the National Centre for awareness raising of Experts in Meteorology and Environment; and alignment of services provided with public interest, funding observation networks and fostering investigation and development. The Plan also establishes the creation of a strong National Traditional Knowledge System.
- At the territorial planning level, it is part of a set of prescribed activities to regulate cartographic and record activities, register lands, modernize the national geodetic network, and update national cartography to the 1:100.0000 scale. It is also part of the Plan to implement and manage the national system of geographic information, to prepare instruments of territorial planning (Provincial and Municipal Plans) and strengthen the institutional and technical capabilities of central and local services in the preparation and implementation of these instruments.
- When it comes to adaptation measures for the agriculture and fishing sectors, the Plan prescribes: promoting action to sensitize all players in the agrarian development process to the need for a sustainable management of natural resources, specifically soil, water, forestry and biodiversity; creating pilot-projects for managing natural resources and, based on the experience gathered with such projects, formulating an environmental policy; afforestation and reforestation of areas close to communities, encouraging the creation of communal forests; revitalizing and diversifying the rural economy, contributing to the fight against hunger and poverty, improving living conditions for farming families and ensuring greater food security. That National Plan also calls for MINADERP, in partnership with the commerce sector, to ensure the existence of strategic food reserves in recommended levels, promoting the creation of logistic platforms that will serve the double purpose of articulating the territory and valuing Angola's geostrategic position. In fishing, the Plan's objectives are to encourage scientific investigation, innovation and the promotion of traditional knowledge, improving natural resource management and managing the coastal area in a more integrated way.
- When it comes to water resources, both in the surface and underground, the Plan calls for a permanent inventory making process, applying the rational and integrated management approach to each and every hydro graphic basin, and adopting measures to ensure a better control of adverse natural effects, such as flooding and droughts. It also prescribes the promotion and development of traditional irrigation systems, building or rehabilitating small ones, with dams or with the introduction of pumping systems.
- At the environmental level, the plan prioritizes the inventory and management of national humid zones, rehabilitating Parks and Natural Reserves, developing a National Waste Strategy and institutionalizing the provincial participating entities. Once again, measures on

atmospheric emissions are not outlined. Another priority is to improve the environmental management mechanisms in geology and mining, through follow up, regulation of corporate activities and studying of environmental impacts.

- In the energy sector, the National Plan establishes as priorities some measures with potential positive impact on mitigating climate change. One of them is the implementation of the National Electrification Program, which includes: defining a plan for rural electrification, followed by decentralization to provincial governments and municipal authorities of medium and small distributions; promoting the development of local sources, such as mini or micro hydroelectric plants; increasing and diversifying production of electricity from sources such as hydro, solar, wind and biomass; and creating a logic of producing entities that are interconnected and sell energy to a national network.
- In the construction sector, the emphasis is on continuing the fight against erosion and adopting measures to contain it, regulating the situation of riverbeds in critical condition. Also on the agenda, consolidating a structured network of public transportation at the municipal, provincial and inter-provincial levels, ensuring greater mobility for people as well as inter-mobility between different modes of transportation.

The process of implementing the Convention requires the involvement and participation of different partners as well as the population as a whole. Local communities' awareness on climate change is beginning to grow, but it is still deficient. It is important to educate, graduate, inform and sensitize the general population about climate change, its impacts and the necessary local adaptation measures. For that, it is necessary to establish an effective and reliable information delivery system, which requires properly equipping institutions specialized in this field to do just that.

In order to increase the country's response capability to current and future challenges, it is required that a balance is struck between capabilities at the different levels of performance as well as in different sectors. Strengthening strategies must be adopted to lead the country toward a satisfactory level of balance between the different types of partners (public administration, civil society organizations, and the private sector) and between the local and central levels of government.

An evaluation was made during the preparation of the initial national communication in 2005, revealing the following needs:

- Development of capabilities in the proper methodology to prepare GHG emissions inventories;
- Lack of experts in evaluating vulnerabilities and adaptation;
- Strengthening of capabilities in relevant methodologies, models and software related to mitigation analysis, as well as vulnerability and adaptation;
- Limited human resources for identifying and removing barriers for environmental technologies;
- Insufficient human resources for the collection and monitoring of climate data, among others.

The process of compiling the National Communication highlighted a series of difficulties, in the preparation of the GHG emissions inventory, vulnerability and adaptation, mitigation, technological transfer etc., all leading to a preliminary study conducted in 2010 about the country's existing capacities. The main difficulties included limited understanding or familiarity with the issue of climate change, limited data availability, limited technical cooperation between different institutions, difficulties in preparing data for processing in the IPCC's inventory software.

During the capabilities study, a questionnaire was distributed to several ministries, public institutes, local administrations, and universities. Given the crucial role played by these organizations, interviews were conducted within the Ministries of Agriculture, Rural Development and Fishing, Energy and Water, Oil, Industry and Territorial Administration.

Gathering information has shown that in most institutions there is not enough awareness on the issue of climate change or proper understanding of its impact over the competences and activities of each institution. Only a minority of the respondents considered that climate change might interfere in their activities. These same respondents also believe that climate change is a global challenge in which they are required to participate through local actions.

The perception of institutional capabilities for different kinds of action is significantly balanced. About one third of the institutions answered that it was more capable to perform adaptation activities, about 30% claims to be better equipped for education/ awareness raising activities, and the other 30% feels more capable to perform investigation activities.

A significant portion of the respondents considered that their institutions are not capable of dealing with the problem of climate change. The vast majority (90%) indicated that there is a need for institutional strengthening to address challenges presented by climate change. Institutional representatives are aware of the need to prepare Angola to undertake its part in the global challenge of climate change.

Preface

As stated in Constitutional Law, the protection of the environment and our natural resources is a duty of the State, which, by elaborating strategies, policies and legislation, adopts specific programs and rules, nationally to ensure the protection, conservation and sustainable use of natural resources.

In the institutional context, the Ministry of the Environment (MINAMB) is the public administration entity responsible for the coordination, preparation, execution and inspection of environmental policies, namely within the realms of environmental management, biodiversity, environmental technology, climate change, prevention and evaluation of environmental impact, as well as education and awareness.

The fact that Angola has joined both the UNFCCC in 2000 and the Kyoto Protocol in 2007 has led the country to implement commitments made in these international legal instruments. One of these commitments entails the evaluation of the country's climate situation, as well as the adoption of measures to mitigate, reduce or eliminate emissions by sources and sectors.

So we present this National Communication to the United Nations Framework Convention on Climate Change that fulfils Angola's commitment to implement national actions aimed at reducing GHG emissions into the atmosphere, as well as elaborating a mitigation and adaptation programs to deal with the effects of climate change.

The issues presented on National Communication are based on the principles that define an Action Plan, identifying ways and mechanisms to be used and indicating possible benefits to the Republic of Angola of implementing the instruments created by the Convention and the Kyoto Protocol:

- Protection of the climate system in order to benefit present and future generations, according to the country's responsibilities and capacities, and taking into account the common but different responsibilities resulting from the different commitments made by developed and in developing countries;

- Taking precautionary measures to anticipate avoid or minimize the causes of climate change and mitigate its adverse effects, including the cost-efficiency principle regarding these measures. Defining such measures must take into account the socioeconomic context of the country; they also must be applicable, cover all sources and reservoirs of GHG and encompass all the economic sectors with activities that directly or indirectly affect climate change;

- The efforts against climate change can be conducted in cooperation with different governmental departments directly or indirectly interested, the private sector and environmental organizations from civil society. This cooperation must equally include the principle of international cooperation to achieve the goals set

With Angola joining the UNFCCC and Kyoto Protocol, these instruments become part of the country's judicial order. Beyond these agreements, Angola is also part of several other multilateral accords related to environmental preservation.

The Angolan legal framework, comprised of the legal instruments mentioned above, is relatively innovative when it comes to environmental management, as well as taking into account aspects related to environmental protection and preservation in the products and services sectors. However, an effort must be made to adopt norms and measures to mitigate atmospheric pollution, burnings in forested areas, and the unsustainable use of coal and wood as sources of energy.

This report presents an outlines of an action plan address the difficulties and constraints that environmental managers has faced since this country's attained independence, constituting an important contribution to a growing awareness about the environment that all people live and the latent causes of climate change. Its publication shows the government's commitment to make available to the entire citizen a clear and comprehensive information on pertinent climate change issues as they affect the Republic of Angola.

My sincere gratitude to all institutions both National and International as well as everyone who has contributed, in one way or another, to the preparation of this national climate report.

Maria de Fátima M. Jardim

Angola's Minister of the Environment

Introduction

According to Article 4 of the UNFCCC, each party must develop, periodically update, publish and submit to the Conference of the Parties its national inventory of man-caused emissions by source, as well as an account of carbon sequestration in sinks, of all GHG not controlled by the Montreal Protocol.

Taking into account the elements that must be communicated to the Conference of Parties, as described in Article 12 of the Convention, in the mid-term the following must be completed:

- ✓ National inventory of man-caused emissions by source, as well as an account of carbon sequestration in sinks, of all GHG not controlled by the Montreal Protocol, according to the country's capacities and using methods comparable to the ones promoted and agreed upon by the Conference of the Parties;
- ✓ A general description of the steps taken or planned by the Party to implement the Convention; and
- ✓ Any other information that the Party considers to be relevant to achieve the Convention's objectives and wishes to add to the communication, including, if possible, subjects relevant to the calculation of global emission trends.

This National Communication aims to inform the international community, through the Conference of the Parties of the UNFCCC, about the country's situation in terms of GHG emissions and proposed measures to reverse the observed trends and to adapt to climate change.

The Angolan National Communication format follows the guidelines contained in Decision 17 of the 8th Conference of the Parties (document FCCC/CP/2002/7/ Add.2, of March 28th, 2003) – Guidelines for the preparation of the National Communications of the Parties not included in Annex I of the Convention. The structure of each chapter was developed based on this Decision, adjusting it, obviously, to the national circumstances and to the programs and actions developed within the country.

The Angolan Government presents its Initial National Communication to the Convention, composed of three parts. The initial part presents the national circumstances, providing a general overview and taking into consideration the complexity of the country, as well as its priorities and development. The second part includes the inventory of man-caused emissions by source, as well as an account of carbon sequestration in sinks, of all GHG not controlled by the Montreal Protocol.

The third part presents the actions planned already implemented in the country, and is itself divided into two sections: a) Programs containing measures related to the mitigation of climate change; and b) Programs containing measures to facilitate the adequate adaptation to climate change, being those the actions that contribute, directly or indirectly, to the realization of the Convention's goals, as well as describing other information considered to be relevant to the achievement of these goals, including: transfer of technology; research and systematic observation, education, awareness raising and awareness; development of national and regional capabilities; and information and network development.

The preparation of the GHG inventory provides a concrete answer to the problems related to GHG emissions, upon which the Parties agreed to implement to reduce GHG emissions and, at the same time, establish appropriate adaptation measures to the results presented by the fourth IPCC report, that indicates a temperature rise of 1,5 degree in the next few years.

In order to prepare the inventory, a training seminar for Angolan technical expert was held on the subject of GHG inventories, according to tools prepared by the IPCC. The seminar was held in August of 2009, with the participation of several institutions from the five sectors that comprise the inventory (Energy, Waste, Forestry and Land Use, Agriculture and Industry). The training concluded that the GHG Inventory should be made according to the models and methods established by the UNFCCC for developing countries, referencing the years 1995, 2000 and 2005.

This consideration pertains to the fact that Angola was involved in a armed conflict up until 2002 and also address to paragraph 7 of Decision 17/CP8, which rules that countries not included in Annex I should prepare GHG inventories having 1994 and 2000 as base years for the initial and second communications respectively.

The five areas on which the inventory focused were identified during the stocktaking exercise as Energy, Industrial processes, Agriculture, Land use Changes and Forestry and waste; and are in accordance with the guidelines contained in Decision 17 CP8 on preparation of National Communications by non-Annex I Parties and the IPCC Matrix. Data used to compose the report were gathered from official sources or calculated by experts from the respective fields, according to the existing knowledge or information levels in each area.

In 2003 (data from the 2005 UNDP report), the country's Human Development Index reached 0,445, which placed Angola in the 160th position amongst 177 countries.

The average age of the population 20, 40% was less than 10 years old and only 2% was 65 or older. This age structure determines an elevated dependence on an active population and, in the mid-term, a great workforce supply.

The social landscape for the period in reference can be summarized by the following: extreme poverty, exodus from the rural areas to the urban centres (with the end of the conflict, the people that returned to their province of origin returned mostly to suburban areas); high rates of unemployment; sharp unbalance between supply and demand of goods and services; disparity between national income distribution and population growth; deficient academic, professional and scientific education of economic agents; high levels of bureaucracy in the legalization of companies; and absence of investment, financing and incentive policies to small and micro businesses.

In order to deal with this situation, the government produced a Poverty Reduction Strategy, based on the following goals: social reinsertion, security and civil protection, food security and rural development; education, healthcare, HIV/AIDS, basic infrastructure; employment and professional training, governance, and macroeconomic management.

It can be said that for the past 20 years the structuring sectors of the internal economic order – buildings and public construction, transformative industry and energy – have been paralyzed, making its relative average participation about 7,3% of the GDP.

In 2004, the GDP structure was divided as follows: 8,8% (primary sector); 60,2% (secondary sector, with 54% of that corresponding to the Oil and diamond sectors); and 31% (tertiary sector). The economy continues to depend heavily on the Oil sector, which is highly technological, does not require a significant amount of local workforce and depends on what international markets and global strategies for Oil production establish each year.

On the other hand, Agriculture has been the main source of income (the sector has employed about two thirds of the workforce) and food supply, being therefore key to food security. However, this activity has always been practiced in a large part of the country as a subsistence activity, with rudimentary methods and limited means. Expansion programs were not broad enough to meet the sector's needs, increased by the return of refugees and displaced peoples to their places of origin. Localized problems correspond to pollution and degradation of natural resources resulting from the operation of businesses that explore natural resources.

Problems directly related to the country's circumstances, affecting high percentages of the territory and the population. Generalized poverty, the country's weak institutional capacity, and the illegal exploration of resources have provoked the destruction of those resources, sometimes permanently. For the referenced period, the main threats to the environment are:

- ✓ Soil erosion, originated by over-exploration in agriculture, over-utilization of pastures and deforestation in certain areas, leading to the weakening of the soil in terms of nutrients and its exposure to aggressive agents, sun, water and events;
- ✓ Water pollution and desertification of rivers and dams, with an impact on biological water resources and the drinking water supply;
- ✓ Loss of biodiversity due to over-exploration of resources, hunting, burnings, wood and coal exploration, and nomadic agriculture.
- ✓ Deforestation in the range of 450 km^2/year.
- ✓ Over-fishing and shortening of the fishing seasons;
- ✓ Air, soil and water pollution in the cities, due to the lack of adequate management of solid, liquid and gas waste; an area that requires policies and legislation of its own.
- ✓ Other man-caused pressures, such as the mining industry or the changes to river itineraries, which contribute to pollution and the destruction of the ecological balance in rivers and other humid zones.

By ratifying both the UNFCCC in 2000 and the Kyoto Protocol in 2007, Angola has made a commitment to uphold these international legal instruments. This National Communication aims to establish the intervention framework from the legislative, technical and human standpoints, to contribute to the stabilization of GHG emissions and the country's technological development.

The Government of Angola through its Ministry of the Environment was entirely responsible for the preparation of this National Communication. The government enjoyed financial support from the Global Environment Facility (GEF), and technical assistance and project management support from the United Nations Environment Program (UNEP).

Institutional Arrangements

The handling of the environment and of all issues pertaining to it was established by the Organic Statute of the Ministry of the Environment. The National Strategy for the Implementation of the UNFCCC and the Kyoto Protocol has set the intervention framework for Angola in the legislative, technical and human domains, to contribute to the stabilizing of GHG emissions and technological development of the country. It is also charged with generating reports and inventories about GHG emissions in Angola and their impact on the environment and public health; producing programs and projects with measures to mitigate the effects of climate change; developing technical and professional training actions in areas related to climate change; fostering international cooperation within the context of climate change, particularly in terms of transfer of knowledge, experience and technology; and instituting the Designated National Authority (DNA), under the Ministry of

the Environment, as the entity responsible for coordinating inter-sectoral efforts for the implementation of UNFCCC in the country on the issues related to CDM.

The strategy has identified some mechanisms of cooperation in the climate change such as the Clean Development Mechanism (CDM), which can generate additional profits through the monetization of carbon reductions, and functions based on a cycle of projects identification, viability analysis and development of the project conception document, being this subsequently implemented in accordance with the pertaining legislation (EIA – Environmental Impact Study – and proper licensing) and monitored through verification, certification and emission of credits, thus contributing to the sustainable development of the country.

DNA has its attributions defined through Government Order 2/10, being responsible for the execution of all CDM actions pertaining to the implementation of UNFCCC in the country.

General Considerations

Innovation is consolidated as a stalwart of competitiveness and globalization, and it must be accompanied by transfer of technology. When it comes to climate change, there already are clean technologies capable of replacing current technological processes. The great debate is about the massification and transfer of these technologies at an accessible cost to developing countries that wish to reduce GHG emissions.

Current evidence, high temperatures, frequent floods and changes in rainy seasons are by themselves indicators of climate change in Angola, so there is a need to generate dialogue and prepare mitigation and adaptation plans through technologies that exist in other countries.

Methodology

In general, the methodology used to prepare Angola's National Communication followed the guidelines for preparation of national communications of parties not included in the Annex I of the United Nations Framework Convention on Climate Change.

Internally, beyond the document guidelines agreed upon with the United Nations Environment Program and the Global Environment Fund, inter-sectoral participation according to the intervention area of each institution and its respective approach were integrated to the document.

Therefore, for subject matters related to GHG emissions, all entities that contribute to emissions in the following sectors – energy, industry, agriculture, forestry, land use and waste – were integrated. The tool used to calculate emissions was the software prepared for the Convention by the IPCC.

In order to analyze vulnerabilities and adaptation mechanisms, the following sectors were integrated: Territorial Administration, Agriculture, Industry, Civil Protection, Energy and Waters, Fishing, Hotel and Tourism, Healthcare and Education. The situation in the southern part of Africa was emphasized, as well as vulnerable sectors in Angola.

In regards to mitigation, a correlation was made between GHG emissions and the energy matrix, using a tool called LEAP (Long-range Energy Alternative Planning System). Due to lack of information, the industry sector was not included.

For research and systematic observation, INAMET and similar sectors were involved in the gathering of meteorological, hydrological and technological information, identifying weaknesses and opportunities.

On education component, the Ministry of Education and related institutions were involved. A thorough analysis was made of all the climate change related actions fulfilled in the formal and informal sectors of the education system.

Regarding the integration of climate change into development plans and programs, all sectors were included; academic and scientific institutions and representatives from the private sector and civil organizations were later added.

The methodology chosen consisted in a bibliographical review, interviews and, in several cases, estimated calculations, taking into account the lack of information in many important sectors encompassed by the inventory.

Initially an invitation was made to the institutions included in the inventory (Energy, Industry, Waste, Agriculture and Forestry). The corresponding Ministries nominated representatives, who participated in educational seminars.

To implement the work, three consultants were identified for each area, in order to facilitate the gathering of information and not overwhelm them. This choice of consultants also had the goal to include as many people and institutions as possible in the process, strengthening the capacity to deal with similar situations in upcoming.

Chapter 1 – National Circumstances

Angola is located in the west coast of Africa, between the latitudes 4° 22′ and 18° 02′ South and longitudes 11° 41′ and 24° 05′. The country encompasses 1.246.700 Km^2, with a maritime coast of 1.650 km and ground borders of 4.837 km. Its maximum north/south length is 1.277 km and maximum East/West length is 1.236 km. Also included in Angola's Exclusive Economic Zone is the maritime area delimitated by lines corresponding to 200 nautical miles beyond its shores.

Angola borders with the Republic of Congo and the Democratic Republic of Congo in the north, with the Democratic Republic of Congo and the Republic of Zambia in the east, and with the Republic of Namibia in the South.

Its political and administrative divisions include about 1.671 villages, 547 communes, 163 Municipalities and 18 provinces, called: Cabinda, Zaire, Uíje, Luanda, Bengo, Cuanza-Norte, Malanje, Lunda-Norte, Lunda-Sul, Cuanza-Sul, Benguela, Huambo, Bié, Moxico, Namibe, Huíla, Cunene and Cuando-Cubango.

The weather in Angola is very diversified, due to the conjugation of several factors such as latitude (4 to 18 degrees), altitude (0 to 2.620 meters), orography, maritime currents (specially the Benguela Cold Current), hydrographic basins, such as Zaire, Cuanza, Zambeze, Cunene, Cubango and other smaller ones that lead directly to the Atlantic Ocean. Generally, the weather is divided into two more or less defined seasons: the dry, cool season called "Cacimbo", that lasts from June to September and the hot, humid and rainy season, which lasts from October to May. The precipitation levels also change according to region, being that rainfall is a practically daily occurrence in the north and almost never happens in the south, especially in the desert region. In the central plateau, the rainy season last almost eight months.

Figure 1 - – Administrative Map of Angola (Source: UN, Jan. 2004)

The relief patterns also vary, being characterized by a coastal area with 0 to 200 meters of altitude, and a breadth of between 200 km and 14 km in the Canjala region, that is followed by a transition

zone, which ranges from 200 to 1.000 meters of altitude, and then the Plateau Zone, which goes from 1.000 to 1.500 meters and comprises a large part of the national territory. In the central regional of the country, corresponding to Cuanza Sul, Benguela, Huambo and Huíla Provinces, there is, between the Transition Zone and the Plateau, a Marginal Chain of Mountains extending from 1.500 to over 2.500 meters (the highest peak is called Morro Môco at 2.620 m, Huambo Province). With all these varying factors, average temperatures also vary greatly from region to region: 26ºC in the north and below 19ºC in the south.

There are more than 47 River basins in Angola, directed at five main watersheds. The main five are Zaire (22% - green); Atlantic (41% - dark blue); Zambeze (18% - gray); Okavango (12% - blue, west of Zambeze); and Etosha (pink – to the south).

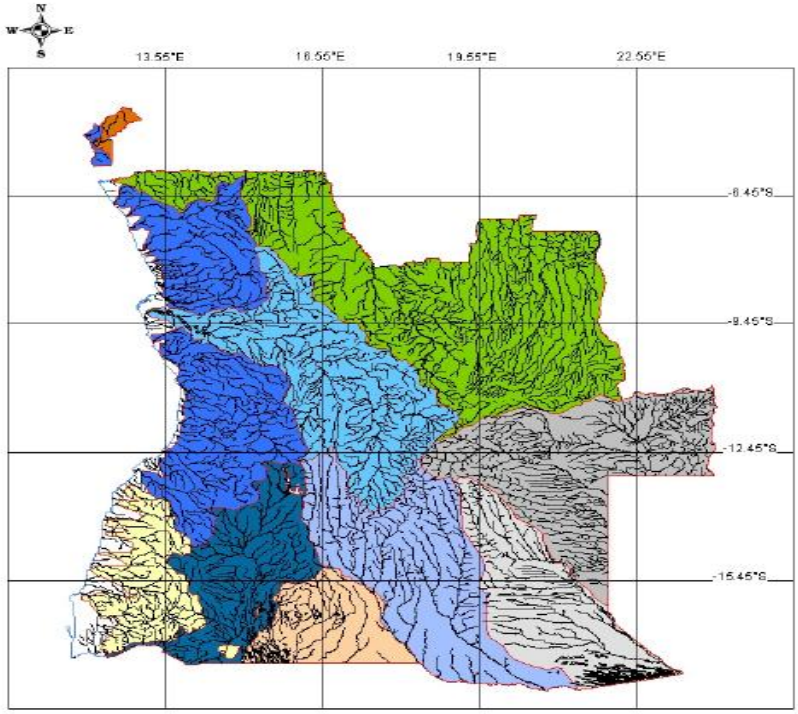
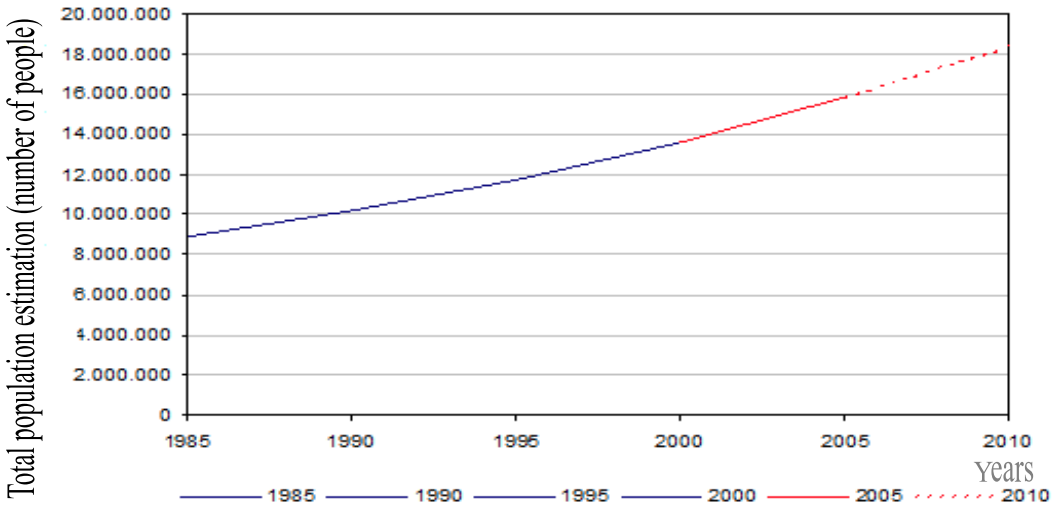


Figure 2 - Main hydrographic basins in Angola, (Source: Geographic Atlas, Vol. 1, 1982, in Angola's State of the Environment Report, 2005)

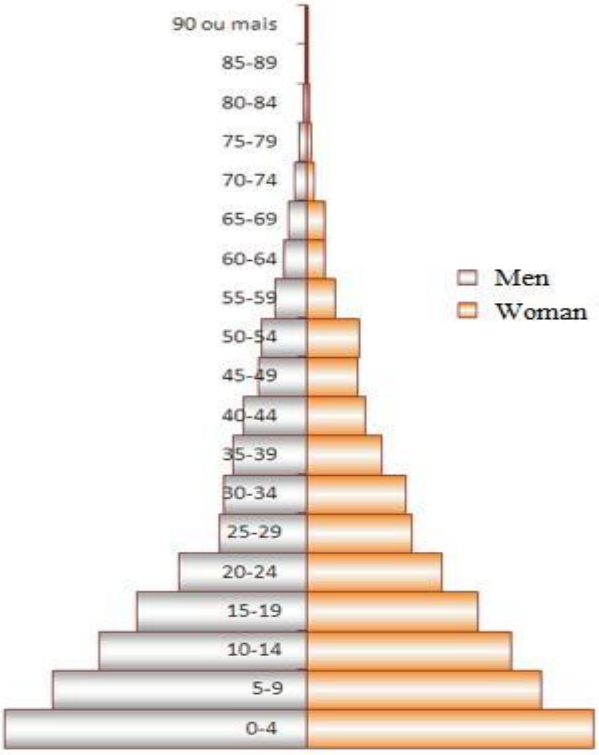
1.1 – Social Characteristics

Angola is a multicultural and multilingual country. Its population is estimated to be of 18,082,000 people (INE2010). The demographic density is approximately 13,2 people per km^2, a low number when compared with the African average, which is 21 people per km^2. The Angolan population is very young. About 50% of them are less than 15 years old, while 60% are less than 20. 93% of the population is 50 years old or younger.

The war for independence, followed by a civil war, which lasted until 2002, had severe repercussions over the demographic structure of the country, since a large portion of the population was forced to leave their place of origin and migrate in mass to the urban areas, where they could find some degree of protection and security, as well as food donations. This had a great impact on the population distribution over the territory and its management. It is estimated that over half of the Angolan population now lives in urban centres, while maintaining rural living habits.



The average population growth rate is 3.5%. Life expectancy upon birth is 49 years and the infant mortality rate is 150 for every thousand live births, while the child and adolescent mortality rate is 250 for every thousand live births. The current birth rate is of 7.2 children per woman



The Angolan population is comprised mostly of ethnic groups of Bantu origin: Ovimbundu, Ambundo or Akwambundo, Bakongo, Lunda, Ngangela (Ovankhumbi), Ovambo, Herero (Figure 4).

There is a small minority of native peoples that are not Bantu, specifically the Kung (Bosquimanes).

Figure 5 - Angola's main native ethnicities and their distribution on the national territory (Source: Lusotopia, 2006)

A large part of the population is of mixed heritage. Miscegenation was common, originally between the different African ethnic groups that migrated into the territory, and subsequently, with the European population (especially the Portuguese) throughout five centuries of colonization.

1.2 – Economic Characteristics

The Angolan economy is characterized by high levels of growth, but also by an essential dependence on the oil sector, which represents 55% of the GDP and 95% of all exports. Despite this dependence, the country registers a remarkable macroeconomic stability, which is reflected in the stability of the national currency.

The non-oil sectors, which have the potential to absorb a considerable portion of the economically active population, are currently undergoing reorganization, reconstruction and awareness rising phase, especially the agricultural sector.

The rural sector, which comprises agriculture, forestry and livestock activities, is the second largest producing sector in the country, representing about 8% of the GDP, even though the existence of mines still constitutes an obstacle to rural development.

The roads, railroads and telecommunication networks, as well as all industry and the food distribution networks, destroyed during the armed conflict, are currently being reconstructed and rehabilitated due to large government investments.

The Angolan population's income rates are very low. There are still income discrepancies in the country as a consequence of the prolonged conflict it has been involved. The population's poverty level is reflected on the deficient access to food, potable water, sanitation, education, healthcare, electric energy and other commodities.

The dependence rate is estimated to be 92,3 out of every 100 people between the ages of 15 and 64, which indicates a high level of unemployment.

The macroeconomic picture in Angola for the years of 2010 and 2011 was established according to Oil production predictions and the expected behaviour of the crude oil price on the international market; diamond production and its expected price; and variables related to the established inflation and exchange rates, as well as other financial components.

The expected economic performance is positive, corresponding to a GDP growth rate of 7,5% and 9,8% in 2010 and 2011 respectively. The largest contribution to the projected economic growth comes from a series of sectors not connected to oil producing activities.

Table 1 - Annual Average Rate of Sectors Growth

Activity Sectors	2009	2010	2011
AGRICULTURE	29.1	10.7	12.6
FISHING	15.2	2.8	7.8

DIAMONDS	3.6	-8.9	4.0
OIL	-3.6	3.4	6.1
TRANSFORMATIVE INDUSTRY	9	20.0	15.0
CONSTRUCTION	12.3	10.0	12.0
ENERGY	10.9	21.2	20.0
MERCHANT SERVICES	-8.1	11.1	13.5
OTHERS	3.0	9.6	10.0
GDP COST OF FACTORS	0.8	7.5	9.8
GDP MARKET PRICES	1.3	8.6	10.4

Table 2 – Main Indicators of Socioeconomic Development in Angola from 2006- 2010

Designation	2006	2007	2008	2009	2010
Territory in km^2	1,246,700				
Population Demographic Density	16.038	16.526	17.028	17.547 13.2 hab./km^2	18.082
Demographic Growth Rate	3.5%	3.5%	3.5%	3.5%	3.5%
Population under the age of 15	7,217	7,437	7,663	7,897	8,136
Urban Population	50%	50%	50%	50%	50%
Rural Population	50%	50%	50%	50%	50%
General GDP	18.6	23.3			
Forested Area				43%	
Life Expectancy Upon Birth				49	

1.3 – Financing – Climate Change

The implementation of the Kyoto Protocol is fundamentally based on the trade of Certified Emission Reductions, derived from the implementation of projects established by Article 12 of the Protocol, and in accordance with the decisions made by the Conference of the Parties and the CDM's Executive Council, between the Annex I and non-Annex I countries. On the other hand, these activities are also based on market rules, under which several countries developed structures that would help them capitalize on this promising, prosperous market share.

Angola stands out due to its socioeconomic growth potential, especially in the industrial and agricultural sectors, as well as given its capacity to develop competitive structural projects, with scale and high rates of permanence in the market, and long-term sustainability. Finally, in this time of opportunity that will come upon Africa, it is crucial that Angola demonstrates, until the end of 2011, that it has both operational instruments and specific projects defined when it comes to the general CDM as well as the involvement in voluntary carbon mechanisms.

Angola also has to demonstrate that it has established the necessary tools for promoting and enabling the country to form private international partnerships, specifically the ones related to Annex II of the Kyoto Protocol, created for regional and even bilateral interventions, direct investments in projects located in developing countries, joint management of these projects and making them internationally profitable.

With this goal in mind, it is strategically important that Angola possesses a financial vehicle, operated by a bank. It is relevant as well that this vehicle should also involve State guarantees,

which would grant it status for long-term structure developments, with flexibility and the ability to manage risk. So it is formed a set of instruments capable of promoting the proper conditions for acquisition of international investment funds and investing partners, promoters and operators, in sectoral and multi-sectoral projects. It must also be capable of promoting the appropriate conditions for professional, measurable, reportable and verifiable independent management of each project, in accordance with the applicable international criteria.

1.3.1 – Financial Mechanisms and Sources

The UNFCCC manages mechanisms that finance actions and activities conducive to the achievement of its goals. There are other mechanisms, within the Convention, that act as operating entities in the context of financial investments. These are the Global Environment Facility (GEF), the World Bank and regional banks such as the African Development Bank. In order to help prepare the National Communications of developing countries, the GEF, during COP11, in conformity with the decision 17/CP.8, agreed to completely finance the preparation of these countries' communications.

Education and public awareness (Article 6 of UNFCCC) are promoted through decisions 2/CP4 and 6/CP7, which reaffirm the importance of community involvement in dealing with climate change issues, in accordance with what was established by the communication 4/CP9. These decisions also aimed to deal with the need for strengthening of available funds for the implementation of the New Dehli Program, related to public education, awareness and involvement of local communities. The actions were established in conformity with the decisions 1/CP11 and 11/CP2. Within this context, the funds required to implement actions to reduce GHG emissions and Adaptation in Angola can be acquired from the following sources:

- Fund for Least-Developed Countries;
- National Communications Support Program;
- Special Climate Change Fund;
- Adaptation Fund under the Kyoto Protocol;
- The State's General Budget; and
- Donations and Contributions from National Companies.

1.4 – Objectives and Priorities for 2010 / 2011

In order to proceed with the process of national rebuilding and socioeconomic development, the Government has prepared and approved the "Long-term Development Strategy 2025". The 2010&2011 program as the following goals:

- Promoting national unity and cohesion, as well as the consolidation of democracy and its institutions;
- Ensuring a high and sustained level of economic development, with macroeconomic stability, transformation and diversification of economic structures;
- Improving quality of life and human development in Angola;
- Stimulating the development of the private sector and supporting national companies;
- Promoting the insertion of Angola as a competitive force in the international community;
- Implementing a rural and suburban development policy that mitigates the discrepancies in quality of life between the rural and urban areas;
- Promoting an accelerated industrial development, with the objective of replacing imports;

- Rehabilitating and developing the necessary infrastructure for the reconstruction and development of the country;
- Modernizing the financial system and transforming Angola into a strong regional and international financial force;
- Defining and implementing an appropriate social protection and national solidarity policy;
- Ensuring the rapid urbanization of the shantytowns and the modernization of urban communities.

1.5 – Profile of the Different Socioeconomic Sectors

Angola is in a stage of reconstruction and development. With peace, the Government is implementing its long-term development strategy. The defined goals of Angola's strategy for the period between 2000 and 2025 are:

- Promoting employment and valuing human resources;
- Building a more just and equal society;
- Ensuring the sustainable use of the environment and natural resources, and mitigating desertification;
- Fostering competitiveness and developing the private sector.

In order to achieve these goals, a series of preparatory actions was approved, pertaining to all areas of Angolan life. In this initial phase, the priority is on basic infrastructure initiatives, such as means for communication, energy production, telecommunications, human settlements technical networks, new human settlements, and social equipment for general, technical, superior and healthcare education.

1.5.1 – Agriculture, Forestry, Livestock, Fishing and Food Security Sector

The sector faces a set of difficulties, such as:

- Lack of basic food products;
- Family agricultural explorations in disarray;
- Incipient organization of business pursuits;
- Deficient and disorganized distribution networks for agricultural and fishing products;
- Incipient organization of the fishing sector and related activities;
- Great deficiencies in the economic and social infrastructure of rural and fishing areas;
- Disarticulation of the rural areas, with technical assistance providing support and training;
- Functional inability to control forestry exploration and even the destruction of vegetation for several ends;
- Functional inability to control the health of bovine livestock, and of other animals of economic importance.

The sector needs to increase food production in competitive and profitable conditions, ensuring its distribution, which implies meeting a set of requirements, such as:

- Education and training of specialized personnel in several areas of knowledge connected to the sector;
- Availability of production factors; infrastructure, access to water, adequate production technologies, organization of the rural markets, means of transportation.

For the rural areas, the Government is betting on the construction and structuring of professional training centres for research and experimentation, in several levels, in an attempt to relaunch the rural economy with access to concessional bank credits, and improvement of the life conditions of peasant families, which will be made easier with the recuperation of roads and railroads.

1.5.2 – Commercial Sector

The commerce sector is one of the key development sectors, since a solid network of product exchange avoids the waste brought on by deterioration, especially when it comes to perishables, like food.

The sector faces some problems, such as:

- Non-existence of a logistical and distribution network;
- Great territorial asymmetries in the supply network and circulation of merchandise;
- Weak or even non-existence presence of rural commerce;
- Insufficient commercial infrastructures;
- Strong presence of informal commerce;
- Great distortions in distribution circuits and in terms of pricing and competition;
- Diminished capacity and qualification of technical and human resources in the sector.

1.5.3 – Oil & Gas Sector

The sector may have not suffered the effects of war directly, since it has developed significantly in the last few years, but even so, it has problems that must be addressed:

- Better insertion of Angola in the world energy market;
- Definition of technical reserves of oil and gas;

The structure required for the production of biofuels (ethanol) is currently being implemented in the Malange Province, where 200 thousand hectares' have been set aside for the cultivation of sugarcane. Other projects included in Resolution 122/09 of December 23rd and the Biofuels Law (6/10 of April 23rd), and contained in the Angolan Strategy for Development of Biofuels, are being developed.

1.5.4 – Mining Sector

Angola is a country with great diversity of mineral resources, this sector presents significant problems, such as:

- Insufficient knowledge of Angola's mineral resources;
- Absence of a global, sustainable, long-term strategy for the mining sector;
- Outdated, unregulated and non-consolidated mining legislation;
- Development of the sector, which is strongly dependent on foreign investment;
- Relative degradation and low operation of basic infrastructure.

Actions are being implemented for the technical training of personnel for the sector, fostering the diversification of mining exploration with the development of an industry from top to bottom.

Diamond exploration occupies a place of distinction, but there is, however, a low value added to the national economy. Illegal diamond exploration is a very serious problem not only for the environmental degradation that it causes in the places where it is conducted.

1.5.5 – Transformative and Extractive Industry Sector

Angola has inherited from the colonial period an insipid, poorly structured and antiquated industrial sector. After independence and as a result of civil war and the massive exit of the colonial era administrators and proprietors, the transformative industry became more and more depredated until it completely shut down, which led to the import of a large part of all manufactured products. In the current context, this picture is being reversed due to incentives given to the cause of awareness raising for industrial processes and industrialization of the country, with preference for national capital, reinforced by international capital. Incentives are also given with the intention of reducing importing and promoting the exporting of finished goods. The creation of industrial poles or zones should facilitate these objectives, due to the possibility of concentration of infrastructure and services.

The extractive industry should still play an important role in exports, but in the midterm this trend should be reversed with the local transformation in finished goods. Both the transformative and extractive industries have a great deal of influence in the production of air pollutants and GHG. Therefore, a lot of attention must be paid to a sustainable industrial development, with the application of clean techniques and technologies which, in the mid to long term, should be very rewarding economically. The idea of advancing at any cost to compensate for delays in the past has no valid economic basis.

1.5.6 – Energy Sector

Due to the characteristics of its hydrograph basins, Angola possesses a large hydroelectric energy potential, at low cost, evaluated at 18.000 GW. When fully explored, it could be distributed to the entire national territory to cover current and future needs. The exceeding production could be then exported to neighbouring countries.

However, the sector faces some problems that must be solved, such as:

- The inexistence of an energy strategy and policy that integrates all sources and forms of energy use. The exceptional existing potential need to be used in an articulate way: 13 billion barrels of oil (a number that can be increased), 13 billion cubic meters of natural gas, hydroelectric potential superior to 15 thousand megawatts, coal, solar energy etc.;
- The installed capacity is still much smaller than it could be and the three main systems of energy production are not interconnected;
- Great difficulties in transportation and electric energy distribution;
- Severe losses and deviations of electric energy at the distribution level (more than 20%), being that half of the energy provided by the generator to the distributor is paid for.
- General absence of technical personnel in the sector;
- Near absence of the private sector in the production of electric energy.

As a result of this deficient production and distribution of electric energy, a large part of the population with some economic capacity, companies from several business areas and even a lot of

official services, use generators fuelled by gasoline or diesel oil, that are great sources of atmospheric pollution.

The sector is expected to play its role in increasing the economy's productivity, ensuring a supply of energy compatible with the demands of a growing economy and developing nation. For that, the prescribed objectives are as follows:

- Rehabilitating, modernizing and expanding the energy producing capabilities and moving on with the institutional reorganization of the electric energy sector;
- Promoting the development of the national transportation network, including interconnecting the North/Centre and Centre/South systems;
- Promoting the development of local energy sources, such as mini and micro hydroelectric plants;
- Initiating the National Electrification Program;
- Increasing and diversifying electricity production with the use of all sources (hydro, solar, wind and biomass);
- Ensuring a tax system that guarantees the return of operating costs and protects vulnerable population groups;
- Ensuring the correct management of the systems through systematic operational and maintenance;
- Promoting a reform of the sector based on the already approved Directive Plan;
- Promoting the permanent formation of a personnel roster for the sector.

1.5.7 – Transportation Sector

The transportation sector, given the near elimination of the industrial sector, must be at the moment the one that contributes the most to atmospheric pollution through the use of fossil fuels. The existence of a large fleet of automobiles and the lack of quality and maintenance control, the intensive use of air travel, with a lot of airplanes that don't go through any form of pollution control, and the abandonment in public streets of a large number of obsolete or crashed vehicles, undoubtedly contribute to the fact that the sector is considered to be the main producer of GHG.

The maritime transportation area also plays an important role in pollution, especially in relation to port waters and adjacent areas.

In short, it will be very difficult, due to a lack of data, to present exact numbers of polluting gas production by the transportation sector.

When it comes to reconstruction, it is expected to facilitate a more intense circulation of people and goods, and for that to happen the following objectives must be pursued:

- Consolidating a structure network of public passenger transportation at the municipal, provincial, and inter-provincial levels, ensuring more mobility for people and a interconnectedness of different modes of transportation;
- Effecting the launch of railroad transportation through a rational and commercial exploration of the sector, which is appropriate to the needs of the people, business owners and agricultural producers, as well as assuring the awareness raising of railroad shops and equipment;
- Continuing actions that aim to unclog the country's ports and building new initial-rate or second-rate port infrastructures that will ensure the fluidity of international commerce and significantly reduce the high costs bared by the economy;

- Consolidating the restructuring of the air travel sector, sustaining its national and international development, modernizing airports and instituting a national aeronautic regulation up to par with international standards;
- Initiating the sustained launch of maritime activity in Angola, both in the national and international levels, improving security and inspection throughout the Angolan coast.

1.5.8 – Water Sector

Water resources are probably one of Angola's greatest riches, especially since the world is moving toward a quality water shortage. Only recently, an independent regulation body has been created for the sector, and a sustainable use regulation is being prepared.

In southern Africa, where Angola is located, water resources must also be shared with other countries to the south, which increases the responsibility of serious management, generating a factor of political balance in the region.

However, there are still problems to be solved, including:

- Lack of information about the national water resources;
- Saturation and waste in the urban areas and lack of distribution in the rural zones;
- Fragile control of water usage, due to a lack of qualified personnel;
- Absence of regulating guidelines and of a development strategy for the sector.

1.5.9 – Communications Sector

Communications is not an area of concern when it comes to GHG production; what is worrying is the level of sound pollution by microwaves that cause atmospheric changes, given that its consequences to the atmospheric equilibrium are not yet fully known.

However, the new wave of mobile phones causes concern due to accumulation and abandonment in waste sites of batteries that contain severely toxic components.

1.5.10 – Hotels and Tourism Sector

The hotels and tourism sector has never been economically expressive in Angola, resulting in a deficient hotel network throughout the country. Only after 2002, with the achievement of peace, has the construction of new units and renovation of old ones began.

Verified tourism so far is business tourism. There is little demand for local tourist spots.

Starting in 2002, internal tourism began to have some expression, which has allowed the building of hotel units of some quality not only in almost all province capitals, but also in tourism spots.

For tourism to become a reality, it is necessary:

- To define tourism products to be developed and market niches to be prioritized;
- To establish a strategy and directive plan for the sector;
- To increase the offer of hotel installations and train the necessary human resources;
- To frame the environmental and ecological picture of the sector to avoid the distortion that a misguided development can cause;
- To define a system of incentives for the private sector.

Tourism must, more than a great source of revenue and a way to create jobs, project a positive image of the country abroad.

With the enormous amount of high quality tourism choices being offered globally, Angola must develop an offer based on its own natural resources, and its still existent wild areas (National Parks, beaches), being careful to maintain these characteristics and not transform these places into new urban centres.

1.5.11 – Education Sector

Education, the basis for every country's development program, still faces some challenges despite of the enormous efforts made since independence.

The severe lack of teachers with adequate training on the basic level, coupled with the destruction of the existing school system, specifically in the rural areas, has prevented several generations from having access to a proper education, resulting in a population without the basic knowledge they would need to be apt to work in one of the many professions the country needs and join the employment market.

On the other hand, this deficiency also limits the people's capacity to take responsibility for minimal professional obligations, which has led foreign and even local operatives to prefer expatriate workers.

Despite the significant efforts by the Government to form teachers for the primary and secondary levels of education, these teachers, for the most part, don't take to the profession, frequently abandoning their activities in the middle of the school year, or missing too many classes, and thus compromising the learning progress of new generations.

According to the 2025 strategy, the fundamental issues for the sector are:

- Low educational level of the population, with high rates of illiteracy;
- Disarticulation between the education and formative systems, and between those and the country's development needs;
- Need to connect the demand for access to education with the search for knowledge, competencies and qualifications;
- Articulation between the different educational subsystems;
- Low levels of efficiency, with elevated rates of failing and abandonment.

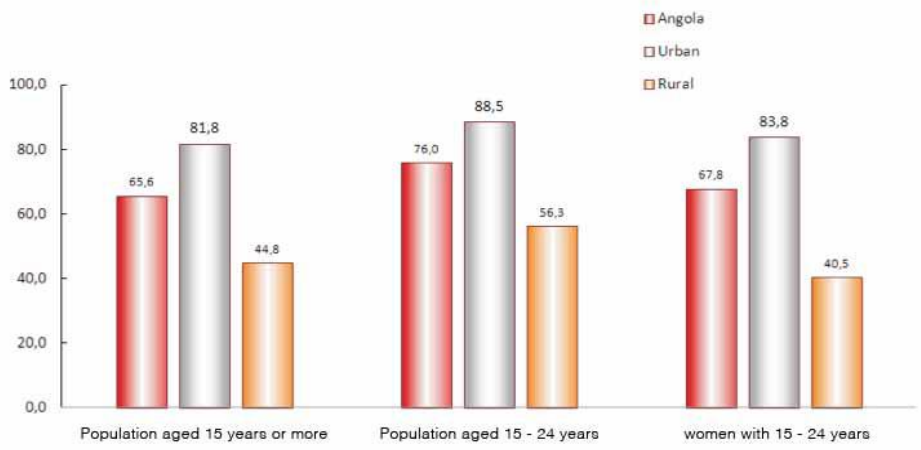


Figure 6 - Population with more than 15 Years that knows how to read and write, IBEP 2009

Thus, each and every GHG emission reduction policy must necessarily involve the improvement of the population's level of knowledge, which must be slowly raised to higher levels.

1.5.12 – Healthcare Sector

In relation to what was discussed about the education sector, the low levels of education and knowledge in Angola influence the healthcare sector, when it comes to:

- Low levels of nutrition and access to good conditions of sanitation, water and energy, leading to poor sanitary standards;
- High rates of maternity, infant and child/adolescent mortality;
- High incidence of infections and parasitic diseases, such as malaria, increase of HIV/AIDS prevalence and return of trypanosomiasis;
- Reduced coverage in healthcare infrastructures;
- Low level of healthcare spending per capita;
- Reduced numbers of technically trained personnel.

The total population with access to basic health services is resumed in figure 7.

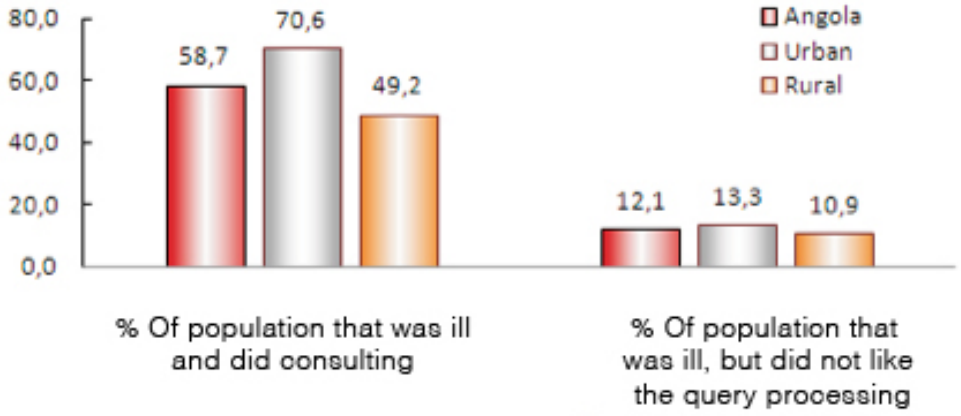


Figure 7 - Population with Access to Basic Health Services, IBEP 2009

1.5.13 – Housing Sector

Housing is the sector with the greatest number of problems in meeting the needs of Angolan citizens. From independence to the year 2000, little was done to increase the amount of housing options, making it difficult to buy or rent a home everywhere in the country. This problem is particularly disturbing to the country's youth.

The main issues are:

- Absence of a global and integrated housing policy;
- Low quality and overcrowded housing both at the urban, suburban and even rural levels, coupled by a severe deterioration of urban buildings;
- Weak quantitative and qualitative access to basic sanitation, water and electric energy, both in the urban and rural areas;

- A reduced number of cities with coverage, even partially, of sewage lines of waste water;
- A housing deficit of more than one million people.

In 2009, the government released a house building program, leaning more toward provinces that lack technical personnel, to encourage recently graduated youth in these areas to stay. The highest environmental standards must be met when building these houses so that they are not later abandoned due to poor living conditions.

1.5.14 – Cultural Sector

The protection of cultural aspects has not yet been disseminated to different sections of the population and one of the aspects that contribute to that is related to the fact that the national languages are not yet taught in the general school system. The main deficiencies in this sector pertain to:

- Absence of an integrated, articulate and structured cultural policy;
- Absence of combining the traditional cultures with positive aspects of modern times;
- Respect for linguistic diversity and cultural pluralism;
- Lack of qualified human resources, financial means and a clear deficiency in cultural infrastructures.

1.5.15 – Sports Sector

Sports have been an important element in the process of national unity, but the sector still has not been given due attention.

There are several shortcomings in the sector, among which we emphasize:

- Absence of a national strategy for the development of sports;
- Great deficiencies and regional asymmetries in the distribution of sporting structures;
- Lack of qualified technical personnel on all levels;
- Need to clarify the role of high competition sports.

1.5.16 – Territorial Administration Sector

The territorial administration sector is key to the administrative structuring of the country. For many years, there wasn't the preoccupation of putting qualified personnel in the local administrations, which resulted in an almost complete elimination of the government's presence at the municipal and communal levels.

Projects and action plans conceived a long time ago at the central and provincial levels had no response when they would get to the lowest administrative levels, exactly due to the lack of local competencies. Similarly, information that left the bottom to the top was not correct, which made it very difficult to adequately plan coherent administrative actions.

This fragility in local administrations did not allow agents from other sectors of national life, such as agriculture, education, healthcare, justice and others, to settle into small villages and communities. On the other hand, it did allow and facilitate the actions of elements from armed guerrilla factions.

1.5.17 – Science and Technology Sector

The Ministry of Superior Education, Science and Technology was recently formed, so there hasn't been enough time for it to perform its true role as a coordinator of scientific investigation activities. Even so, it must, in partnership with the Ministry of the Environment, assume the responsibility of gathering and dealing with the elements provided by the structures that must be mobilized in relation to climate change.

1.5.18 – Telecommunications and Information Technology Sector

Ensuring the expansion of the infrastructure that supports a supply of diversified information and communication services, which must be available to society as a whole, in all regions of the country, with high quality and priority status within the directive plan of the sector.

Postal Services – To provide universal postal services, promoting national integration through a network of multifunctional stations with diversified services;

Meteorology and Geophysics – To adjust the sector's services to the public's needs, emphasizing operational, economic and information network aspects, in conformity with investigation and development;

Information Technology – To promote the development of an information society, through the mitigation against digital exclusion and the expansion of electronic governance projects.

1.5.19 – Social Security and Labour Sector

The social security and labour sector is of fundamental importance to the lives of our citizens, given that this is the area that controls the workforce, promoting a constant search for technical and technological knowledge. The sector must also regulate labour relations between employers and employees and foster in both of these groups a greater level of satisfaction and perception that their needs are being met, therefore increasing productivity.

It is up to the sector to encourage the mastering and use of technologies and techniques with low pollution rates, including GHG production.

Even though it is a goal of the sector to "Promote access by all Angolans to produce qualified, rentable and socially useful employment", it still suffers from a number of deficiencies, such as:

- Reduced presence of structured employment (15% of total employment);
- High relative incidence of family and subsistence agricultural activities;
- Poorly qualified human resources (13% of formal employment can be considered qualified);
- High unemployment rate (33% without family agriculture and 23% considering family agriculture);
- Intense proliferation of micro-companies;
- Need to create about 8 million jobs until 2025;
- Inexistence of a Global Integrated System of Human Resources Planning.

1.5.20 – Environmental Sector

The environmental dimension of development claims for attention, promoting the need for sustainable development. In fact, the National Environmental Management Plan pursues the following goals:

- Developing a National Waste Strategy;
- Inventorying and managing national humid zones;
- Gradually rehabilitating Parks and Natural Reserves;
- Developing a National Environmental Indicators Control System;
- Developing the implementation process for the National Climate Change Program.

1.6. Climate and Environment

Angola's environmental face has changed drastically in the last decades. The vast forested areas have diminished, the savannah vegetation has changed due to human pressure, and a significant part of the coastal towns is in disarray due to the dislocation of rural populations to the cities.

In spite of the long war period, Angola continues to be, more and more, a nation that wishes to preserve natural resources and cultural values to future generations. Therefore wisdom, technical and professional skills are required to lay the foundation for sustainable development and at the same time meet the country's obligations in terms of participating in the global change process.

Angola has the conditions to contribute and perform its role in the mitigation against the climate change that so affects the continent and developing countries. In this context, access to current, reliable and timely information about environmental issues is a fundamental right, ensured by current legislation, as well as a governmental priority for more than 10 years.

This National Communication emphasizes the challenges that Angolans face in the next few years to ensure its future within a long-term environmental and socioeconomic sustainability framework.

When it comes to climate change, it must be mentioned that, in Angola, there are several sources of GHG emissions caused by man, and many of those are at the core of fulfilling the population's energy needs.

These basic needs are essentially connected to the production of fossil and biomass energy. The initial is highly unsustainable, as it emits GHG into the atmosphere, and the second, though renewable, contributes to the loss of biological diversity and equally introduces GHG, especially CO_2, into the atmosphere.

Other activities that have local impact over changes in climate parameters and contribute to global warming include deforestation; gas burnings associated with Oil production; transportation systems that prioritize individual mobility over public transportation; energy production from fossil fuels; some agricultural practices, especially uncontrolled burnings that are the single main source of GHG emissions in sub-Saharan Africa, including Angola.

The impact of these activities over the environment and over public health is considerable, even though it has not yet been quantified.

The data contained herein is what could be gathered from the several institutions that collaborated in the preparation of the GHG Inventory. For the most part, the data obtained represents a portion of the emissions. However, a large part of the information that could increase emissions is not documented, not having been possible to calculate estimations. This will be accomplished in the Second National Communication.

War has contributed greatly to the lack of updated information, given the access difficulties that remain in many places. Faced with this reality, it is vehemently recommended that priority is given to information management, given that this makes it possible for political decision makers to consider options based on scientifically proven facts and statistics, even if these don't represent the full spectrum of emissions and consequent impacts.

1.7. International Circumstances and Interface with the National Strategy for Climate Change

It is clear, however, that international action models to deal with the problem of climate change, especially when it comes to developing economies, in the UNFCCC and Kyoto Protocol frameworks, are being prepared for significant restructuring until the end of 2012.

It can be seen that there is room for readjustments, especially if corrections are made to the quotas initially set for former-soviet and eastern European countries. There will probably be a revision of the limits to credit imports by the main demand markets, starting with the European Union that, until 2015, may not need to import credits anymore.

In fact, there is confirmation today of the frequent difficulty of putting into practice, in a timely fashion, projects related to the clean development mechanisms; projects that would contribute greatly to the actual reduction of GHG emissions, ground permanent and sustainable measures and resources connected to the adaptation to climate change, or even contribute to the execution of financial compensations. This creates obstacles, especially for developing nations, which have structures that require more time and resources to adapt, and have to do it in a context of greater risk due to the volatility and maturity of the dominant market, the European Union.

Added to these characteristics to be corrected is the fact that projects associated with clean development mechanisms are not adequate to some of the larger African potential contributions to climate change adaptation and mitigation of GHG emissions, namely those that come from the correct management and promotion of lands and forestry. These have the distinction of being the main drains of carbon in the continent, which in itself should lead to the correction of models and the referred adoption of new paradigms in relation to climate adaptation and carbon mitigation.

Finally, in the case of Angola in particular, it is a priority that new solutions that can evolve from current clean development mechanisms, or from alternative and innovative solutions, should effectively accommodate the main factor of economic growth, diversification of economic activities, improvement of quality of life, and growth of the middle class, since the country shall be, in the next decade, one of the economies that presents higher levels of improvement in these areas globally.

It is in Angola's interest to adapt as soon as possible its action model in these matters to these new solutions, without jeopardizing the models that, in the UN Framework, must be developed. Angola intends to be proactive in contributing to these solutions, so that they can have effective, permanent and sustainable applicability to the reality of the country, but also because, in the face of Angola's potential in several areas, it can become a reference within the African continent in general, and the southern region in particular, in relation to climate change adaptation and mitigation issues.

The publication of these instruments and of the fundamental documents before the international community aims to confirm that Angola is definitely betting on good governance, quality and structuring characteristics of the projects that it intends to promote. It is known that, for these adaptation and mitigation measures to be successful, it is crucial to ensure the full and effective ability of self-verification according to the best international practices, giving credibility to new projects implemented by emerging economies. This would allow them to be inserted definitively into new markets that are being defined internationally. It should be emphasized that these solutions would have to be implemented in a regional scale, by activities sector, and based on voluntary initiatives by the countries for the promotion of policies and programs of multi-sector intervention.

Angola demonstrates today that the country's sustainable adaptation to climate change is definitely a national priority, sponsored at the highest levels, considering that it has:

- Adopted the UNFCCC in 2000 and Kyoto in 2007, formally adhering to these two international legal instruments;
- Published in September of 2007 its National Strategy for the effective implementation of UNFCCC and the Kyoto Protocol;
- Regularized in 2004 the Environmental Impact Studies;
- Instituted in November of 2009 the DNA (Designated National Authority);
- Concluded in 2011 the preparation of the initial National Adaptation Programmes of Action (NAPA) and the initial National Communication;
- Proposed, also by the end of 2011, the initial National Climate Change Adaptation Program;
- Regularized, during 2011, the legal and institutional framework and established the consequent attributions and responsibilities that formally implement and operationalize the Angolan strategy, actions, goals and resources related to adaptation and mitigation of climate change.

Angola propose to address the problems related to climate sustainability in a way that takes into account the country's environmental and socioeconomic characteristics, as well as development scenarios.

Chapter 2 – Greenhouse Gas Inventory

2.1 – Socioeconomic characteristics of the period of the Inventory

In 2003 (data from the 2005 UNDP report) the Human Development Index in Angola was 0,445, which placed the country in the 160th position among 177 countries around the world.

The average age of the Angolan population was 20 years, being that 50% was less than 15, 40% was less than 10, and only 2% was 65 or older. This age structure determines a high dependence on the active population and, on the midterm, implies a large workforce supply.

The social landscape for the period in question can be summarized by the following conditions: extreme poverty; exodus from the rural areas to the urban centres (with the end of the conflict, the population that returned to their original provinces relocated mostly to suburban areas); high level of unemployment; large discrepancies between supply and demand for goods and services; discrepancies between national income distribution and population growth; deficient academic, professional and scientific education of economic agents; bureaucracy filled system for legalizing companies; and absence of investment, financing and incentive policies for micro and small businesses.

In order to deal with these situations, the Government has produced a Poverty Reduction Strategy, based on the following precepts: social re-entry; security and civil protection; food security and rural development; education; healthcare; HIV/AIDS, basic infrastructure; employment and professional training; governance, macroeconomic management.

It can be said that for the last 20 years structuring sectors for the economy – such as construction and public improvements, transformative industry and energy – have remained stagnated, with average relative participation as 7,3% of the GDP.

In 2004, the GDP structure was as follows: 8,8% primary sector; 60,2% secondary sector – being that 54% corresponded to the oil and diamond trades; 31% to the tertiary sector. There continued to be an excessive dependence on the high technological Oil industry, which does not require significant local workforce and depends on what international markets and global strategies establish for each year.

On the other hand, agriculture was the main source of income (the sector employed about two thirds of the working population) and food supply, being therefore key to the issue of food security. Agriculture however has always been practiced in most of the country as a subsistence activity, with rudimentary methods and sparse means. Even so, expansion programs were still not enough to fulfil growing needs, due to the return of displaced peoples and refugees to their birth places following the end of the civil war.

Transformative industry has long been in decline in terms of infrastructure and diversification.

The five areas this inventory discusses were previously identified during the preparation of the document "Initial National Communication Project" and are in conformity with the guidelines contained in decision 17/COP8 (about the preparation of National Communications for countries not in Annex I), and the IPCC Matrix for the preparation of GHG inventories. The five areas studied are: Energy, Industry, Agriculture, Use of Land and Forestry, and Waste.

Data used for the preparation of the report were taken from official sources or calculated by experts from the respective fields, according to the existing level of knowledge or information of each area. On the other hand, a series of emission factors was used, some national, from the Luanda Refinery, and others contained in the Reference Manual for preparation of National Communications and the IPCC (Intergovernmental Panel on Climate Change).

2.2 – Sectors with Constant Emissions in this Inventory

Energy – In this sector, were considered essentially emissions from fossil fuel combustions in activities such as transportation, electricity production, public and residential lighting (generators), looking beyond the use of butane gas for food production in several sectors. Beyond these, a country with such large oil production numbers has to consider fugitive emissions of CO_2 and methane gas. To obtain the amount of gas burned in flares, was considered information contained in the report from the International Energy Agency, Angola – Development of the Energy Strategy, which stated that the amount was 10.336 million m^3 per year in 2000 and an estimated 27.700 million m^3 in 2009, considering the burning of 70% of the gas produced. Proportionally, the value for 2005 should be 16.158 million m^3. The gas considered was all natural gas, with density of 0,86 kg/m^3 and carbon percentage of 62% of the total mass. The oxidation factor was considered to be 95%.

Industry – For industrial processes, emissions were calculated for cement production and other industries, considering the near complete shut down the industrial sector was undergoing during the inventory years.

Land Use Change and Forestry – Emissions were calculated essentially by the deforested area corresponding to the use of wood by direct burning and for production of vegetal coal, as well as information on planted eucalyptus forests. Due to difficulties to obtain concrete information, emissions derived from deforestation, soil and abandonment of deforested areas were not calculated.

Agriculture – Emissions from this sector are essentially associated with burning in savannahs, rice production and livestock.

Waste – Waste emissions were calculated basically by daily waste production per capita, and sewage emissions were estimated using default values for the calculation of methane and nitrous oxide emissions.

2.3 – Methodology for the Preparation of the Inventory

The methodology chosen for the preparation of the inventory consisted of bibliographical reviews, interviews and, in many cases, calculations, taking into account the lack of information in many sectors of extreme importance for inventories of this sort.

Initially, invitations were extended to the institutions encompassed by the inventory (Energy, Industry, Waste, Agriculture and Forestry). The Ministries related to these specific areas nominated their representatives, who attended an awareness raising seminar conducted by the Brazilian consultant Mauro Meireles (Member of the GHG Inventory Review Group for Annex I countries).

To implement the work, three consultants from each sector were identified, so as to facilitate the collection of information and, at the same time, not overload them. This choice also aimed to involve more people and institutions and with that strengthen the creation of capabilities to deal with similar situations in subsequent inventories.

This section gives a general overview of estimated emissions related to the years 2000 and 2005, where the contribution of each sector mentioned above to GHG emissions can be seen. It is important to note that the base year used by the Conference of the Parties was 1994 for the initial national communication and 2000 for the second. Considering that during this period the country was involved in an armed conflict, the base year for Angola was set as 2005, but an effort was made to obtain as much information as possible about 2000.

For the reference year, estimated emissions were calculated in gigagrams (Gg) – or a thousand tons – of carbon dioxide equivalent (CO_2eq), which is obtained by multiplying CO_2 (carbon dioxide) emissions by 1, CH_4 (methane) emissions by 21 and N_2O (nitrous oxide) emissions by 310, according to the Global Warming Potential (GWP) established by the IPCC and adopted for the inventories. For the present inventory, in 2000 CO_2 emissions corresponded to 13.243 Gg, CH_4 ones were of 15.953,39 Gg CO_2eq and N_2O emissions total 13.944,01 Gg CO_2eq; in 2005 CO_2, CH_4 and N_2O emissions were of 29.261, 20.158,32 and 14.098,37 Gg CO_2eq respectively, as illustrated on tables 3 and 4.

Table 3– GHG Emissions, 2000

Sources of GHG Emissions, 2000	CO_2	CH_4	N_2O	total
	CO_2eq - Gg			CO_2eq - Gg
Energy – Fuel Combustion	2,701	9.43	10.18	22.311
Energy – Fugitive Emissions	13.406	6517,97	0,00	19.924
Industrial Processes	210	0,00	0,00	210
Agriculture	0	8911,30	13780,17	22.691
Change in Land Use and Forestry	-3.074	22,38	2,27	-3.049
Waste	0	492,31	151,39	644
Total	13.243	15.953,39	13.944,01	43.141

Table 4– GHG Emissions, 2005

Sources of GHG Emissions, 2005	CO_2	CH_4	N_2O	total
	CO_2eq - Gg			
Energy – Fuel Combustion	6.498	57,35	27,34	6.583
Energy – Fugitive Emissions	20.959	10.189,76	0,00	31.148
Industrial Processes	352	0,00	0,00	352
Agriculture	0	8.929,25	13.644,83	22.574
Change in Land Use and Forestry	1.452	226,08	229,45	1.907
Waste	0	755,87	196,75	953
Total	29.261	20.158,32	14.098,37	63.517

The graph below shows GHG emissions in Angola distributed by the sectors and years considered for this inventory.

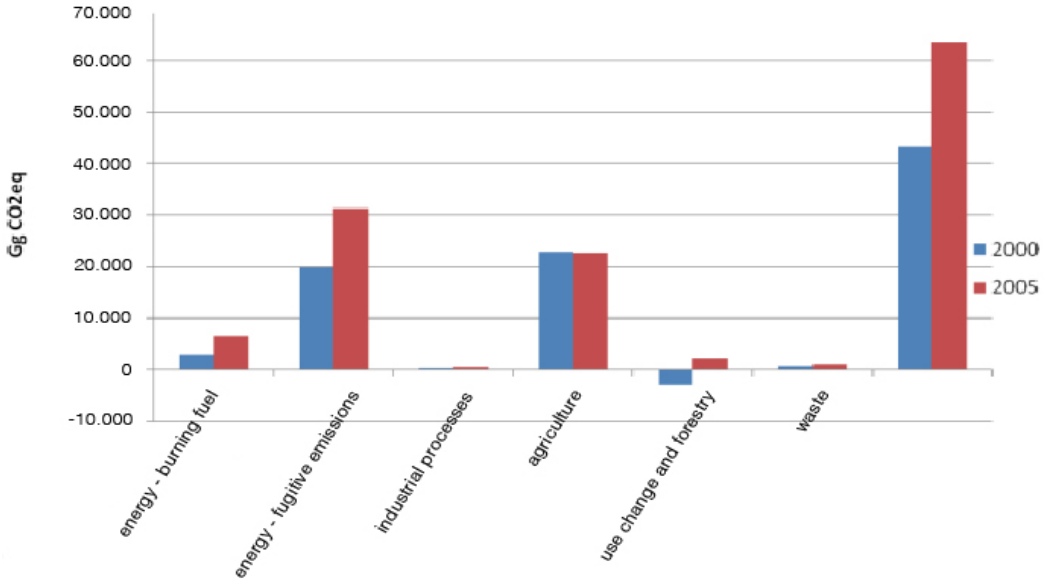


Figure 8 – GHG emissions in Angola for 2000 and 2005

2.4 – GHG emissions by sectors

In 2000 most emissions came from agriculture (49%), followed by fugitive emissions (43%), and emissions derived from fuel combustion (6%). Waste and industrial processes represented about 1% of emissions each. In 2005, emissions were distributed in the following way: 50% for fugitive emissions, 11% for combustion of fossil fuels, 37% for agriculture, and 1% each for waste and industrial processes.

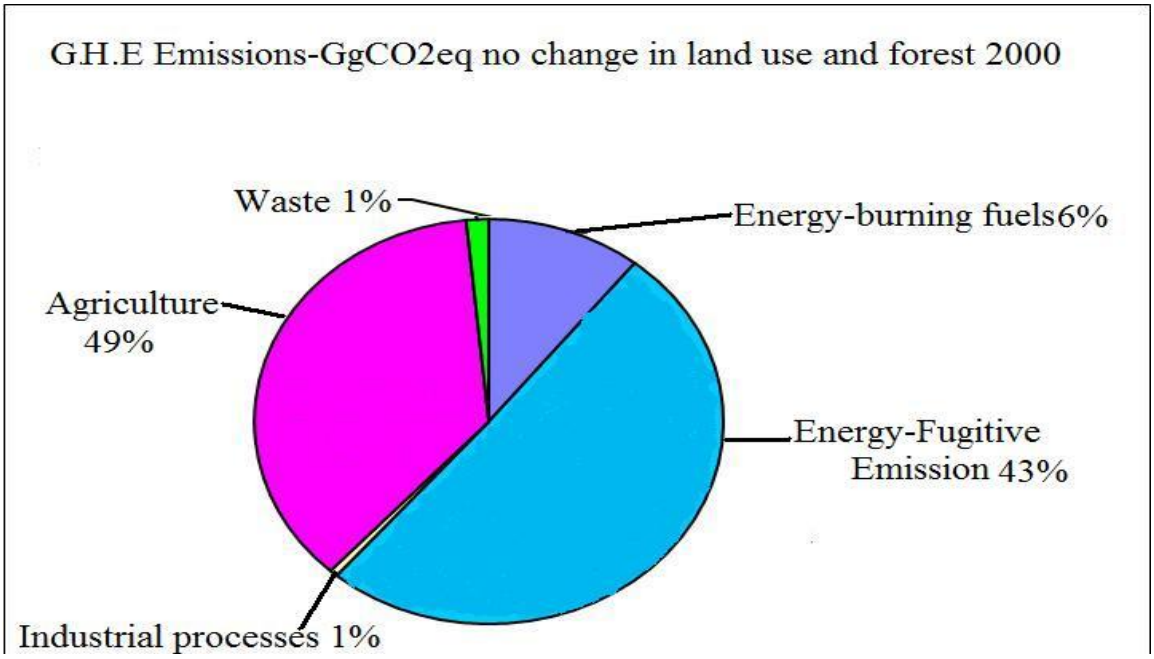


Figure 9 – GHG Emissions - GgCO2eq without Land Use Change and Forestry (2000)

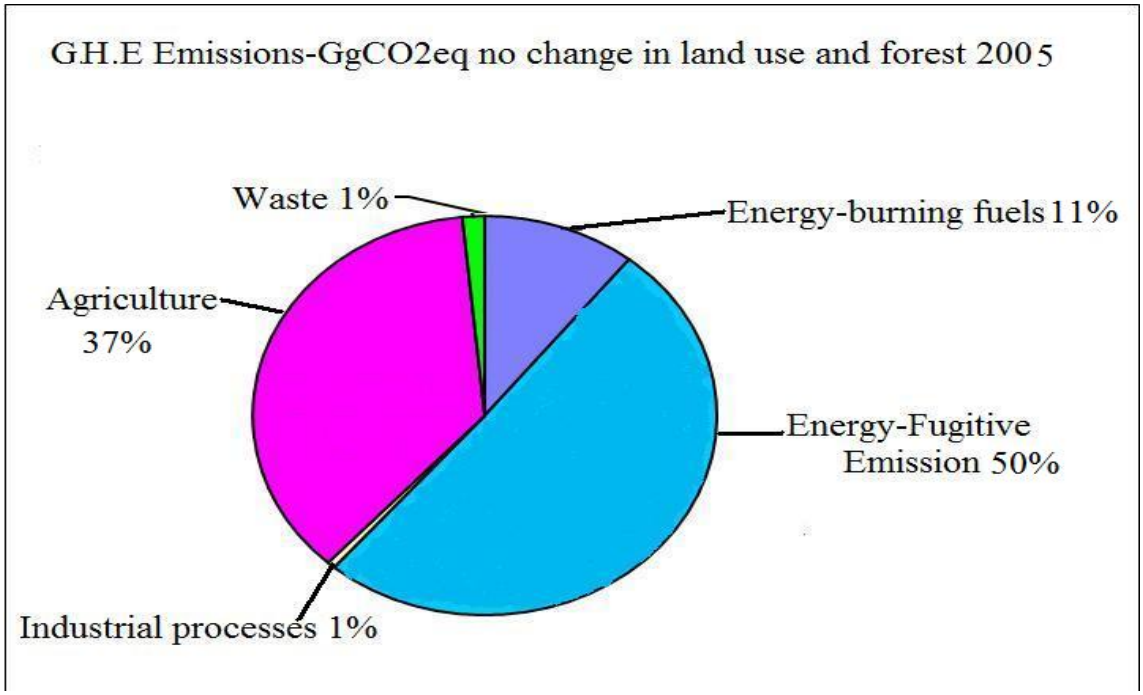


Figure 10 – GHG Emissions - GgCO2eq without land use changes and forestry (2005)

2.5 – Carbon Dioxide Emissions - CO2 (Gg)

For this inventory CO_2 emissions were calculated based on the following areas of activity: fuel combustion, fugitive emissions, industrial processes, and Land use change and forestry, as shown in the table below. The negative value for Land Use Changes in 2000 reflects a liquid absorption of CO_2, instead of emissions.

Table 5 – CO_2 Emissions by Sector

Sectors	2000	2005
Energy – Fuel Combustion	2.701	6.498
Energy – Fugitive Emissions	13.406	20.959
Industrial Processes	210	352
Land Use Changes and Forestry	-3.074	1.452

2.6 – Methane emissions - CH4 (Gg)

Methane (CH_4) emissions in the reference year were the result of the following activities: fuel combustion, fugitive emissions, industrial processes, land use changes and forestry, and waste.

Table 6 – Methane emissions by sector

Sectors	2000	2005
Energy – Fuel Combustion	0.45	2,73
Energy – Fugitive Emissions	310,38	485,23
Industrial Processes	424,35	425,20
Land Use Changes and Forestry	1,07	10,77
Waste	23,44	35,99

2.7 – Nitrous Oxide Emissions - N2O (Gg)

Nitrous oxide emissions are the consequence of the following areas of activity: fuel combustion, agriculture, land use changes and forestry as it can be seen on the table below, for each year.

Table 7– Nitrous oxide emissions by sector

Sectors	2000	2005
Energy – Fuel Combustion	0,03	0,09
Agriculture	44,45	44,42
Land Use Changes and Forestry	0,01	0,74
Waste	0,49	0,63

2.8. Emissions Per Capita

Emissions per capita were calculated for the reference year dividing the total emissions for each year in all five sectors by the total Angolan population in those same years.

Table 8– Emissions of CO_2eq per capita

Angola	Year	
	2000	2005
Total Emissions (Gg CO_2eq)	43.141	63.517
Population	13.930.000	16.095.000
Emissions per capita (t CO_2eq/hab)	3,10	3,95

Graph 1 - Emissions of CO_2eq per capita

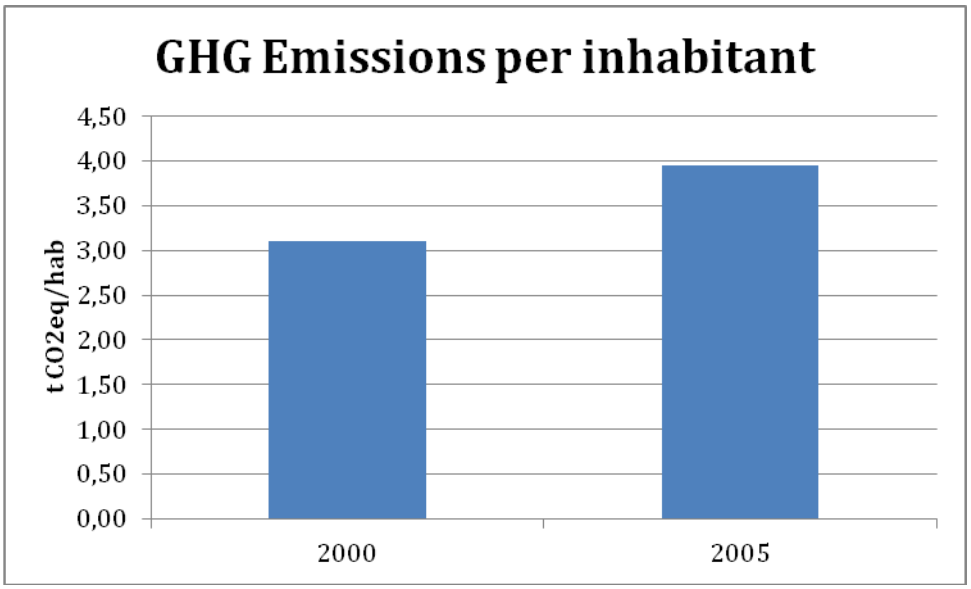


Table 9 – GHG Emissions Scheme taken from the Inventory Software

TABLE 9 - Short Summary Report For National Greenhouse Gas Inventories

Country-Angola								
Inventory year-2005								

SHORT SUMMARY REPOT FOR								
NATIONAL GHG INVENTORIES								
(Gg)								
GHG SOURCE AND SINK	CO1	CO2	CH4	N2O	Nox	CO	NMVOC	SO2
CATEGORIES								

Total National Emissions and Removals	29.261	0	959,9	45,48	154	6.929,40	27,95	0,30
1 Energy Reference Approach (1)	27.456							
Sectoral Appoach (1)	27.456		2,73	0,09	38,01	203,04	27,76	0,00
A Fuel Combustion	6.498		2,73	0,09	38,01	203,04	27,76	
B Fugitive Emissions from fuels	20.959		485,2		0,00	0,00	0,00	0,00
2 Industrial Processes	352		0,00	0,00	0,00	0,00	0,19	0,30
3 solvent and Other Product Use	0			0,00			0,00	
4 Agriculture			425,2	44,02	113,3	6.631,15		
5 Land-Use change & Forestry	(2) 1.452	(2) 0	10,77	0,74	2,68	94,2		
6 Waste			35,99	0,63				
7 Other (pleasse specity)	0	0	0,00	0,00	0,00	0,00	0,00	0,00
Memo Items:								
International Bunkers	348		0,00	0,00	0,00	0,00	0,00	0,00
Aviation	0		0,00	0,00	0,00	0,00	0,00	0,00
Marine	348		0,00	0,00	0,00	0,00	0,00	0,00
CO2 Emissions from Biomass	1.007							

2.9. GHG Emissions in 2000 and 2005 by the Energy Sector

In the energy sector, in 2000 and 2005, CO_2 total emissions 16.108 and 27,456 Gg; methane emissions were of 310,83 and 487,96 Gg, while nitrous oxide total emissions 0,03 and 0,09 Gg, respectively.

For indirect GHG emissions, the sector recorded in 2000 and 2005, when it comes to nitrogen monoxide, the emission of 11,67 and 38,01 Gg; for carbon monoxide, 52,08 and 203,04 Gg, while for NMVOC (non-methane volatile organic components), 8,99 and 27,76 Gg.

Table 10– Energy Sector Emissions (Gg)

Non-CO_2 Gases	**2000**	**2005**	**Variation**
Energy Sector	Gg		
NOx	11,67	38,01	226%
CO	52,08	203,04	290%
NMVOC	8,99	27,76	209%

2.9.1 – Emission factors in the energy sector

Carbon Emission Factors (CEFs) represent the quantity of carbon contained in the fuel per energy unity. The factors used in the document were taken from the Reference Manual and, pertaining to the energy sector, they can be found in the following table, with the units tC/TJ:

Table 11– Emission Factors Used

Gasoline	**Jet Kerosene**	**Diesel**	**Residual Oils**	**LPG**	**Cement**	**Lubricants**
18,9	19,5	20,2	21,1	17,2	22	20

2.10 – Industry Sector

GHG emissions in the industry sector refer to activities developed within the sector, as the ones listed here: breweries, cement, clinker, pastry, crackers and cookies, margarine, beef, animal feed, as well as glass and freezer assembly.

2.10.1 – Mineral Production

In relation to mineral products, emissions were estimated in the cement production which is constituted essentially between clinker and plaster, given that clinker is obtained from the calcinations of calcareous, when CO_2 emissions occur. GHG emissions were estimated as being based on the annual clinker production.

Table 12 - Cement and Clinker Production (t)

Year	**Cement Production**	**Clinker Production**
2000	528.211	411.067
2005	519.231	690.686

Source Ministry of Industry 2006

In cement production, emissions occur during the clinker production process, and emission estimates are based on the amount of calcareous oxide generated in the burning of $CaCO_3$ (calcareous), according to the following equation:

$$CaCO_3 \xrightarrow[\text{Heat}]{} CaO + CO_2$$

Since CO_2 emissions are derived from clinker production, taking into account the calcium oxide content, the emission factor used is the one defined by the IPCC: 0,51 t CO_2 / t clinker, with correction factor of 1,02.

Table 13– Beer Production and NMVOC Emissions

Year	Production	Emission Factor	NMVOC Emissions
2000	1.212.057	0.035	42.422
2005	2.082.825	0.035	72.899

Source Ministry of Industry 2006

2.10.2 – Food Production

In the sector, the main gas emitted is also NMVOC, with some percentage of CO_2. Regarding the reference period, production was verified in the following industries (see table below).

Table 14– Food Production and Emission Factors

Type of Product	2000	2005	Emission Factor
	t		kg NMVOC / ton of product
Beef and Chicken	101.546	93.640	0,3
Margarines	194	127	10
Cakes and Cookies	229	1.037	1
Animal Feed		7.447	1
Coffee Toasting	4.260	1.860	0,55
Pastry	257.398	9.455	8

Source Ministry of Industry 2006

2.10.3 – Other Industries

As far as relevant industries are concerned, glass production must be emphasized, emissions were not estimated due to a lack of emission factors. Mattress and foam factories are experiencing great expansions, as well as plastic articles, and the production is measured in units, which made it impossible to calculate emissions. Asphalt production data was obtained from the Luanda Refinery and Odebrecht.

Table 15– Industrial Production

Product	1995	2000	2005
Glass	7654	9212	46721
Paint (Kl)	570	2254	1546
Foam (Unit)	10700	102113	147057
Asphalt (t)	-	43505	53320

Source Ministry of Industry 2006

The results presented here demonstrate a considerable uncertainty level, since there isn't a database that integrates all industrial activity conducted in the country, even though it can be verified that in the last few years industrial units not controlled by the Ministry of Industry have come to be regulated by it.

CO_2 and NMVOC from the industry sector are related to mineral, cement, food and beverage, meat, and pastry production.

Table 16– Industry Sector Emissions (Gg)

Year	CO_2	NMVOC

2000	210	2,14
2005	352	0,19

As the tables show, the industry sector has remained practically unchanged, as a result of the almost complete sector shut down. This demonstrates that GHG emissions in the sector have not varied in the reference years. The inauguration of the Lobito Cement Factory, in the Benguela Province, should be noted as a significant development.

2.11. Agriculture sector

GHG emissions in agriculture come from five different activities:

- Domestic Pets;
- Rice Cultivation;
- Savannah Burnings;
- Burning of Agricultural Residue; and
- Agricultural Soil

The national agricultural potential is high. The country has the capacity to be self-sufficient and generate supplies that can be exported, of corn, manioc, sorghum, rice, peanuts, sugarcane, sunflower, coffee, sisal, greens, citrus and other tropical fruit, beef, pork and goat, milk and eggs, as it was in the initial half of the 1970s.

Agriculture has been characterized mostly as a family activity for millions of small farmers working for subsistence, planting an average of 1,4 ha per family in two or more pieces of land, with yearly increases in the planted area total. Subsistence agriculture has provided a livelihood for 85% of the rural population. The family sector has detained 90% of the total area.

It is estimated that in Angola about 57,4 million hectares' comprise the total area with agriculture potential, of which about 8 million is of fertile land. Of that only 31, 25%, or 2,5 million hectares', is currently being used. Before the war, agriculture was highly productive and efficient in Angola, being self-sufficient in almost all cultures except wheat, and exporting coffee, sisal, palm oil, bananas, sugarcane and cotton.

Currently, Angola depends on the large-scale importing of rice, wheat, corn and beans and the cultivated area corresponds to something between 20% and 30% of the usable area.

Angola's climate diversity allows the cultivation of a great variety of cultures. The country also has a diversity of phylogenetic resources hardly comparable in the region. The National Phylogenetic Resources Centre maintains a germoplasm bank containing, among other things, 823 varieties of corn, 853 varieties of beans, more than 200 varieties of massambala and peanuts, and more than 100 varieties of massango, pumpkin and sesame.

In a close correlation with climate aspects, namely precipitation levels, as well as the distribution and duration of the rainy season, the Angolan territory can be divided, when it comes to agricultural exploration, into three distinct zones with the following characteristics: In the north (Uíge, Kuanza Norte, Zaire and Malange) and northeast (Lundas area), the cultures of manioc, corn, beans and peanuts are predominant. In the Central Plateau, corn and beans are more often grown. In the south, corn and livestock are predominant, with some areas in which corn is replaced by manioc, massambala, massango and macunde beans, while pastoral systems dominate the Cunene and Huíla provinces.

The surface used for agriculture has occupied about 26% of the territory and is divided in the following manner: pastoral land, 23, 30% or 290.481 km²; land that can be ploughed, 2, 41% or 30.045 km²; permanent culture, 0,41% or 5.111 km; irrigated land, 0,06% or 750 km².

Irrigation, especially in alluvial soil, has been practiced in an area estimated as about 130.000 hectares', which represents 3,93% of the total area available. Irrigated areas are distributed mainly in the sugar regions (Caxito, Catumbela and Dombe Grande), as well as in the production of rice (43%), greens (22%) and citrus (4%).

2.11.1 – GHG emissions by the agriculture sector

CH_4 (Methane), N_2O (Nitrous Oxide), NOx (Nitrogen oxide) and CO (Carbon Monoxide) emissions from the agriculture sector are the result of activities related to enteric fermentation, livestock, rice plantations, management of animal waste, savannah burnings and soil degradation, being that the emission factor was 5, taken from the Reference Manual, since Angola does not have defined emission factors.

Table 17– Sector Emissions (Gg)

Year	CH_4	N_2O	NOx	CO
2000	424,35	44,45	113,06	6,626
2005	425,20	44,02	113,31	6,631

2.12. Land use Changes and Forestry

When it comes to forestry resources, 53 million hectares' of land are considered to be forests (43,3% of the country's territory). Only 2% is comprised of dense, humid, high productivity forests, very rich in biodiversity. 65,2% is comprised of a mosaic of forest and savannah, as well as open forests called *miombo*, with medium productivity of wood, but socially and economically important for the production of wood fuel, construction materials, medicinal plants, and non-wood products for food. The remaining percentage is occupied by dry savannah, with sparse tress and/or bushes, desert and sub-desert steppe of low productivity. The wood chopping capability in the country's natural forests is of 333.000 m^3 per year, which can allow the transformation of 1,150m^3/day of chopped wood.

Table 18– Transformation of Vegetation Areas by Province

Province	Hectars	2000	1990	1975
BENGO	3.904.042,37	2.38	2.20	0.30
BENGUELA	3.954.299,31	15.97	9.62	9.83
BIE	7.213.358,31	19.44	14.70	12.76
CABINDA	697.555,131	6.88	5.93	0.00
CUNENE	7.732.318,06	12.30	5.27	5.47
HUAMBO	3.318.128,46	31.26	16.32	26.26
HUILA	7.872.295,75	27.46	19.69	13.55
KUANDO KUBANGO	19.964.557,8	1.51	1.34	1.53
KUANZA NORTE	1.924.228,33	7.58	6.78	1.00
KUANZA SUL	5.538.725,34	11.31	8.12	6.33
LUANDA	243.488,568	52.91	36.35	5.35

LUNDA NORTE	10.802.506,4	4.04	2.98	0.73
LUNDA SUL	7.796.024,9	3.45	2.87	1.24
MALANGE	8.226.823,37	9.55	8.77	3.09
MOXICO	19.989.761,8	3.92	3.54	2.69
NAMIBE	5.810.344,96	3.21	1.39	0.72
UIGE	6.212.574,25	6.28	6.24	0.30
ZAIRE	3.646.367,65	1.13	0.62	0.18

Source: Forestry Development Institute (2000)

Table 19– Percentage by Type of Transformation of Vegetation by Province

Province	Red	Yellow	New	Increase	Old – No Change	Old – Recovered	Cloud Obscured
BENGO	0.08	1.87	0.54	0.12	1.93	3.14	11.70
BENGUELA	6.26	7.00	1.27	0.49	14.34	1.36	0.23
BIE	2.06	7.95	2.47	0.71	24.50	3.65	0.02
CABINDA	0.00	1.56	1.35	0.36	4.32	1.51	74.02
CUNENE	9.21	6.38	1.68	1.60	6.47	0.21	0.00
HUAMBO	19.11	13.93	2.35	1.22	27.99	1.05	0.15
HUILA	5.39	9.90	2.36	1.07	29.82	1.43	0.00
KUANDO KUBANGO	0.03	1.30	0.43	0.10	1.68	1.22	0.04
KUANZA NORTE	0.00	2.39	0.97	0.26	15.87	0.52	0.31
KUANZA SUL	3.52	7.39	1.51	0.37	12.03	4.19	1.45
LUANDA	9.10	13.69	1.85	1.09	44.31	1.42	0.01
LUNDA NORTE	0.00	3.62	1.62	0.28	4.56	2.20	0.22
LUNDA SUL	0.00	2.64	1.26	0.19	4.82	1.81	0.71
MALANGE	0.15	3.30	1.86	0.31	14.63	1.97	0.05
MOXICO	0.12	1.82	0.95	0.17	5.94	1.36	0.01
NAMIBE	1.44	2.12	0.70	0.22	2.64	0.13	0.00
UIGE	0.68	4.23	1.87	0.51	8.92	7.36	8.88
ZAIRE	0.00	0.34	0.42	0.03	0.17	0.61	49.03

Source: Forestry Development Institute (2000)

Table 20– Area Transformed in 2000 (GIS)

Class	%	Area
Transformation	8.88	11,081,523.02
Lack of Clarity	0.52	643,945.75
Plantations	0.06	75,943.90
Non-Transformed	90.55	113,044,788.13
TOTAL	**100.00**	**124,846,200.80**

Source: Forestry Development Institute (2000)

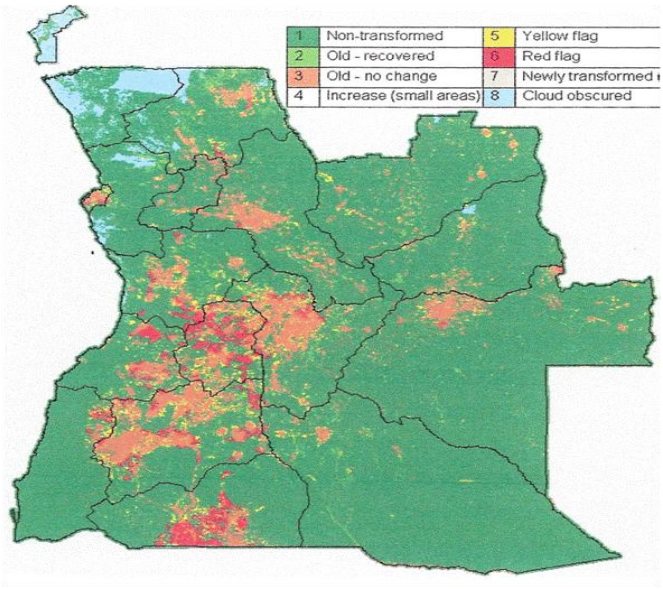


Figure 11 – Map of Angola with Transformed Areas in 2000 (Source: Forestry Development Institute)

2.12.1 – Emissions from the Land Use Changes and Forestry Sector

The calculation of CO_2 emissions and removals from land use changes and forestry is primarily based on the following main activities:

- Forestry conversion;
- Use of biomass;
- Abandonment of harvested land.

The main gases emitted by this sector are: CO_2, CH_4, N_2O, NOx, CO. The following tables illustrate general emissions and removals from Land use change and forestry.

Table 21– GHG Emissions and Removals (GG) in 2000

CO_2		CH_4	N_2O	NOx	CO
Emissions	Removals				
	-3.074	1,07	1,01	0,26	9,32

Table 22– GHG Emissions and Removals (GG) in 2005

CO_2		CH_4	N_2O	NOx	CO
Emissions	Removals				
1.452		10,77	0,74	2,68	94,20

2.12.3. Waste Sector

There are several factors that worsen waste accumulation in urban centres and surrounding areas. Among them, population increase in large urban areas, lifestyle changes in the population with difficulties to adapt to new eating and hygiene habits etc., deficiencies in civic education; sparse notions of basic hygiene; insufficient environmental education; lack of cleaning and waste collection companies in sufficient numbers in some provinces; difficult access to suburban neighbourhoods in some cities; insufficient waste collection and transportation means; out-of-control urbanization; commerce liberalization policy, with the consequent proliferation of small industries without the ability to manage effluents. This leads to the increase in the volume of waste, both dangerous and harmless.

Table 23– Waste Classification According to Reuse

Classification	Daily Generation (t)	Monthly Generation (t)	Annual Generation (t)
Recyclable, Reusable	1.040	31.197	379.558
Paper	79	2.363	28.744
Cardboard	302	9.070	110.354
Card	15	456	5.547
Hard Plastic	85	2.563	31.182
Soft Plastic	245	7.343	89.342
Iron Metal	148	4.442	54.043
Non-Iron Metal	26	781	9.497
Glass	139	4.179	50.849
Co-processing	32	953	11.599
Tires and Rubber	30	912	11.094
Oily Residue	0	14	168
Paint	1	28	336
Composting	753	22.589	274.835
Organic Matter	563	16.890	205.496
Fabric and Cloths	190	5.699	69.339
Final Waste	503	15.101	183.728
Toxins	4	111	1.345
Medication	2	69	840
Batteries	1	41	504
Electronics	11	318	3.866
Other	103	3.088	37.569
Losses	26	774	9.413
Inert	357	10.701	130.190
TOTAL	**2328**	**69.840**	**849.720**

Source Elizal 2008

2.13.1 – Waste Treatment and Final Destination

Among the methods for solid urban waste treatment used in the country, incineration is the main one, both for hospital and industrial waste. Burning accumulated waste in the streets and next to

squares is one of the non-conventional solutions used in Angola to reduce the volume of waste. These types of methods are often used by the more low-income population.

In the last few years there has been an increase in waste production in the country, associated with changes in consumption patterns that usually come with economic growth. The Government has employed efforts to solve pollution problems caused by waste, especially in the urban centres, and there are some signs of improvement. For example, in the cities of Luanda, Cabinda, Lubango and Lunda Sul there already are companies that do waste collection, namely accumulated solid waste, near residences and roads, and transport it to final disposal grounds or land fields.

As final destinations the waste is collected and transported to areas identified for disposal. Normally, these areas should be very distant from residential areas, which are not true in most of the country's provinces, especially Luanda, where two disposal grounds are located within the community. Waste disposal on Golf 2 and Camama are examples of bad practices and inadequate disposal and treatment systems.

In some provinces, waste is deposited in swamp areas, which means that the dangerous toxic elements contained in it can easily be transported into superficial waters during the rainy season.

2.13.2 – GHG Emissions from Waste

CH_4 (Methane) yearly emissions were recorded as 26 and 36 Gg respectively for 2000 and 2005, as a result of the quantity of waste disposed of on the soil. Estimations were calculated from existing information in Luanda, as a pilot case, given the total population of Angola in the reference years, and the percentage of the population that lived in urban areas. CH_4 and N_2O emissions from sewage treatment were also calculated, using default factors for treatment systems use and nitrogen content in protein (this last piece of data provided by the FAO – Food and Agriculture Organization).

Table 24– GHG Emissions for the Waste Sector

Year	Urban Population	Waste Generation	Protein Consumption*	CH_4 Emissions by disposal of solid waste	CH_4 Emissions by sewage treatment	N_2O Emissions by sewage treatment
	person	kg/day/ person	kg/year/ person	Gg	Gg	Gg
2000	6.268.500	0,3	13,94	23,26	0,19	0,49
2005	8.266.000	0,35	15,68	35,78	0,22	0,63

The sector recorded in 2000 emissions of about 23, 44 Gg of methane and 0,49 of Nitrous Oxide, while in 2005, the sector recorded emissions of 35,99 Gg of methane and 0,63 of Nitrous Oxide. For year 2005 the total west production was around 1056 Gg or 1056 kt or1056000 t.

The real west production for the country couldn't be calculated because there is no national institution responsible for west management. Each province is responsible for its waste management without any tape of statistics.

Uncertainties and Archiving of Information

The uncertainties of this report are based on different causes like use of emission factors in some cases, estimated that and same time calculation. The use of incomplete knowledge and

information's of the process that contribute to GHG emissions, emissions factors and others contribute to level of uncertainty..

In this report there was an effort to present emissions based on secure information without any influence because of the lack of data in some areas of activities there same emissions that could not be calculated

The use of estimations was more or less according to the sector, the available data, characteristic of the sector and as maximum as possible adequate to Angolan National Circumstances. The was given specific relevance to the sectors with are considered the most emitters of GHG

During the preparation of the National Communication there was a process of archiving information used to produce the emissions and the report. Part of this information is on digital basis and most of it as hardcopies and books. The project initiates to create a web page and a small database.

Chapter 3 – Climate Change Adaptation Measures

The component of vulnerability and adaptation is an evaluation, based on available information, of the probable impact of climate change in Angola and the measures that the country can adopt to reduce the possible impacts of climate change.

Climate changes are long-term alterations in the climate due to human activity that change the composition of the atmosphere. The detailed causes continue to be an object of research, but scientific consent identified growing concentrations of carbon dioxide, that creates a greenhouse effect, retaining more heat. A rise in global temperatures can cause other changes as well, including rise in sea levels and changes into precipitation patterns.

In order to make this evaluation, meteorological data was examined, even though there is only information from the period between 1950 and 1975 from a large part of the Angolan meteorological stations. Interviews were conducted in the Central Plateau and the Highlands of Huíla to gather information from people and agricultural workers about their perception of climate trends and the impact on agriculture. Literature on climate variability in the southern region of Africa was consulted to find information about possible reasons. Existing literature on climate change and its implications for Angola as well as information about climate models for the region were also studied. Through this literature and local informants, vulnerabilities that will possibly be induced by climate change, based on global scenarios, were listed.

Angola is located in the inter-tropical and subtropical zone of the southern hemisphere. Climate varies between the north and the south, and between the Atlantic coast and the countryside. Precipitation occurs generally in the form of storms, which are different from rains for lasting less time and presenting larger raindrops. The well-defined dry season is called "cacimbo". During the rainy season there are generally two peaks (in November and March) and between them a small dry season called "small cacimbo", the impact of which depends on the region of the country. Variability from one year to the next is generally high, which makes it difficult to identify climate change.

The understanding of factors that contribute to weather variations in Africa is limited, especially in the Angola region. The development of models for this region is in its initial stages. Analysis of world climate historical data indicates that ENSO (El Niño-Southern Oscillation) is connected to the weather in several areas of the globe, for instance in the eastern part of Africa. However, ENSO's impact is not felt in Angola, where variability is more connected to conditions in the

Atlantic Ocean, such as the variations in the Benguela Current, variations in the movement of the Inter-tropical Convergence Zone, and atmospheric and sea temperature conditions in the southern Atlantic.

There has been a rise of 1,5ºC in surface temperature between 1970 and 2006 in Angola, in the coastal areas and in the north, and a rise of 1,0 to 2,0ºC in the centre and the east. Climate models indicate that there will be a rise of 3,0 to 4,0ºC in the surface temperature of Angola in the east, and a slightest smaller increase in the coastal and northern regions in the next 100 years. There is no consensus about future trends concerning precipitation in the region.

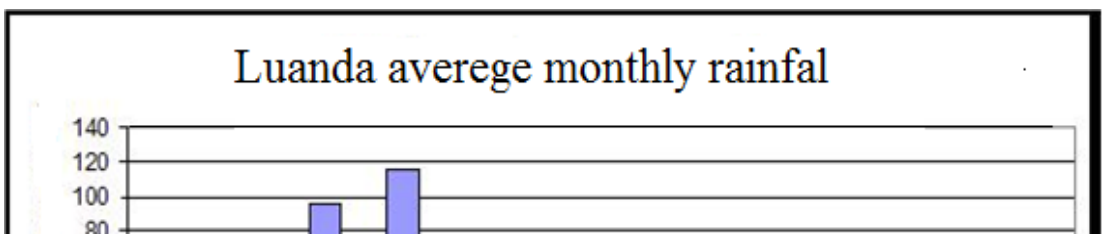
Regional climate models indicate that the climate in Namibia and Botswana will be dryer in the future, and that Zambia, Malawi and northern Mozambique will have the same precipitation levels, or a rise, but with more torrential rains.

Climate models for the southern Africa region don't include Angola and the Democratic Republic of the Congo due to a lack of data from these areas, but there are a few models that include areas close to Angola (Shongwe et al, 2009. KNMI, 2006.) There is a high degree of agreement that weather in Namibia will be dryer in the future. In northern Botswana and southern Zambia, models indicate a descending trend in precipitation for the 21st century and predict that rains will begin later. In Botswana and northwest South Africa there is a prediction of decrease in precipitation and contraction of the rainy season. So, in the countries south of Angola, the general prediction is that precipitation will experience a descending trend in the 21st century (Shongwe et al, 2009. KNMI, 2006.), and there is a chance that this trend could affect the south of Angola.

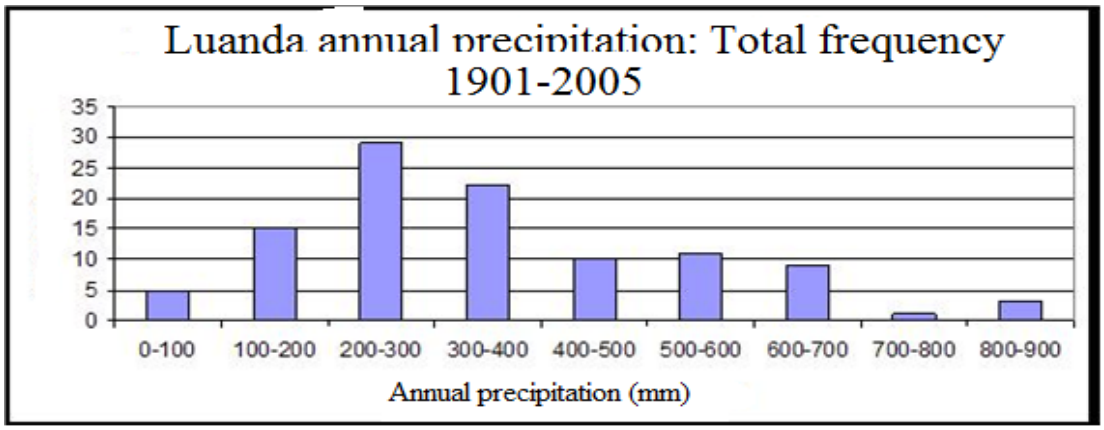
In Zambia, predictions are different. For the country in general, the prediction is that there will be no great changes in precipitation, but more intense rainfall (WSUP, 2010). More detailed models indicate that in the south of Zambia there is a weak tendency toward a precipitation decrease and perhaps a contraction of the rainy season, while in northern Zambia (and most of Malawi), models indicate a increase in precipitation during the 21st century (Shongwe et al, 2009. KNMI, 2006.). Thus, based on neighbouring countries' models, there are certain indications that the east and northeast of Angola could experience heavier precipitation in the future and a higher incidence of extreme rainfall.

There will possibly be the same trends for the areas of Angola close to Namibia and Botswana. Meteorological data from the central plateau of Angola (where there is a more or less continuous series of data since 1943) and local interviews don't indicate changing trends in precipitation. In southern Angola, data is less reliable but indicates that there is less precipitation and more variability than on the past, which is also the perception obtained from local interviews. So changing trends in precipitation probably depend on the region of Angola and future studies must take this fact into account. The south region deserves special attention due to its proximity to Namibia and Botswana, where models indicate dryer conditions.

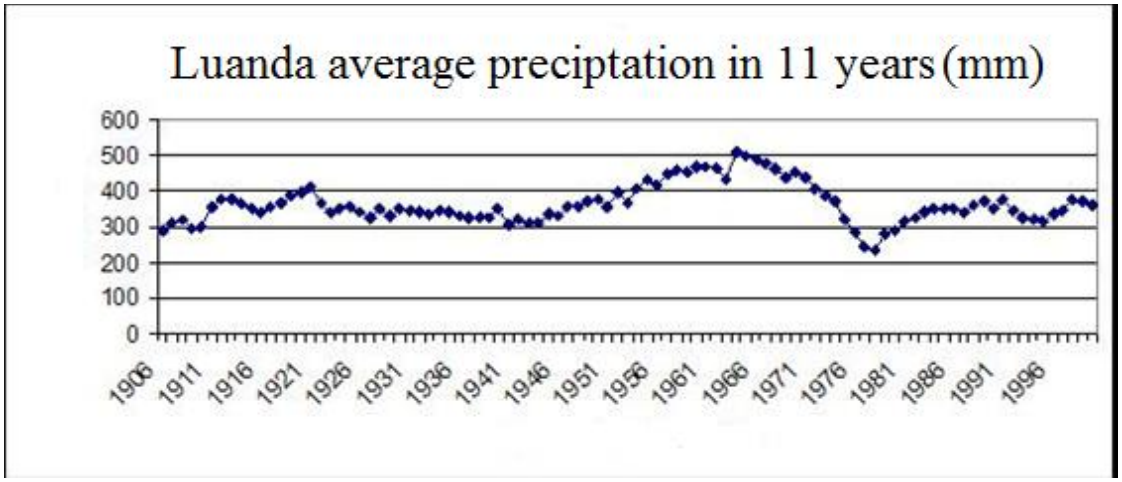
Uncertainties in precipitation trends make it difficult to evaluate the impact of climate change in Angola. Climate change can impact several areas (for example, hydrology and flooding, soil erosion, coastline, housing and human settlements, fishing, agriculture, biodiversity, healthcare and education). The analysis of vulnerabilities due to climate change (the difficulty of avoiding or recuperating from negative effects of events or factors that disturb the system) must take into account the possible climate change risks, the existing vulnerabilities in these areas and the ability to manage the risk effects.



Graph 2– Monthly Average Precipitation in Luanda



Graph 3 – Annual Precipitation between 1901 and 2005



Graph 4– Average Mobile Precipitation

When it comes to drought years, the rural population in this region speaks of years in which there is a period of two weeks or more, during the rainy season, with very low precipitation. The years when this has happened are the following:

Table 25 – Dry Weather at the Central Plateau Since 50s

Dry Weather at the Central Plateau since the 1950s	
1954/1955	Initial two decades from February 1955
1971/1972	February 1972
1973/1974	January 20th until February 10th 1974
1977/1978	January 20th until February 20th 1978
1985/1986	December 20th until January 10th 1986
1988/1989	February 20th until March 10th 1989
1994/1995	January 10th to 30th 1995

Source / Development workshop 2010

Rural communities were capable of indicating the year in which this happened starting in 1954/1955 and the information was consistent between all communities and when compared to meteorological data from Chianga, which indicates precipitation for periods of 10 days.

Even though this phenomenon has a significant impact over agricultural production, it can rarely be observed in data about annual rainfall; only the 1954/55 period from these years has a low annual total. Even monthly data is not a reliable guide to identify droughts: the drought periods can be distributed in two months, occurring from the end of December to the beginning of March. It was only in a discussion with the rural population that this information was uncovered, since it was apparently significant for them.

In the case of Luanda, there is a lot of variability in precipitation from one year to the other. The average is 347 mm, but there are years when it is twice as much. The rainier months are March and April, when the inhibiting effect from the Benguela Cold Current is weaker, but variability in these months is high: precipitation can vary from zero and 400 mm.

Generally, precipitation in these months comes in the form of torrential rains. There was a tendency of increase in precipitation between 1941 and 1964, and then a rapid decline between 1964 and 1978. After 1978, precipitation rose to the pre-1941 levels. There are no indications of future tendencies, but variability and torrential rains in certain years have important implications.

In the Chianga station, near Huambo, the annual average precipitation is 1.389 mm/year. There is no visible long-term trend in rainfall records. Precipitation variability between years is low in comparison to other parts of Angola: just one year in the 65-year record shows an annual total of more than 30% below average. But there are years that the rural communities call dry which are years in which there is a dry period of more than 20 days in the middle of the rainy season (which has important implications for agricultural production). Since 1970, annual precipitation in Chianga does not show rising or declining trends and the years with drought periods have not been more frequent.

In general, climate change will make existing vulnerabilities more severe. Angola must also consider possible climate change in neighbouring countries; dryer weather in Namibia or South Africa can elevate the regional importance of the water, energy and agricultural resources of Angola.

In the hydrology area, information about the behaviour of river basins is deficient, but actions are being developed to improve the level of knowledge. A rise in temperatures or a reduction in rainfall can lower the rivers' water levels. Variability in precipitation, or more intense rainfall, brings changes in the parameters of the river basins (for instance, sedimentation or the probability

of flooding). More soil erosion has implications on sedimentation and more intense rainfall can increase the risk of soil erosion. Hydroelectric plants are important for the production of electric energy. A higher variability in rainfall and the possibility of soil erosion and sedimentation have implications for these plants' production capacities. Changes in hydrology also have an effect on neighbouring countries.

The maritime coastal currents (such as the Benguela one) are part of the system that redistributes the energy globally and can be altered due to climate change. Another coastal factor is the rise of sea levels. There will also be changes in coastal sedimentation and erosion if there are changes to the hydrology of rivers that end in the Atlantic Ocean, with implications for oil plants, ports, human settlements and other installations along the coastline.

In the area of human settlements, higher temperatures bring a need for better ventilation of inhabited and occupied spaces, which has implications in the design and orientation of housing and other buildings. The design of human settlements must also take into account the risk of flooding and the need to reduce the risk of soil erosion.

Modifications in the Benguela Cold Current can have implications in coastal fishing and, therefore, impact the fishing communities and industry. Changes in the hydrology of rivers or water temperature can have an impact in river and lake fishing.

Rises in temperature can impact the livestock sector, through changes in the geographical distribution of diseases (such as sleeping sickness) or through the water availability in pastoral regions in southern Angola. Rising temperatures will have a negative impact in agricultural production due to the increase in evaporation and transpiration. Changes in precipitation and hydrology affect dry and wet agriculture. Impacts will depend on the area of the country, the agricultural systems used in each area and current vulnerabilities. For example, in the central plateau, there is no tendency of increase or decrease in precipitation, but years with extended dry periods during rainy seasons have reduced harvests. The impact of war and low soil fertility are still factors in reducing the ability to manage the risks created by the climate in this area. Further south, there are signs of precipitation reduction and increase in precipitation variability. The difficulty to access seeds adapted to local conditions and climate variability is a general vulnerability factor.

3.1 – Sensitivity to Climate Risks

Uncertainties in precipitation trends make it difficult to evaluate the impact of climate change in Angola, but the analysis takes into account the impacts verified in other areas of Africa, as well as the analysis made about the possible impact of climate change in sectors such as hydrology and flooding, soil erosion, coastal zone, housing and human settlements, fishing, agriculture and biodiversity. The analysis takes into consideration possible risks due to climate change, existing vulnerabilities in these areas and the ability to manage risk effects.

Climate change will make existing vulnerabilities more severe. Angola must also consider possible climate change in neighbouring countries: dryer weather in Namibia and South Africa can give regional importance to Angola's water, energy and agricultural resources.

"Vulnerabilities" are the difficulties that a certain group of the population faces to avoid, or recover from, the negative effects of events or factors that disturb the system. Climate can create risks for the survival system of a specific group. Extreme weather makes agriculture more difficult, even though few people inhabit extreme weather zones, and those who do generally adapt their way of life to the climate. Climate variability is frequently a risk factor because one year without

rain or with more rain than usual will have an impact in production. Climate change can create other risks if, for example, precipitation passes a limit that defines the possibility to cultivate a certain kind of culture or if variability increases. The number of rainfall data gathering locations declined from more than 500 to 20.

Areas identified as vulnerable are those where vulnerabilities and serious challenges already exist, but where climate change can make these challenges even more difficult to deal with. The identified impacts include:

• Hydrology (changes in the hydrology of river basins, with impact on neighbouring countries);

• Forestry and agricultural systems (due to changes in precipitation and hydrology, affecting dry and wet farming);

• Soil erosion (due to higher levels of rainfall);

• Coastal fishing (if there are changes to the Benguela Current);

• River and lake fishing (if there are changes in hydrology or water temperature);

• Maritime coastal currents and coastal erosion (due to risings in sea level and changes in sedimentation and erosion if river hydrology is altered);

• Industry and energy, oil plants, and ports (due to changes in river hydrology and the coast);

• Human settlements (due to changes in temperature and the need to more effectively cool inhabited spaces; there is also the issue of higher risks of flooding and erosion)

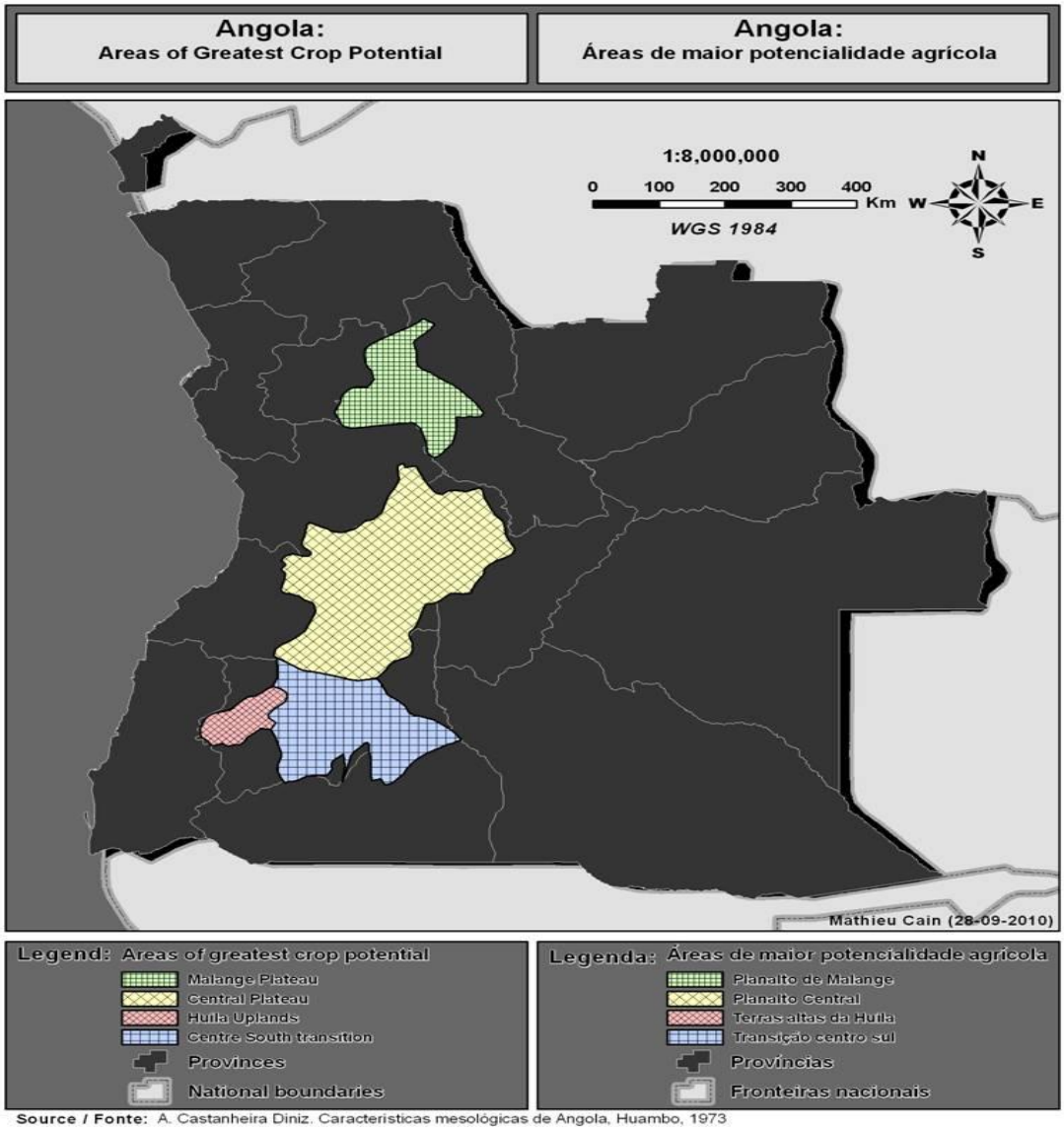


Figure 12– Areas of Greatest Agricultural Potential

The rise in temperature can have an impact on human health through a modification in the geographic distribution of diseases, such as malaria. More frequent flooding can generate the risk of diseases related to deficient sanitation.

Variability in precipitation, or more intense rainfall, which leads to changes in the parameters of river basins and flooding, soil erosion and sedimentation, will have implications for infrastructure and transportation, both of which can be damaged by abnormal flooding. Hydroelectric plants are important for the production of electric energy. A higher variability in rainfall, and the possibility of greater soil erosion and sedimentation, has implications for the capacity of these plants.

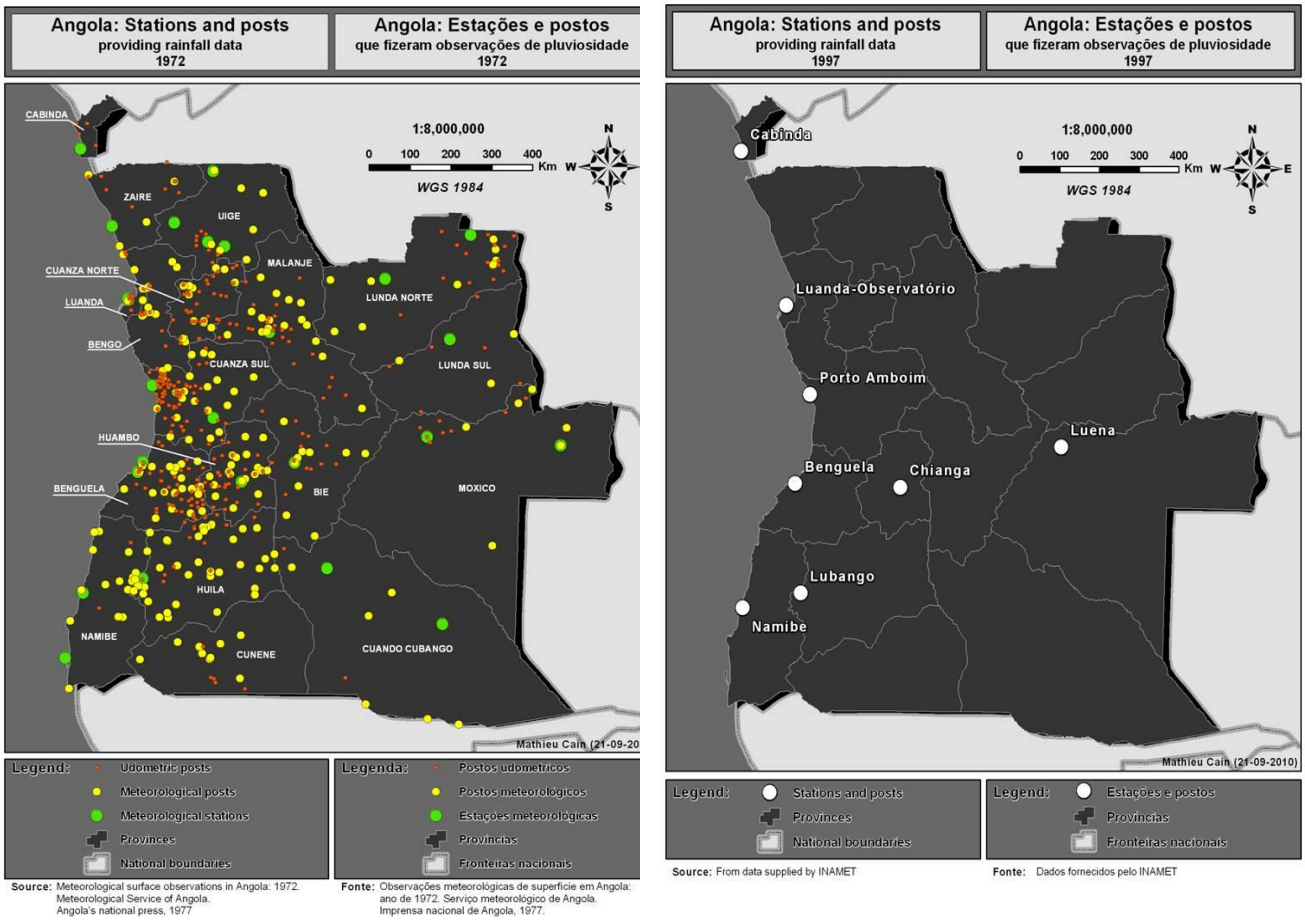


Figure 13 – Difference Between Stations and Posts that Conducted Rainfall Observations in 1972 and 1997

Generally there is little updated information about terrestrial biodiversity and its state of conservation in Angola. Angolan reserves are small and have been poorly managed during the conflict years. Warming temperatures and alterations in precipitation patterns now can lead some species to their limit. It will be very difficult to genetically adapt and the fragmentation of habitats makes it more difficult for species to migrate to zones where they can find the conditions to which they are adapted.

There is still not enough information about possible climate change in Angola and its impacts, so it is not appropriate to make specific recommendations about adaptation strategies. The strategies presented here aim to reduce current vulnerabilities and create the ability to adapt in the future, especially through the gathering of precise information about climate change in the region, possible impacts and appropriate methods of adaptation. Adaptation policies must increase the capacity to manage risks, and must avoid fixed large-scale investments that depend on still poorly studied factors.

The generation of capacities to face current situations (for instance, soil erosion and flooding) will be useful to face future situations as well. These capacities can be created at the individual, community, local and central government levels. In all risk areas, it is necessary to better perceive the systems that can be affected by climate change, as well as these systems' vulnerabilities, and rehearse strategies to reduce these vulnerabilities in partnership with the people involved.

The main recommendations for adaptation are as follows:

In hydrology:

- Continuing the actions that are underway to improve the level of knowledge in hydrology;
- Deepening studies about factors that contribute to risks of rises in water levels and flooding;
- Elaborating pilot-projects that reduce risks of rises in water levels and flooding;
- Taking into account the implication for hydroelectric plants in these studies;
- Preparing geographical charts of areas with risk of flooding.

In soil erosion:

- Studying human and natural factors that contribute to the risk of erosion in several areas of Angola, for instance the exploration of forests and commerce of vegetal coal;
- Mapping erosion risk areas;
- Creating pilot-projects that generate the local capacity to develop actions that reduce erosion risks.

In the maritime coast area:

- Studying more deeply the influences to the shape of the maritime coast and measuring the erosion and sedimentation processes;
- Studying the possible impacts of rises in sea level;
- Studying the impacts of coastal sedimentation and erosion changes;
- Deepening the engagement in current studies about the maritime coastal currents (Benguela Cold Current) and possible variations and trends pertaining to these currents;
- Studying the implications on several installations located at sea or on the coast.

In human settlements and housing:

- Studying the implications of higher temperatures and more intense rainfall on housing;
- Seeking design improvements in construction, taking into account factors such as ventilation and improved protection;
- Testing new designs;
- Mapping human settlements at risk of flooding and erosion.

In fishing:

- Gathering information from fishermen about variabilities and trends in fishing;
- Studying the vulnerability of the current fishing activity and if there are changes to currents or the weather.

In agriculture:

- Studying the local agricultural systems in Angola and the meteorological aspects that present risks to these systems;
- Gathering information from rural communities about variability and climate change, as well as about risks associated with this variability and changes to the agricultural systems, paying special attention to the southern region;

- Reducing the vulnerabilities that agriculture, especially the peasant kind, currently faces, such as difficult access to seeds appropriate to local conditions, through the use of a national collection of local seeds, which can be the basis for a program to create adapted varieties, with the participation of farmers and peasants;
- Studying the implications of modifications in the geographical distribution of animal diseases and the availability of water for animal farming.

In healthcare:

- Gathering more precise information about the geographic distribution of human diseases and their occurrence in relation to precipitation, temperature and extreme events (such as floods and droughts);
- Studying the implications of climate change;
- Improving the preparation of the healthcare system to handle more extreme situations.

In biodiversity and ecosystems:

- Continuing to gather information about current levels of biodiversity and its state of conservation;
- Improving the management of current reserves and studying the possibility of creating new ones;
- Studying the probable impacts of climate change and preparing conservation plans for different climate patterns.

In infrastructure and transportation:

- Reviewing climate parameters (for erosion and sedimentation) used in the construction of roads, railroads, hydroelectric plants etc.;
- Adapting the parameters to future constructions;
- Studying possibilities for the adaptation of current infrastructure;
- Ensuring that maintenance plans are followed and these projects are concluded correctly to avoid erosion and sedimentation.

In meteorology, in order to have more adequate information about meteorological trends, so that better climate change predictions can be made:

- Organizing the information from 1975 to 2005, such as data that has not yet been centralized;
- Using agricultural bulletins, food security bulletins, reports and newspapers to rescue information about exceptional climate occurrences;
- Interviewing people in rural areas, who generally have a great memory about exceptional climate occurrences, paying special attention to the southern part of the country;
- Cooperating with regional investigative centres to create climate models that include Angola and that take into account Angola's specific situation;
- Studying more profoundly the factors that contribute to year-to-year variations of the weather in Angola and then, based on that, creating and publicizing a system of seasonal predictions for different regions of the country.

3.2 – Sea Level

In the region, there are few data available about the sea levels during the period of 1960 to 2001, and none in more recent years with the quality necessary to be used to analyze increases in average sea level. Global sea level rising rates must be used cautiously, since they reflect the best estimates available. These global rates indicate that the sea level has risen, since 1961, by an average rate of 1.8 mm/year (between 1.3 and 2.3 mm per year), and since 1993 at an accelerated rate of 3.1 mm/year (between 2.4 and 3.8 mm). Global estimations for the 20th century are significantly higher than those from previous centuries. The global sea level average in 2005 was about 50 mm higher than it was in 1990.

However, the occurrence of additional acceleration in the rise of sea levels connected to climate change during the 21st century seems probable. The two main processes are the thermal expansion of the ocean with higher temperatures and the melting of ice caps and blankets (ice caps being masses that cover an area smaller than 50,000 km², generally in a elevated zone, and ice blankets being ice masses covering more than 50,000 km²). The great question is knowing if it will surpass a critical point during the 21st century, which would lead to polar melting, the irreversible melting of the ice in Greenland and West Antartida. This could lead to a rise in the sea level of several meters. The thermal expansion of the ocean will continue for centuries after the concentration of GHG is stabilized.

3.3 – Adaptation Capacities

In this section considerations are made about how Angola can create the necessary adaptation capacities to deal with the impacts of climate change in each sector. Appropriate adaptation strategies are considered to reduce the risks provoked by climate change. Adaptation is the adjustment of the natural or human systems, in response to real or expected climate stimulation or its effects, which moderates benefits or explores beneficial opportunities.

Projections about precipitation, surface water draining and soil humidity for the future are very uncertain. There is still not enough information about possible climate change in Angola and its impacts. Thus, it is not appropriate to make specific recommendations about adaptation strategies. But it is also not adequate to assume that past climate and hydrological conditions will remain in the future. It is necessary to create the capacities that would allow future adaptation in several sectors. The strategies presented here aim to reduce current risks, which will probably increase with alterations to temperature and precipitation standards. The creation of capabilities to deal with current situations (such as soil erosion and flooding) will be useful to deal with future situations. It is necessary to create resilience to these vulnerabilities that can become more serious due to climate change. These capabilities can be created at the individual, community, local and central government levels. Adaptation policies must increase the ability to manage risks on these levels, and should avoid fixed large-scale investments that depend on still poorly studied factors.

It is important to incorporate climate change risks into planning and infrastructure investments. This implies gathering information and resources, as well as creating institutions. In all risk areas, there is a need for more data, for example:

- Meteorological;
- Sea level;
- Sedimentation in rivers and the ocean, detritus in dams;
- River torrents;
- Levels of aquifers.

The analysis of meteorological data should take into account variability's in precipitation, as well as other climate variables. It is important to understand if it surpasses critical points, which would lead to serious impacts.

In all risk areas, it is necessary to better perceive the systems that can be affected by climate change and the vulnerabilities of these systems, as well as rehearse strategies to reduce these risks in partnership with the people involved.

3.4 – General Considerations

Angola's climate is diversified. The country is located in arid and semi-arid zones in the south and humid areas in the north. Studying climate change in Africa is difficult due to lack of data and modelling ability, especially in the region of Angola and the Democratic Republic of Congo, where there is an extreme lack of data from recent years. Given all that, there are many uncertainties about the impact of climate change in this region and it could probably be different in different regions of the country. However, it is generally accepted that temperatures will be higher in the future.

Several climate models indicate that the region of Namibia and Botswana, as well as certain regions of South Africa, will have dryer weather in the future, so it is possible that southern Angola could also experience dryer conditions. Certain climate models indicate that the region of Zambia, Malawi and northern Mozambique will experience more variability in precipitation in the future, as well as more torrential rain, so it is possible that the same happens in the north and east of Angola as well.

In general, variability in precipitation on the southern region of Africa is influenced by a phenomenon known as ENSO (El Niño-Southern Oscillation), but it doesn't have as much influence in Angola, where conditions in the Atlantic Ocean are more important. Influences on the Angolan climate have not been studied enough. It is important that these studies are conducted to provide a better understanding of the influences on precipitation in several Angolan regions. This could be the basis for meteorological predictions adapted to Angola. With better predictions, economic activities can adapt every year to the expected levels of precipitation and temperature. The studies could also serve as a basis for more precise scenarios about the climate of each region of the country. With dryer conditions in certain areas, and a more acute variability in precipitation, it is possible that Angola could face, in a large scale, certain problems, such as: sedimentation in hydroelectric dams, soil erosion, floods and insufficient agricultural production. Thus, Angola must continue with its efforts to face these problems as a way of adapting to climate change, while improving the level of knowledge about future climate scenarios.

3.5 – Examples of Projects that Contribute to Climate Change Vulnerabilities

3.5.1 – The Angolan Charcoal Industry Contribution to Deforestation, Erosion and Sedimentation due to Climate Change

This project is a research that aims to contribute to the understanding of the vegetal coal industry, especially in the Huambo province, and how it contributes to the deforestation phenomenon. The general hypothesis is that the commerce of vegetal coal is an important factor in deforestation, and deforestation contributes to soil erosion, as well as river and coastal sedimentation. It also contributes to changes in hydrology that have impact not only in Angola but also in neighbouring

countries. These impacts can become amplified with climate change that will probably cause more intense rainfall.

The result will be a description of the vegetal coal commerce, especially wood chopping in the Huambo Province for the production of vegetal coal and its transportation to Luanda, Benguela and Lobito, as well as an evaluation of the industry's impact on deforestation in recent years. The description will be shaped as a value chain, indicating the several players involved in the trade, with some quantitative and pricing estimation. This could allow for the estimation of deforestation rates and its possible effects. It can also allow for an evaluation of the role of vegetal coal production in local subsistence strategies.

The methods include interviews with key informants (people that chop wood, transform it into vegetal coal, sell it by the side of the road and at markets, restaurant owners in Luanda and Benguela, buyers and transporters). There is also the observation of markets, by the side of roads and in automobile and truck terminals, as well as analysis of real photographs of forested areas in the Huambo Province through several years, and the counting of trucks leaving Huambo on their way to Lobito, Benguela and Luanda.

The long duration of the Angolan conflict lead to a significant urbanization of the population. During most of the war period, the main fuel in the kitchens of the urban centres was vegetal coal. Angola produces LPG gas as a product of oil production and is currently reducing the quantity of gas burned at production platforms. The distribution of LPG gas for urban areas has improved since the end of the war in 2002, but there is still a significant demand for vegetal coal in the cities. Even in Luanda, where coal is rarely the main fuel used by a family, vegetal coal is used to cook certain dishes, and there is high demand for vegetal coal from restaurants and other commercial establishments. In some other cities, coal continues to be an important cooking fuel.

Current demands for vegetal coal and its large-scale use in the last 30 years have probably had a significant impact on the natural forest called "miombo". One of the most affected provinces is Huambo where interviews conducted with farmers near Huambo city indicate that coal production took place about 10 km from the city 20 years ago, but now could only be done about 50 to 60 km outside of the city. Huambo Province is the closest area to the cities of Benguela and Lobito. Vegetal coal was produced in the coastal areas close to these cities, and even on the coastal mangroves, during the war, but rapidly it was transferred to the Huambo Province, once it became safe to do so, after the war.

The duration of the conflict in Angola also meant that the main environmental indicators have not been controlled. During the war, there was very little control over the use of natural resources such as wood (for direct fuel use for construction purposes), sand and rocks in construction. The period following 2002 has registered an explosion in the use of such natural resources while control has been slowly reinstated. The Forestry Section of the Ministry of Agriculture is aware that deforestation is happening quickly, but it has not been able to completely develop a forestry inventory yet.

Rapid deforestation increases the risk of soil erosion. For the most part of the year, rainfall happens in the form of heavy rain: in Huambo between 50 mm and 80 mm of rain can fall in one day of the year. Rain of this kind, falling on surfaces where vegetation has been removed, provokes furrows and ravines in the surface. Important Angolan rivers (Kwanza, Cunene, Queve, Cubango) originate in the Huambo Province. The erosion potential is high due to the elevation difference between the riverbeds and the higher surfaces where the majority of the forests, communication means and human settlements are concentrated. Erosion sedimentation is transported through these rivers and Change the balance between sediments and erosion further down along the coast where the rivers end.

Currently, the Angolan economy depends strongly on its oil resources, but it is recognized that, in the future, the economy will have to be diversified and that water resources will be crucial. Angola is part of the East-West African belt (including Zambia, Malawi and northern Mozambique), with abundant water resources, and the southern countries will in the future look for hydroelectric energy in the area. Namibia is especially arid and the prediction is that it will become even more arid in the next 100 years. Namibia already depends on energy and water from hydrographic basins that derive most of their water from Angolan rainfall (such as Cuvelai, Kuvango, Cunene and Zambeze).

South Africa suffers from lack of energy and water and, after the power and water resources development in the Drakensberg Mountains, in the last 30 years, it is again looking to the countries to the north. Angola produces a large part of its electricity from hydroelectric plants, with the full potential yet to be explored. Both dry and wet farming will be an important part of the process of economic diversification. The internal water demand in Angola should also increase. Therefore, water is an important resource, for the country and for the region. The use of this resource depends on a better understanding of the country's water resources, not just in terms of total quantity, but also when it comes to seasonal variations and variability by year, the possibility of flooding as well as erosion and sedimentation problems. There has been, for the last few years, several climate extreme events such as floods on Cuvelai basin in southern Angola, and on Zambeze basin in the East.

The climate models for Zambia, Malawi and northern Mozambique indicate that rainfall in the future will be more intense in these regions and, if this also applies to northern and eastern Angola, flooding can become more severe. There are also erosion problems in many areas of Angola, associated with intense rainfall and as a result of problems that affect sedimentation of hydroelectric plants and contribute to flooding, blocking draining channels. Variations in river torrents, combined with the content of the sediments, affect coastal sedimentation and, therefore, have implications for Angola's ports and coastal areas.

Information about these problems and the performance of Angola's hydrographic basins is extremely limited. A global study conducted in 2005 was the initial to create maps of Angola's basins, admitting that it had only approximate estimations about the flows of rivers, and very little information about yearly variations and erosion or sedimentation. The water measurement system created in the colonial era, the monitoring of rivers and their torrents, as well as measurements about groundwater levels, were all dismantled in 1975 and are only now being re-established. It is recognized today that gathering basic information and understanding processes, such as the performance of hydrographic basins and soil erosion, is extremely important for the post-conflict reconstruction efforts.

Deforestation is believed to be an important factor that leads to erosion and flooding in certain areas of Angola, with significant economic consequences. Another consequence of deforestation is the disappearance of CO_2 absorbents, reducing the environment's ability to absorb CO_2, and worsening the global warming problem. Tropical deforestation and forest degradation are also main causes of loss of biodiversity and species extinction.

Understanding the vegetal coal trade, considered to be an important factor in deforestation, contributes to the comprehension of important environmental issues for the country. It would contribute to the development of basic information on the national level about natural resources and understanding of processes such as the behaviour of hydrographic basins, erosion, sedimentation and flooding.

3.5.2 – Oral Information and Secondary Documentation for a Better Understanding of Climate Variability and Climate Change in Angola

This project is a research that aims to gather data that can contribute to the understanding of climate variability and possible climate change in Angola, with a focus on the central plateau and areas immediately to the south of it, including three out of four Angola regions considered to have the greatest agricultural potential (the central plateau, the centre-south transition and the Huíla Plateau). This research will contribute to the development of local adaptation capabilities to climate change.

The result will be a better understanding of climate and its variability: if there is change to climate patterns and the impact of these changes in the availability of water and the subsistence means of the communities (agriculture, wild food, livestock, fishing, potable water etc.). Another result will be a better understanding of how people adapt to change in climate patterns and what are the main difficulties of doing that. This information will be made available for use in climate models for Angola and neighbouring regions, and will also help in the development of adaptation strategies in the local and national levels, as well as improvement of local adaptation capabilities.

Meteorological data is scarce in Angola, with just a reasonable amount of data available pertaining to the period between 1945 and 1975. In order to provide complementary information, especially for the period post-1975, a variety of methods shall be used, including:

- Recovery of food security bulletin information, as well as information from the Ministry of Agriculture from the period between 1990 and 2005. These contain information about climate events. Combining this information to create maps and ordering them chronologically to reveal trends and changes in climate patterns;
- Recovering press information. Development Workshop Angola (DWA) maintains a file of local newspapers and has access to local news summaries. These contain information about heavy rain, floods, erosion and droughts, which will be compiled and then incorporated into chronologically ordered maps;
- Recovery and analysis of meteorological data contained in files from recent years, colonial records and international files. DWA already has a significant amount of meteorological data from the pre-independence era.
- Recovery and analysis of meteorological data from local sources (such as agriculture and agricultural services stations, where data may have been gathered but not consolidated);
- Gathering of documents, such as press clippings and scientific studies of the region about meteorological matters;
- Information about changes in climate patterns in the context of agriculture systems in several regions of Angola (especially those with greater agricultural potential) through interviews and conversations with farmers and peasants.

These will include the collection of oral stories from elderly people in selected zones and the conduction of interviews with focus groups in the villages to capture, on the local level, memories and perceptions of climate variability and climate change, environmental changes in general and human adaptation to those changes. The focus of the interviews will be, but no limited to, the last few decades, where meteorological data is scarce due to the conflict. Interviews with locals will involve permanence in the communities and prolonged qualitative interviews, especially with older people. DWA has conducted small-scale tests and research indicates that there is potential in these methods.

Information will be analyzed in the context of current agricultural systems in each region, in order to understand how current practices can be altered by climate change and the needs this creates

(such as new kinds of seeds, new cultures or new practices). When environmental risks (such as flooding or erosion) are identified, these will be located and put on maps.

Angola is located in a region where different climate zones meet. The south is arid and semi-arid as are the south and central areas of the coast. Northern Angola is part of Africa's humid tropical zone. Precipitation increases from the south to the north, and from the coast to the countryside, happening mostly in the form of heavy rainfall. Precipitation can vary significantly from one year to the next. In some areas of the country, climate indicators also change quickly through short distances. It is difficult to identify climate change in a context where there is a high degree of variability from year to year. There are also difficulties in predicting the impacts of climate change in regions (such as Africa) where there is few data to calibrate models with and where there is less understanding of how different factors, such as relief and vegetation coverage, interact.

Uncertainty is particularly high in Angola and the Congo Bay region, where conflict reduced the number of operational meteorological stations in the last 30 years. In Angola, a network of meteorological stations was only created in the late 1930s and early 1940s: before then, there were only a limited number of stations regularly providing precipitation data. Between 1950 and 1975 there were about 500 stations, but in 1975 the abandonment of the country by the colonial Portuguese administration reduced that number to about 20. Meteorological data stopped being published and from some stations data was not even sent to meteorological services.

This means that in Angola there are only acceptable meteorological records from 1945 to 1975. Thus, due to this lack of data, most regional models for southern Africa don't include Angola and very little analysis has been made about climate trends in this geographical space.

Despite the lack of information to evaluate climate change, the African continent will have to adapt to the impact of these changes. Adaptation implies actions to reduce vulnerabilities within communities and regions, and diminishing adverse effects; it requires actions from governments, communities and individuals. It is generally accepted that effective adaptation strategies should reduce current vulnerabilities, as well as vulnerabilities to future climate change, and be ecologically sustainable. Adaptations based on communities will be a important part of this process and the perceptions of local communities affected by climate change will be important in the planning of adaptation strategies.

3.5.3 – Design of Buildings and Urban Zones to Minimize the Effect of Higher Temperatures in the Context of Climate Change.

This project is an investigation of design and planning techniques for buildings and human settlements, in the context of Angola, which can reduce the effect of higher temperatures on human comfort and health.

The result will be a description of building and urban planning techniques that can reduce the effects of higher temperatures through more effective ventilation of inhabited and occupied spaces and reduction of sun light incidence; it includes a study about the orientation of housing and other buildings so that they are less exposed to sun light, and doors and windows don't face the sun at noon. This requires the study of sun incidence angles in key seasons as well as a study about most frequent wind currents, to optimize the amount of fresh air.

One of the likeliest consequences of climate change in Angola is that, until the end of the 21st century, temperatures will be higher than today. Climate models indicate that there will be an

increase of more or less 3ºC in surface temperature in the next 100 years. One of the consequences of higher temperatures can be uncomfortable conditions inside housing and other buildings.

Temperatures in urban areas are higher than in rural ones due to the concentration of man-made heat sources and greater absorption of heat. Urban surfaces have lesser reflectivity than rural ones. The use of materials the greatly absorb sun light (of low reflectivity) provokes a larger accumulation of heat during the day, and the deep spaces between building prevent ventilation and cooling of these surfaces. This phenomenon is called "urban heat island", and these islands cause discomfort in cities with tropical warm weather. Changes in air humidity, precipitation and wind are also associated with the presence of urban heat islands.

So it is in the urban areas that the effects of higher temperatures are felt. The heat islands worsen the effect of heat waves, with consequences such as sleep disturbances and health problems. A prolonged stay in hot buildings negatively affects the general health of a person due to extreme demands made on their thermal regulation mechanism. Under the influence of high temperatures or a high level of radiation, there is an increase in sweat secretions and a change in the metabolism. Even though the human body's thermal regulation mechanism is efficient, it doesn't have the ability to deal with the excessive demands made under these conditions.

Air conditioning equipments or ventilators may compensate high temperatures, but they are expensive for certain sections of the population and consume significant amounts of electric energy. During heat waves, there are peaks of energy demand for refrigeration and ventilation, and probably the increase in these peaks will be greater than the average increase in energy use.

The design and planning of human settlements can reduce the effects of higher temperatures through more effective ventilation of inhabited and occupied spaces. The direction of housing and other buildings in such a way that it is not exposed to so much sun light, as well as doors and windows that don't face the sun at noon reduces temperatures. The direction can also be adjusted so as to ensure a constant flow of fresh air through the buildings in optimum speed to improve ventilation, which is one of the most important health factors to consider in designing buildings. This would entail studies about the direction of the sun and of the winds in each location. The use of these techniques, combined with the planting of trees and bushes and the growing vegetation near the housing, can significantly reduce the ambient temperature. Urban geometry can be planned taking into account wind flows, energy absorption and the capacity of a determined surface to emit long wave radiation into space.

3.5.4 – Identification of Urban Areas at Risk of Flooding and Erosion

This project is an investigation that aims to identify urban areas in Angola that will be in risk of flooding and erosion, describe the nature of these problems and provide alternatives to diminish the risks. The results will be geographical charts of the risk areas, descriptions about the nature of the problem and strategies to deal with and minimize the effects.

In Angola precipitation takes in general the form of storms, which differ from regular rain due to its shorter duration and larger raindrops. Variability from one year to the next of meteorological elements, such as precipitation, is usually high. Precipitation in a certain location varies significantly from year to year; for example, in Luanda, between July 1977 and June 1978 only 48 mm of rain fell, but between July 1983 and June 1984 it rained 898 mm. Precipitation also varies greatly from one location to a not so distant location in the same year. Precipitation variability in many regions of Angola is higher than in other parts of southern Africa, even though the reasons for this have not yet been well studied.

Variability in precipitation, and the possibility of torrential rains, creates risks of flooding: rivers overflow when the excess water cannot be drained after heavy rains. The Cunene Province, especially the city of Ondjiva, has suffered from floods in recent years due to higher water levels in the rivers of Cuvelai Bay after abnormally high precipitation. In storms and torrential rains the water hits the ground pretty hard. Where there is human activity, the soil tends to have low levels of organic material to connect it and naked surfaces. Where there are naked surfaces, rain cannot infiltrate the ground, water begins to flow over the surface and the strength of the rainfall closes the pores in the surface of the soil, moving its particles around.

Most of Angolan cities occupy erosion risk areas and present signs of erosion in their surroundings. Erosion is more of an urban problem in Angola, while in other African countries it is more prevalent in rural areas.

There are Cities that create situations of occupation of risk zones. In Luanda, for example, the city has and has always had inhabited areas in cliff edges along the coast. The city of Huambo is located on a plateau, but the series of important rivers that begin near Huambo are the object of incisions in the landscape. Residential areas have also started to occupy riverbanks that can suffer floods in certain years. Several years can go by without a flood, which encourages the occupation of terrains that seem safe, but they will flood in a year of intense rainfall. In rural areas, soil from areas located near rivers is often fertile due to continued sedimentation. Inhabitants of riverbank areas choose to live in those places so they can be near fertile ground, grow their food and fish, knowing that it is dangerous to live so close to the water, since they can lose their homes and possessions. Also after floods there is an increase in illnesses transmitted via water. Meaning, their lifestyle is vulnerable.

One of the risks of climate change is that precipitation increases and there are more torrential rains. So, climate change can increase the risk of floods and erosion; a risk that already exists. Adaptation to climate change begins with the creation of the ability to deal with current risks. The initial stage is to create geographical charts that indicate risk areas: these can be identified with the use of satellite imaging, marking inhabited riverbank areas and tilted land. Another source of information is newspaper archives and emergency bulletins that indicate terrains that have already experienced floods or erosion. Interviews with local residents and observation indicate when the flooding and erosion episodes occur.

Identifying risk areas generates the conditions for the identification of strategies to deal with current risks and possible future risks. A type of strategy is the protection of risk areas through physical barriers; the disadvantage of this is that the height of future floods is unknown and, once the barriers are surpassed, destruction can be complete. Another type of strategy is a retreat, which requires evacuations of risk areas: the disadvantage of this is that inhabitants of risk areas chose to live there for economic reasons and the pressure to occupy such land is high, so it may be difficult to find other sites that present the same economic advantages.

The third type of strategy is accommodation, which involves a series of actions that allow the continuation of the occupation of risk areas, but minimizing risks: for instance, the implementation of robust early warning systems, the use of several communication systems to transmit information (from drums and flags to colours and electronic systems), the identification of escape routes for people and valuables, the identification of refugee sites and survival strategies until external aid arrives, the regular drill of warning responses, and the acquisition of material and spare parts to make an important piece of equipment work after an incident.

The identification of risk areas can be the initial step in the choice of strategies and the identification of measures to reduce the risk of floods and erosion and also to live with those risks.

Chapter 4 – Climate Change Mitigation Measures

4.1 – Appropriate Measures to Mitigate Climate Change

The increased human interference in the biosphere in search of energy and materials is causing the deterioration of the environmental quality. One of the manifestations of this deterioration is the increased GHG concentration (especially CO_2, CH_4, N_2O) in the atmosphere. This increase is responsible for the worsening of the greenhouse effect, which, according to scientific predictions, will lead to an average increase in the temperature of the Earth's surface of 1 to 3,5ºC and an average sea level increase of 15 to 90 cm during the 21st century (IPCC, 1996).

Energy consumption predictions for the 21st century suggest a continuous increase in CO_2 emissions, from 7,4 billion tons in 1997 to approximately 26 billion tons in 2100. Unless drastic changes are made to the energy production and consumption model in the next few years, the world will face severe environmental alterations, particularly in relation to climate change.

Currently, significant initiatives are being developed internationally, aiming to reduce GHG emissions. In this sense, each country has politically set different goals for the reduction or limitation of carbon emissions. The Clean Development Mechanism (CDM) is one of several "flexibilization mechanisms" authorized by the Kyoto Protocol (December, 1997) and it consists in the certification of carbon emissions reduction and sequestration projects in developing countries, as well as the subsequent sale of these certificates to developed countries, as a way of reaching set targets.

Climate change is a problem with unique characteristics, which affects countries such as Angola, currently undergoing a period of intense social and economic development. This development, which will characterize the next few decades, can however follow different directions, resulting in significantly different quantities of GHG emissions, depending on the choices made, especially in the area of energy production and consumption.

Improvements in quality of life, including healthcare and education, as well as the egalitarian distribution of resources, are now key concerns within the Angolan sustainable development policy. This "mission" is inevitably reflected in the mitigation action taken, meaning, in the implementation of measures associated with a predicted reduction of GHG emissions and, subsequently, have a positive impact on the country's macroeconomic tendencies. Actually, the design of a sustainable development trajectory pertaining to energy production and consumption, producing via renewable sources and consuming with greater efficiency, allows the construction of a low emissions scenario that brings to the country more wealth, employment, healthcare and education, i.e. improved quality of life. The main topics discussed in the mitigation work include qualitative analysis of technological and economic potential of mitigation opportunities and their respective barriers, market potential and opportunities, as well as identification of measures and policy instruments. Large gaps of necessary data were identified and a cost-benefit analysis of the identified opportunities was made.

External social, economic and environmental factors were also taken into account in the qualitative analysis. These represent the effects, in this case positive, of economic activities conducted with environmental care, which encompass more population and services than those directly associated

with any identified measure. This means, for example, that the benefits associated with the production of renewable energy surpass the GHG emissions savings, producing also results when it comes to improved air quality, job creation and health improvements. These benefits are reported in the Mitigation Matrix, presented in this communication.

As mentioned, the social and economic context of the country, having recently ended a long civil war, doesn't allow for a detailed characterization of energy consumption in different sectors. So a typical bottom-up analysis does not apply, even though the LEAP (Long-range Energy Alternatives Planning System) methodology, supported by the UNFCCC, was the one that brought the results that were consistent with Angola's reality. The mitigation strategy presented herein should, therefore, be used as a long-term guideline in the evaluation of concrete mitigation projects. It is also important that the indicated scenarios be considered for the use of investment opportunities, both by the scientific community and by other interested parties at the national and international levels. Within this perspective, in the UNFCCC National Implementation Strategy and in the Kyoto Protocol, the forestry, energy, industry and waste sectors were previously identified as the main culprits for GHG emissions in Angola.

In the chapter pertaining to Angola's emissions inventory, the country's emissions level in 2005 was identified. Now, in accordance with article 4th, paragraph 1, and article 12th, paragraph 1, of the UNFCCC, Angola reports in this chapter the main national measures that contain mitigation aspects, while at the same time facilitating the adequate adaptation to climate change, among other actions objectively linked to the Convention's goals. In short, this chapter about "mitigation" identifies the main measures in the sectors that contribute to emission reduction in the most efficient way, based on the knowledge of the principal players involved and, therefore, who contribute the most for the sustainable development of Angola.

4.2 – Summary of GHG Emissions

The GHG emissions inventory for 2000 and 2005 was developed considering the energy, industrial processes, agriculture, Land use change and forestry, and waste sectors.

For the reference years, estimated emissions were calculated in gig grams (Gg) – or a thousand tons – of carbon dioxide equivalent (CO_2eq), which is obtained by multiplying CO_2 (carbon dioxide) emissions by 1, CH_4 (methane) emissions by 21 and N_2O (nitrous oxide) emissions by 310, according to the Global Warming Potential (GWP) established by the IPCC and adopted for the inventories. For the present inventory, in 2000 CO_2 emissions corresponded to 13.243 Gg, CH_4 ones were of 15.953,39 Gg CO_2eq and N_2O total emissions 13.944,01 Gg CO_2eq; in 2005 CO_2, CH_4 and N_2O emissions were of 29.261, 20.158,32 e 14.098,37 Gg CO_2eq respectively

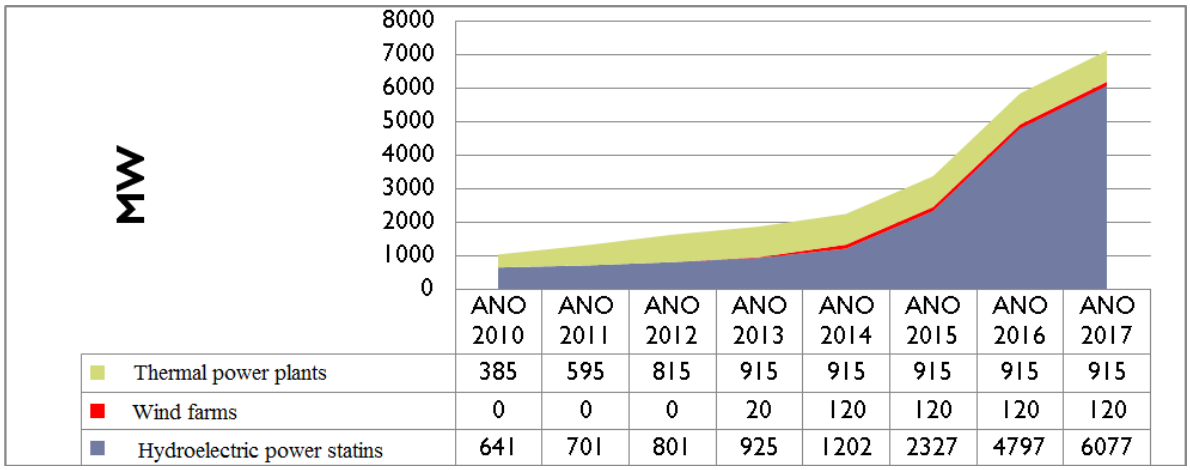
4.3 – Mitigation Measures Matrix

There is not one energy strategy or policy that integrates all sources and forms of energy use. Angola possesses an enviable energy potential: 13 to 15 million barrels of oil (which can come to surpass 20 billion if possible reserves in deep and off-shore waters are confirmed as technically and economically viable); 12 to 13 tcf (billions of m^3) of natural gas (which can come to surpass 20 tcf, in case possible reserves at the Congo Bay and the Congo Delta are confirmed); hydroelectric potential superior to 1200 Hw (corresponding to capacity currently in use, in recovery or being finalized – case of the Capanda Dam, with a predicted potential by itself of 520 MW); coal (wood, turf, lignite) – in the Lungué-Bungo river bay deposits are evaluated at 3

million tons); solar energy (to be quantified) or hydrogen (almost unlimited potential, depending on the cost of production). This potential needs to be used in an articulate way.

When it comes to the search for energy in transportation, it is important to emphasize that most of the Angolan population is concentrated on the coastline, particularly in Luanda. Thus it is necessary to create a transportation and infrastructure common market, remaining aware that investments in transportation infrastructure will have potential profitability and grace periods determined by the characteristics of a common regional market. The programs planned by the government for 2025 include:

- "Integrated Spatial Development Program", including: mapping of transportation corridors; development corridors; and spatial development initiatives;
- "National Rural and Urban Mobility Program", including the development of rural and urban transportation;
- "National Infrastructure Repositioning Program", encompassing ports, roads, railroads and airports;
- "National Technical Capacity Reinforcement Program".



	ANO 2010	ANO 2011	ANO 2012	ANO 2013	ANO 2014	ANO 2015	ANO 2016	ANO 2017
Thermal power plants	385	595	815	915	915	915	915	915
Wind farms	0	0	0	20	120	120	120	120
Hydroelectric power statins	641	701	801	925	1202	2327	4797	6077

Graph 5– Angola's Energy Matrix in 2017

Thermoelectric Plants / Wind Farms / Hydroelectric Plants

Here are some measures discussed in mitigation efforts referring to the mentioned sectors:

In the energy sector
- Expansion and reawakens creation of the electric energy distribution network.
- Construction of renewable energy centres: hydro and wind.
- Use of the natural gas originated from Oil exploration.
- Improvements in domestic demand: promotion of more efficient appliances
- Improvements in transportation demand: reawakens creation of the automobile fleet as well as of railroads.

In the waste sector
- Implementation of selective collection and treatment of urban solid waste.
- Promotion of the creation of landfills.

In the forestry sector
- Reduction of deforestation.
- Increase in the supply of butane gas.

. Strengthening of legislation.

From these efforts a qualitative analysis matrix was built, with guidelines about long-term mitigation options and describing costs and benefits associated to each one, directly contributing to Angola's sustainable development.

The presented matrix summarizes the information gathered about intentions to mitigate GHG emissions in Angola in the next 20 years.

The measure is identified in the initial column; the second classifies the mitigating potential in terms of expected quantity of emissions saved; in the third column, the costs associated with the implementation of each measure; in the fourth, the relation between the measures and the national sustainable development goals, and consequent positive external factors expected; and, in the fifth column, the expected level of difficulty in gathering data for specific cost-benefit analysis of each measure.

In the last column, as a way of gathering all the aspects of previous columns, the measures are classified in a ranking of mitigation objectives from A (greater importance vs. results) to C (lesser importance vs. results), emphasizing that even measured classified and C are indispensable to a mitigation scenario.

Thus, ordered by level of practicability/classification, there are:

Energy supply	**Classification**
New natural gas plant	Being implemented
New renewable production	A
Network improvements	B
Energy demand	**Classification**
More efficient domestic appliances	A
Create awareness on the automobile fleet	A
Awareness risingof railroads	B
Forestry	**Classification**
Reducing deforestation	A
Waste	**Classification**
Selective collection and treatment of urban solid waste	B

Table 26 - Options of GHG emission mitigation measures matrix

Measures		Mitigation Potential	Costs	Consistency with objectives and positive external factors		Data availability	Classification
				Of development	Of the environment		Political, social, technical…
Energy Supply	Network improvements	High: savings of 15% to 22% of energy (% of loss currently estimated)	High: Expansion of the electric network	Popular access do electric energy	Avoids deforestation. Reduces air pollution (from fumes of coal and wood burning)	Existing	B
	New renewable production	High: 7 GW of power in hydro plants in 2014 and 2015	High: construction of eight plants	Increase of employment in the mid term	Saving of natural resources. Possibility of use for irrigation	Existing	A
	New natural gas plant (2010: start of operations)	High: use of 70% to 85% of gas from oil extraction, currently burned	High: construction of one plant	Increase of employment in the mid term	Use of existing resource	Existing	Being implemented
Energy Demand	More efficient domestic appliances	High in the following measures: replacing incandescent light bulbs; implementing new	High initial costs for fluorescent light bulbs and ovens Indirect costs from awareness raising campaigns	Increase of local employment in technology producing factories Increase of real population wealth via savings in	Avoids deforestation. Reduces air pollution (from fumes of coal and wood burning)	Reasonable	A

Measures		Mitigation Potential	Costs	Consistency with objectives and positive external factors		Data availability	Classification
				Of development	Of the environment		Political, social, technical…
		technologies for ovens and lighting		energy costs			
	Create awareness on the automobile fleet	High	Low administrative costs: via implementation of mandatory inspection rules, with adequate allocation of prescriptions	Increase of local employment Increase of real population wealth via savings in energy costs	Reduces air pollution (from fumes of coal and wood burning)	Very few	A-
	Awareness raising of rails roads	High: use of more than 2000 km of railroad lines	High: awareness rising of more than 2000 km of lines and respective convoys.	Increase of local employment Increase in the availability of public transportation	Saving of natural resources	Few	B
Waste	Selective collection and treatment of urban solid waste	High: use of more than 2000 km of railroad lines	High: construction of landfills and establishment of collection routes		Saving of natural resources Preservation of biodiversity	Reasonable	B
Forestry	Reduction of deforestation	High	Medium: administrative costs of creating legislation and future	Increase of local employment in fire fighting and in the	Saving of natural resources Preservation of	Few	A

Measures		Mitigation Potential	Costs	Consistency with objectives and positive external factors		Data availability	Classification
				Of development	Of the environment		Political, social, technical…
			control.	forestry sector Lesser impact on electric networks	biodiversity		

Source: Luanda work session, November 2010

Other mitigation measures shall be complemented by a series of other Government projects. Their implementation depends mainly on the CDM and other market initiatives that can be adopted, within the perspective of economic growth and sustainable development for Angola. The development of the Clean Industrial Park and the reforestation programs will complement the described mitigation measures.

Table 27- Projects Ideas and Proposals Under the Clean Development Mechanism (CDM)

Recovery of burned gas	**Hydroelectric Use/Construction**
Angola LNG	**Mini-hydrous**
Angola LNG-Soyo Power Plant 22 Mw	Solid and liquid/biogas waste
Co-generation plant with gas-Flared on shore SOMOIL, 28,5 Mw-Soyo	Luanda landfill
Malembo Power Plant, 35 Mw-Cabinda	Benguela landfill
Fútila Power Plant, 70 Mw-Cabinda	Huambo landfill
Thermal reconversion of Luanda in gas plants	Lubango landfill
Lobito Refinery	Effluents treatment station in Luanda
Hydroelectric use – requalification and activation	**Solar and wind power**
2nd hydroelectric plant, 520 Mw-Cambambe	70 solar villages, 0,730 Mw
Gove, 60 Mw-Huambo	Tiger Bay wind farm, 23,8 Mw
Requalification and activation of the Lomaum dam, 1,46 Mw-Benguela	Tombwa-Namibe wind farm, 100 Mw
Requalification and activation of the Mabubas dam, 22 Mw-Caxito	**Energy Efficiency**
Requalification and activation of the Matala dam, 40,8 Mw-Huíla	Clean Energy Angola – Light bulbs exchange program
Requalification and activation of the Biópio dam 14,4 Mw-Benguela	Clean Energy Angola – Placement in public lighting of low consumption light bulbs
Requalification and activation of the Cacombo dam, 24 Mw-	**Biofuels**
Requalification and activation of the Jamba-La-Oma dam, 50 Mw-Huíla	Food and biofuels program, 113 Mil ha
Requalification and activation of the Jamba-la-Mina dam, 128 Mw-Huíla	
Requalification and activation of the Dala-Chiumbe dam, 12, 41 Mw-	

The mentioned projects above have a potential to sequestrate up to 23 million tons of CO_2 equivalent in atmosphere.

4.3.1 – Renewable Energy

In the renewable energy sources, actions aimed at increasing the electricity supply are programmed, with the use of the following sources: photovoltaic, wind and water (Mini-hydrous).

In the photovoltaic sources, the following actions are planed:

• Construction of 23 solar villages in the Huambo Province;
• Construction of 75 solar villages in the Bié, Lunda-Norte, Zaire and Malanje Provinces.

This program aims to use photovoltaic energy in 98 villages in the afore-mentioned provinces, in order to satisfy the needs of schools, medical centres, water pumps, police units, public lighting etc.

In the wind power sources, the following actions are planed:

• Installation of two small wind farms of 1 MW each in the Cabinda and Huambo Provinces;
• Installation of a wind farm of 4 MW in the Namibe Province;

Thus, the 2010/2017 program must deal with the decentralized electrification of certain areas of the country that urgently need electric energy services for reconstruction.

In accordance with this, the program proposes the development of the following actions:

- Awareness raising and Education of people in Scientific and Industrial Investigation;
- Solar energy via the installation of photovoltaic panels;
- Construction of mini and micro hydroelectric plants;
- Study of wind potential and installation of respective systems;
- Rationalization of the use of traditional energy; and
- Conservation, saving and application of energy norms.

The extension and diversification of energy sources will help reduce GHG emissions in the rural area, where in 2009 biomass was calculated as about 80% of all energy use.

4.4 Construction of Reference and Mitigation Scenarios

In the sectoral analysis are included: energy supply, including electricity and oil refining, and energy demand from families, transportation, industry, commerce and services. It should be noted that the analysis of agriculture, land use, forestry and waste is not directly listed on LEAP (Long-range Energy Alternative Planning

System). Due to a lack of data, effects from stock and reserves variations were excluded from the analysis, as well as statistical error margins and the calculation of external environmental factors.

To study the evolution of these sectors, two scenarios were built: one of reference, the baseline, and on of mitigation. In building these scenarios, the bottom-up methodology was used, with data previously provided by the UN (World Bank) until the year 2007 related to a large part of the variations. To analyze mitigation measures, 2030 was defined as the final year for calculation of the long-term effects of the estimated scenarios.

These scenarios are defined as:

Reference Scenario (BAS): shows the evolution in Angola without considering new measures for controlling emissions. Assumes continuity in current trends of economic and social growth, with the development concerns inherent to the country's current policies, but without considering GHG reduction measures.

Mitigation Scenario (MIT): estimated the evolution of Angola considering a reduction in emissions associated with different sectors, due to the application of the sustainable development model, such as renewable energy production or improvements in transportation efficiency.

The difficulty to obtain data and in some cases their inexistence is the current reality resulting from the social and political situation through which the country has been, and that only now is beginning to change. It was not possible to build cost-benefit analysis of projects from mitigation actions, due to the lack of data that would quantify current and future characteristics related to energy efficiency, fuel consumption or number of users. The calculation of result estimates was done only in terms of reducing the final energy use, for demand measures, and of clean energy production increases, or even decrease in percentage of losses within the distribution network. The emission factors from TED (Technology and Environmental Database) were automatically considered in the model.

It is intended that projects approved in the future, within the areas considered in the mitigation matrix, will bring results that meet the reduction goals set in the mitigation scenario.

4.5 Other Sectors

Other sectors, namely non-energy sectors, have not been included in the scenario simulations due to a lack of data. However, it was possible to gather the main proposals relative to forestry and waste, currently being prepared for implementation in the next few years.

4.5.1 – Forestry, Agriculture and Livestock Sectors

Besides possessing a rich and varied natural forestry patrimony of approximately 53 million hectares', corresponding to 43,3% of the country's territory, of which about 2% are considered to be high productivity forests, Angola has significant opportunities to initiate a large-scale afforestation and reforestation program, from

which several economic, social and environmental advantages can be drawn, alleviating the pressure on natural forests.

Peace, political stability and the democratization process, macroeconomic stability and economic growth, revitalization of the private sector, the resettlement of displaced peoples and refugees, as well as social and productive reinsertion of the population, bring to the country a new opportunity for development and a new challenge for economic and social transformation, and sustainable growth of the forestry sector, making use of opportunities such as:

Land Availability: large extensions of existing land in Angola that has the potential to implement large-scale afforestation programs. To this virgin lands potential, much of which is marginal and not appropriate for agriculture, is combined those that, during the long period of war, as a consequence of dislocation and concentration of populations in suburban zones, were degraded and need to be reconverted into forested plantations.

Appropriate Climate Conditions: Angola has the benefit of being located in a strategically rich region when it comes to favourable climate conditions for rain and planting of several rapid growth species.

Extensive Water Resources: To these optimum climate conditions is associated the availability of surface and ground water, which provides a favourable environment for planting native and exotic species.

4.6. Potential Areas for Forestation and Reforestation

With a territory of 1.246.700 km^2, about 18 million inhabitants and an annual growth rate of 3,1%, Angola has a potential of about 57,4 million hectares' for agricultural practice, of which about 8 million are comprise of fertile land. The use of this land is limited to about 4 million hectares' across the country.

Obviously part of this land, especially in areas considered to be marginal, uninhabited or of low density and without harm to food production, can be converted into forested plantations, with environmental and social benefits in terms of soil protection, water routes, mitigation of climate effects and sustainable development of forestry products, such as wood and construction poles, paper paste and wood fuel.

The Kwanza Norte, Uige, Bengo, Kwanza Sul, Malanje, Lunda sul, Huambo and Moxico Provinces appear to be the ideal ones in terms of availability of areas for afforestation and reforestation.

Table 28– Areas Designated for Forestation and Reforestation

Areas designated for afforestation and reforestation (ha)			
Provinces	Natural	Degraded	Total (ha)
Bengo	-	30.000	30.000
Bie	90	380	0.380
Cabinda	-	-	-
Cunene	-	-	-
Huila Huambo	12	3.988	4.000
Kuanza Norte	66	18.055	18.121
Malange	760.222,50	771.512,5	1.531.735
Huije	5.376	5.376,5	10.752,5
Kuanza Sul	4.000	16.500	20.500
Benguela	9.000	35	9.035
Lunda Sul	500	270	0.770
Lunda Norte	80.000	1.200	81.200
Mixico	20	55	0.75
Namibe	-	6.550	6.550
Kunene	-	-	-
Zaire	65	30	0.95
Total	859.339,5	853.952	1.713.213,5

Source-Forest Development institute 2007

In terms of degraded areas, the results of the Spatial Evaluation of Forests, Woods and Sensitive Ecosystems of Angola Project, conducted by the IDF in 2007, has clearly demonstrated that there are more degraded areas around the country, with particular incidence in the Luanda, Huambo, Huila, Bié, Benguela, Cunene and Kwanza Sul Provinces, including the desert province of Namibe.

All this information is indicative to establish priorities for large-scale afforestation and reforestation to several ends, including protection and production of consumable and commercial goods.

- In general, the east provinces (Lundas and Moxico), due to the degradation of peri-urban soil from water erosion (Ravines), have become priorities for forested plantations of protection and conservation, with species of rapid growth, and also allowing for the planning of areas for commercial forest plantations given the regularity and intensity of rainfall;
- The north, particularly Malanje, Kwanza Norte and Uíge, has potential to establish large-scale commercial or industrial forest plantations and, on a smaller scale, protection;
- The centre, including Huila, has potential for both sectors (protection/conservation and commercial or industrial), and the coastline – Bengo, Luanda, Kuanza Sul, Benguela and Namibe, including Cunene – has potential for protection and conservation forest plantations, for energy ends, given the desertification phenomenon and the deforestation rate related to the production of vegetal coal.

In Angola, estimates from the Global Forestry Resources Evaluation indicate an average loss of natural forest coverage of 106 thousand hectares' each 10 years, at a annual deforestation rate of 0,2%, and 370 hectares' of forested plantations, at an annual rate of 0,25%. In order to reduce emissions from the forestry sector and mitigate the harmful effects from climate change, it becomes indispensable to combine conservation and environmental management measures and policies with economic and social development at the sub-regional, regional and national levels. To that end, Angola presents the following orientation objectives of the forestry mitigation measures:

- Promotion of way to use and benefit economically from forests, animal wildlife and areas of conservation;
- Promotion of the role and intervention of the private, community and cooperative sector in the rational management and use of forestry, wildlife resources and conservation areas;
- Improvement of the systems from protection, conservation and management of forests, animal wildlife, including integrated management of natural resources, with emphasis on ecologically sensitive areas in arid, semi-arid, humid and mangrove zones;
- Promotion of the involvement and full participation of local communities, civil society organizations and citizens, as active players in the protection, conservation and rational use of forestry resources, animal wildlife and conservation areas;
- Improvement and harmonization of central structures of forestry, wildlife and conservation areas administration, to ensure the integrated and sustainable management of the resources.

Considering the guidelines mentioned above, the forestry measures present in the National Forestry Strategy and reinforced in the work sessions have been:

- Concluding the national forestry inventory (in progress since 2008);
- Concluding the "National Afforestation and Reforestation Strategy", which includes repopulation (with underlying costs of 4000 ($) per person repopulated):

- Commercial or industrial forests;
- Protection and conservation;
- Community or energy;
- Investigative;
- Outside of the forestry and agro-forestry perimeters.

- Defining property rights;
- Setting conservation incentive programs;
- Penalizing the illegal abatement of tress;
- Regulating forestry exploration;
- Establishing a forestry, wildlife and conservation policy;
- Setting a reforestation fund.

At the rural, livestock and forestry development level, the planned action programs are:

- National Integrated Rural Development Program: for integrated rural development on a territorial basis;
- National Rural sensitization Program, with the following goals: rural extension, technical assistance to forestry, agriculture and livestock activities, animal vaccination and vaccine production, professional education and awareness rising in agriculture, strengthening MINADERP's institutional capabilities.

4.7 Waste sector

National guidelines for the waste sector are still being formulated. Given that fact, the following measures have been mentioned as possible implementations for the next few years:

- Construction of landfills;
- Closing of dumpsters;
- Recycling measures;
- Composting measures;
- Sequestration and combustion of CH_4 in landfills, dumps and effluents;
- Awareness risingand regulation:

- Awareness rising to separation
- Creation of taxes on waste
- Regulation about the obligation to burn CH_4
- Regulation about waste management

Angola's 2025 Sustainable Development Strategy implies a strong and strategic bet on a set of activities that, supported by natural resources, can generate wealth and high-level added value. To this end, the country has proceeded to the establishment of Mega-Clusters, which will include some clusters and rolls, and can serve as a reference framework for the development of national businesses and the constitution of national economic groups within and between clusters and rolls:

- Some Mega-Clusters: Mineral Resources; Water; Food; Habitat; Textile, Clothing and Footwear; Tourism and Leisure; Transportation and Logistics.

The introduction of this form of activities structuring must take into account, on the other hand, economic and social changes characterized by strong business dynamism, the location of strategic economic decision centres in the country, inter-sectoral diversity, densification and extension of rolls, organization of production, technological options and the use of native resources in a way that considers environmental sustainability.

Due to lack of information on industrial process it wasn't possible to include the industrial sector in the mitigation component. The use of clean technology to develop the sector would an important tool to undertake mitigation actions.

4.8. Economic and demographic growth

Growth rates assumed for Angola in both scenarios are the ones considered by the UN: 5,23% annual growth until 2010, 4,71% annually until 2015, 3,95% annually until 2020 and 3,12% annually until 2030. These are lower than the ones currently estimated by Angola's national institutions (about 10% annually until 2015). In terms of value added into the GDP by sector, given that there are no studies or data, participants in the work sessions have considered that in 2020 agriculture will contribute with 9% of the GDP, services with 20%, industry with 71% and manufacture with 6%.

When it comes to population, in both the reference and mitigation scenarios, the average UN prediction was considered: 18.993 million people in 2010; 24.507 in 2020 and 30.416 in 2030. It was also considered that in 2010 50% of the population was living in rural areas and that this would grow to a rate of 4% between 2010 and 2015, and 1% annually after 2015.

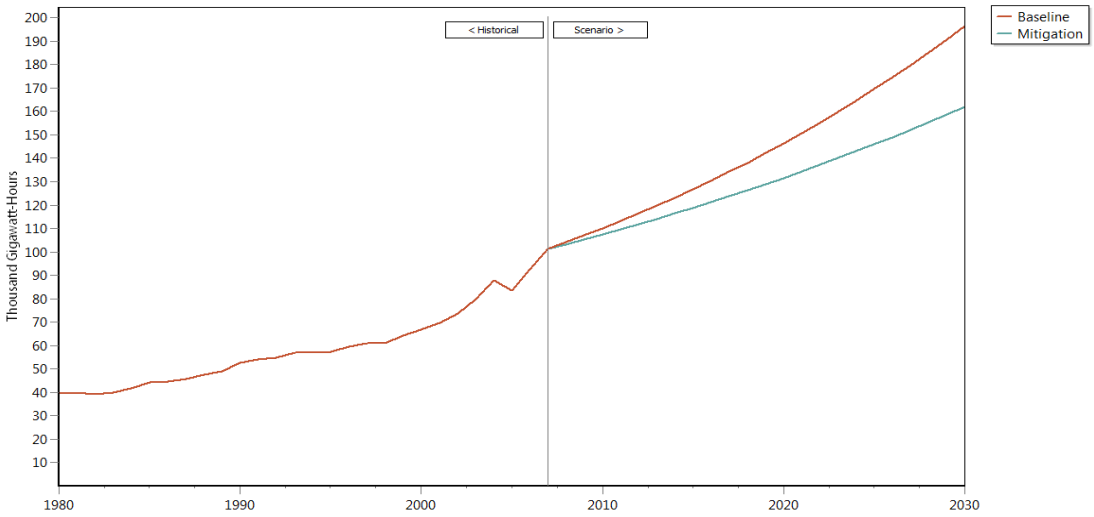
4.9. Energy demand

The evolution of the population and the GDP has a direct influence on energy demand simulations by various sectors. Within the parameters assumed, it were discussed the effects that measures related to promotion of more efficient domestic appliances, as well as creating awareness on the automobile fleet, could bring.

Thus, the reference scenario was built assuming a continuation of the average annual growth rate, from the last 10 years, for energy demand by each sector individually – domestic, agriculture, services and industry – also considering an annual growth rate of 3% (comparable to the GDP growth) in energy demand in maritime and air transportation, non-energy sectors and other unspecified areas.

In the mitigation scenario, due to the implementation of measures related to energy demands, it was considered a 30% reduction in the historic growth of family consumption, the services sector, and also in road transportation, value obtained during the work sessions in discussions about possible energy savings in those areas. It wasn't possible to include measures to mitigate original emissions from industry consumption, due to the fact that the base values for calculation are unknown.

The final results in terms of used energy savings are presented in the following way, totalling final savings of 341 thousand GWh.



Graph 6– Energy savings using LEAP (Source: LEAP, started data set and simulations, Angola). Final Energy Demand (reference and mitigation scenarios)***Unit: 10^3 GWh***

4.10. Energy supply

Electric energy production in Angola has a total installed capacity of about 900 MW in 2008, of which 70% was operational, being 60% water and 40% thermal. In accordance with information obtained during the work sessions, it is considered that 75% has become operational in 2010, and 80% will be operational in 2011.

There is a great difference between electric energy production in 2007 and 2008, in both scenarios, due to the collection of updated data. It wasn't possible to collect data from before 2008, so the original LEAP 'starter data set' was maintained, considering that the difference, referring to previous years, is of great importance. In the reference scenario, with aspects related to energy supply sectors, an average annual decrease rate of the percentage of losses in the electricity distribution network of about half of the average in the past 10 years was considered, since there is a significant lack of information in the IEA World Energy Balances 2008 and the 2025 Angola Development Strategy. In the mitigation scenario, due to the rehabilitation of electricity networks, it is estimated that the average annual decrease rate of percentage of losses will be 3.3% in 2030.

In relation to energy production, technical data from IEA World Energy Balances and Energy Outlook was maintained, updating the information about installed and predicted capacity, as well as estimated production.

Table 29 – Installed Capacity for Electric Energy Production (Reference and Mitigation Scenarios MW)

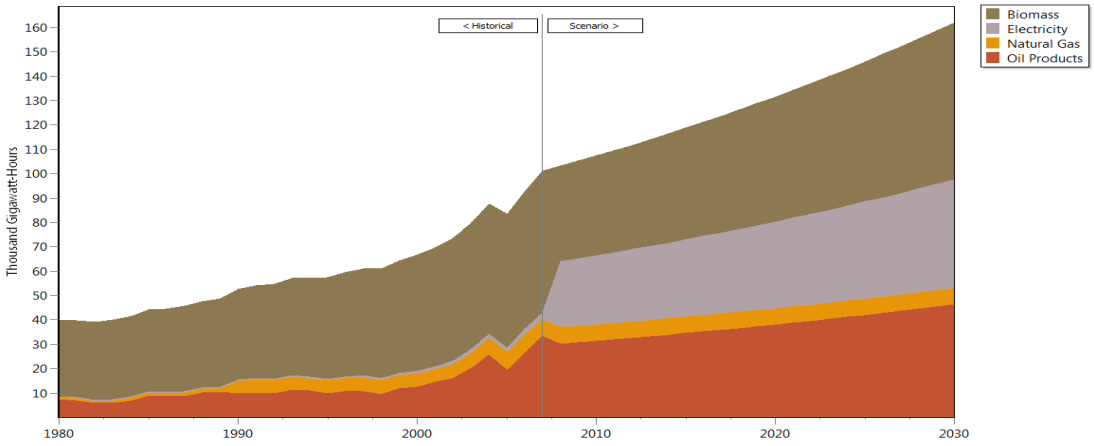
	Reference							Mitigation	
Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Water	378	473.80	507.65	610.29	793.06	1313.06	1378.06	3190.66	3834.66
Thermal	252	331.02	555.67	648.71	1268.89	1668.89	1668.89	1668.89	1668.89
Wind	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00	100.00

Source: LEAP, started data set and simulations, Angola.

The installed electric capacity is nothing more than the power associated with electric plants from around the country, which operate on fuel (thermal) or, in the future, on natural gas (thermal), or via dams (water), and even wind farms. This installed power ensures the production of the electric energy Angola needs. However, not all energy used is electric, especially on the domestic level; biomass is also very important. It should be noted that in obtained simulations, the growth of energy production is consistent with the growth of the installed capacity, and with the growth of energy demands.

The final energy used analysis (for mechanical, lighting and heating ends) is done through the following graph, which represents the growth in energy demand in the mitigation scenario. In fact, the national energy output of Angola, in the mitigation scenario, shows a larger growth in electricity use in detriment of thermal energy.

Graph 7 – Final energy used by type of fuel (mitigation scenario)



Source: LEAP, started data set and simulations, Angola. Unit: 10^3 GWh

4.11 – GHG emissions

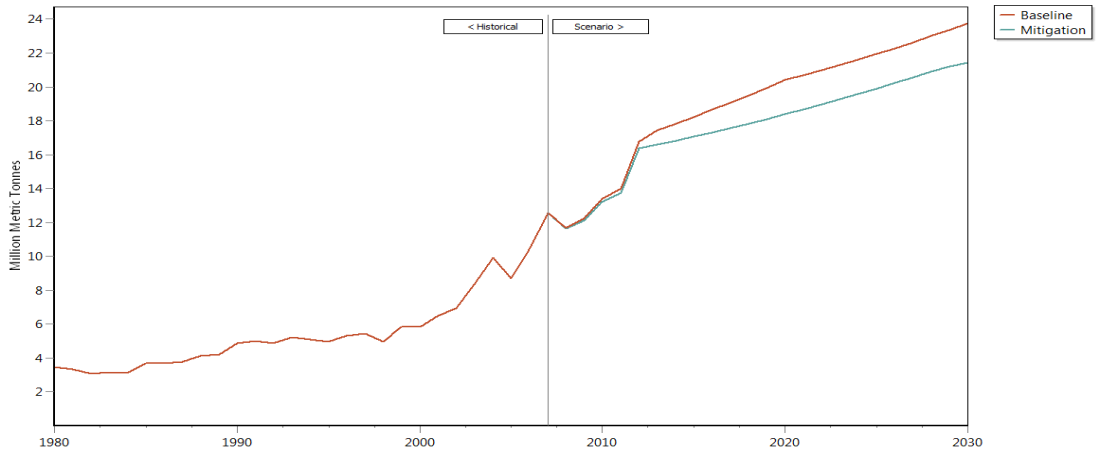
In parallel to the energy savings identified previously, it is estimated that the consequent GHG emissions savings would be of 17,3 Mt CO_2eq, considering as reference the inventory year (2005).

Table 30– GHG Emissions (reference and mitigation scenario). Unit: Mt CO2eq

	1995	2000	2005	2010	2015	2020	2025	2030
Reference	5	5.8	8.7	13.4	18.2	20.4	21.9	23.8
Mitigation	5	5.8	8.7	13.2	17.1	18.4	19.9	21.4

Source: LEAP, started data set e simulations, Angola.

Graph 8 – GHG Emissions (reference and mitigation scenario) Unit: M tCO2eq



Source: LEAP, started data set and simulations, Angola.

4.12 Clean development activities in Angola

By joining the Kyoto Protocol, the Angolan Government developed instruments that would allow decision makers to make the right choices. With this in mind, the National Strategy for the Implementation of the UNFCCC and the Kyoto Protocol was prepared. This document discussed the possibilities and opportunities that Angola has as a result of joining Kyoto, as well as the flexible mechanisms that can be used, especially, in the case of Angola, CDM.

Another particular aspect of this strategy is that it generates an exhaustive characterization of the sectors that must participate in CDM projects. These sectors include:

- Electricity
- Oil
- Transportation
- Agriculture and Livestock
- Management of urban solid waste
- Forestry
- Housing

4.12.1 Challenges for Angola

The two main challenges to be faced are:

- Establishing an efficient and effective legal/environmental framework, based on a clear identification of GHG emission problems in the country, to consider options to reduce or eliminate this emissions, and to define actions to be implemented, taking into account the economic transformations in progress, as well as the population's education and culture;
- Professional education and training of personnel to incorporate the Designated National Authority and be able to in an efficient and transparent manner, analyze and approve projects for the CDM. These courses could happen in the e-learning or presence formats, about the preparation of CDM projects, for expanded dissemination in different regions of the country.

Implementing these challenges takes into account the following steps:

- There are different situations and levels of development in the context of developing nations. For that reason, criteria must be general and broad, covering different sectors that are adopted in COP/MOP (Conference/Meeting of the Parties) decisions. It will be up to each country to define more concrete and specific criteria, always taking into account the COP/MOP guidelines and the reality of the country;
- Given the diversity of sector, the criteria needs to be homogenized for each sector in a way that facilitates preparation by the benefitted country and approval by the investing country, taking into account the principle of vulnerability and the contribution to sustainable development, promoting the reduction of poverty as well as the strategic goals of the benefitted country;
- The broadness of the country's main economic sectors with the implementation of CDM projects being that the best project ideas for Angola include sequestration of methane in landfills; reforestation; use of gas associated with oil production; public transportation sector; energy/dams; biofuels and agricultural industry.

4.12.2 Implementation of a New Development Scenario for Voluntary Projects

It is known that, for the success of new solutions for climate adaptation and emissions mitigation to be implemented regionally, by sector of activity and based on voluntary initiatives from countries for the promotion of policies and frameworks of multi-sectoral intervention, it is indispensable, before anything else, to ensure the full and effective capacity for self-verification according to the best international practices, capable of granting a high level of credibility to these new projects, and allowing them to be definitively introduced into new trading markets that are starting to be defined worldwide.

Angola is creating CDM capacity as well as developing solid and effective public/private partnerships. CDM projects in Angola must adopt criteria that enable

and improve the life conditions of the communities involved in emissions reduction/climate change projects. This initiative aims to ensure welfare and citizenship without degrading the resources base, besides ensuring that these projects can, actually, include sustainable development issues. It is also guaranteed a transparent way of measuring the social gains of the communities involved and a promotion of the environmental services provided to the community (Social Carbon).

Chapter 5 – Science, Technology and the Transfer of Technology

The responsibility for coordinating the implementation of the commitments made as a result of Angola's joining of the UNFCCC fell on the Ministry of the Environment, which gave priority to the issue of science and technologies related to climate change. Climate change issues are primarily scientific and technological, since the measures to mitigate global warming are actions that aim to promote, initially, the use of clean technologies and, secondly, cooperation for development, which requires practices and processes that prevent the problem and its adverse effects.

One of the problems discussed in technical and scientific circles pertains to science, innovation and the transfer of technology. In these meetings, the expression "transfer of technology" relates to different stages of the technological cycle, including research and development. Research and development implies innovation, which has become an important factor in ensuring growth, competitiveness and profitability, all essential for the survival of companies in the current globalized world. Innovating is generating a special kind of change, realized when new ideas lead to the creation or improvement of products, processes or services. Innovation requires constant interaction between research institutions and companies, as well as infrastructure and public policies that support and encourage this type of development.

Innovation also implies transfer of technology, meaning opening of national markets and the input and output of new technological products that improve internal or external processes, in close connection to growing market and consumer demands. The transfer of technology is a technique and know-how exchange process. Due to climate change it is crucial to develop and popularize clean technologies capable of replacing current technological processes that are the principal cause of the changes being observed in the Earth's climate.

Clean technologies already exist in some parts of the world, especially in some countries from the northern hemisphere, responsible for the biggest share of all GHG emissions. However, access to these technologies in developing countries is still difficult not only in financial terms, but also from the human perspective. Developing countries need to use these technologies since they are vulnerable to climate change and have to face developing problems. These countries need clean technology to be able to adapt to climate change in crucial economic areas such as agriculture, livestock and forestry, infrastructure, industry and mining, human settlements, healthcare, and most importantly, energy and transportation.

UNFCCC and its subsequent agreements orient Annex I countries to provide financial and technological assistance to developing countries in their actions to mitigate GHG emissions and adapt to climate change.

Transfer of technology is one of the most serious topics of international debate in relation to climate change. The transfer of environmental technology has polarized discussions during post-Kyoto negotiations in the context of the UNFCCC.

The question of "protecting intellectual property rights" opposes those who hold the patents to most GHG emissions reducing technology and the countries that claim that these technologies are too expensive. In Angola, intellectual property rights have long been protected by the state; industry sector legislation protects brands and products generated by innovation, as well as upholds international law on the matter.

In the case of extreme circumstances, the country will make use of original or patented clean technologies in advantageous financial conditions in order not to compromise other national development efforts. However, the implementation strategy for the UNFCCC consecrates Angola's involvement in the Clean Development Mechanism (CDM), based on a cycle of project identification, viability analysis and approval of these projects by an established authority, the Designated National Authority (DNA), which is also responsible for monitoring, verifying and certifying credit emissions. Entry into CDM and into its financial instrument – the Carbon Fund – can be used as a tool and incentive for the transfer of technology, to deal with adaptation to the country's vulnerabilities, identified in the vulnerability chapter.

5.1 – Public policy on science, technology and innovation

The Angolan Government has invoked the need for public policies on science and technology that promote innovation. Mandates and activities related to science, technology and innovation (STI) are common to many Ministries in the central, and provincial governments, as well as in civil society organizations, where there are also different coordination mechanisms.

In order to coordinate efforts in this area, the Government instituted, in 1997, the Ministry of Science and Technology, which was later, with the signing of the new constitution, restructured and had its name changed to Ministry of Superior Education, Science and Technology (MINESCT).

MINESCT also encompasses the National Technological Centre, in charge of investigation and experimental development in technology, and the National Scientific and Technological Development Fund, a support and financing mechanism for scientific investigation and innovation projects. In its rebuilding process, MINESCT has been called upon to perform the role of anchor for all the processes related to science, technology and innovation.

The Ministry's planned studies program should provide useful subsidies for STI policies and, in the short term, focus, develop and coordinate with other Ministries policies that would foster a favourable environment for science, technology and

innovation, as well as enable the creation of human capabilities and support infrastructure for investigation, something that should be coordinated with universities. The universities are excellence centres in generation of knowledge and as such should be capable of being involved in projects related to solving problems and challenges that social and economic development presents to society. Managing new knowledge and the adaptation to technologies from other parts of the world are challenges that Universities can face if the corresponding incentives, public support and financing are in place.

5.2 – Angola's Needs in Technology Transfer

In this topic are highlighted the technological needs of the country in relation to several areas of activity and development that are combined with the need to reduce GHG emissions. However, this section aims only to identify technologies that the country needs, taking into account its strong dependence on international know-how, since domestically it is not possible to satisfy any of the country's needs. By order of importance, these needs are described below:

5.2.1 – Industry Sector

In the industrial field, the main incentive to the transfer of technology is related to innovation, which is a strengthening factor for competitiveness. For exported products, the level and type of innovation are largely determined by external factors that include competitive pricing, consumer preference and regulations from the importing countries.

The Government has defined policies to stimulate innovative activities in the business level, to lower costs and increase competitiveness and encourage exports at prices that are competitive with the SADC (Southern African Development Community) and international markets.

Generally, the industrial sector's technological needs can be summarized as follows:

Table 31– Technology Transfer Needs for Manufacturing Sector

Manufacturing Sector	Transfer to Angola	of Technology
	South-South	North-South
Electric energy production from renewable sources, for GHG emissions reduction		X
New technological processes that consume less resources and produce less waste	X	X
Valuing and recycling of waste and effluents	X	X

5.2.2 – Energy Sector

Angola's hydroelectric potential is estimated at 18.000 MW. By the end of the civil war, in 2002, Angola had only 205 MW of installed hydroelectric capacity and 412

MW of thermal capacity. The International Energy Agency (IEA) underscores that the development of the energy sector represents the main challenge for the country's Government, especially in this period, with the large-scale construction of infrastructure, roads, railroads and transportation systems. IEA estimates that supply will still be lower than demand, which should grow by 20% annually in Luanda alone.

The Government has elected as a priority for the energy sector the expansion of the production capacity, but the problem of deficiencies in the network, the transmission and overall energy efficiency remains, which combined with maintenance difficulties, leads to systematic interruptions in the energy supply. Angola wishes to make full use of its hydroelectric potential in order to increase energy production and supply to meet the country's own development needs, as well as being able to export energy in the context of a regional plan to interconnect the networks of all SADC countries.

With the need to use water resources to produce electric energy in mind, the strategy also points to other renewable energy sources. For that, the country does not possess the technical or technological capability to satisfy economic, supply security, public health, universal access and sustainable development criteria at the same time. Thus, Angola's energy technology needs are:

Table 32–Technology Transfer Needs for Energy Sector

Energy	Transfer to Angola of Technology	
	South-South	North-South
Energy generation from renewable sources, natural gas, solar photovoltaic power, gasification of biomass, hydroelectricity and biofuels	X	X
Increase of network reliability to reduce losses and consequently improve energy efficiency Reducing consumption through the use of more efficient lamps and appliances	X X	X X
Adoption of clean productive processes		X
Dissemination of renewable sources of energy through the promotion of the use of solar panels and biodigestors	X	X

5.2.2.1 – Oil & Gas

The period between 1990 and 2004 can be considered as one of great discoveries of Oil, which has allowed the country to integrate the group of largest producers of oil south of the Sahara. Given this fact, Sonangol (the company responsible for the management of oil and gas reserves in Angola), aware of the Angolan State's responsibilities as to the adherence to UNFCCC, has prepared and is developing with partners the LNG Angola Project, which consists of the initial and second phases of construction of an enterprise that will stock and process gas associated with oil

production of all platforms from blocks 0, 1 and 14 in Cabinda and Congo Bay. So emissions in Angola will be substantially reduced.

As for refinery, SonaRef is being developed to process 200 thousand barrels of oil per day. This project was subjected to an environmental impact evaluation and the reduction in gas combustion should be one of the most important recommendations within the larger picture of environmental management. When it comes to mitigation strategies, the needs regarding transfer of technology are related to:

Table 33- Technology Transfer Needs for Oil & Gas Sector

Oil	Transfer to Angola	Of Technology
	South-South	North-South
Employment of developing technologies that reduce gas combustion or its transportation through pipelines and the processing in industrial platforms	X	X
Employment of new technologies for prospection, perforation, production, transportation, and stocking of crude oil	X	X
Employment of new technologies for processing and refining crude oil	X	X

5.2.3 – Agriculture Sector

The agriculture sector is characterized by family based operations that produce subsistence agriculture in an area of 1,4 million hectares. Commercial agriculture is developing, with strong private projects for food and agro-food cultures in agro-industrial hubs supported by the government. Continuity in public incentives is expected to reverse the current trend of importing food products once produced in the country.

Thus, in the next few years, there will be an increase in cultivated areas, with the replacement of forested land for agricultural land; an increase in gas emissions not only from higher use of agro-chemicals (fertilizers and pesticides); and an increase of production by culture as well as by surface unity. There will also be more flooding. This sector's technological needs are as follows:

Table 34- Needs in Technology Transfer for Agricultural Sector

Agriculture	Transfer to Of Technology Angola	
	South-South	North-South
Techniques for different cultures	X	X
Changes in topography for better water retention and erosion prevention	X	X
Changes in agricultural practices for the conservation of soil humidity and nutrients, avoiding superficial draining and controlling erosion	X	X
Improvement in the use and availability of water and soil erosion control	X	X
Rotation of cultures and changes in the periods of planting and harvesting	X	X
Development of new varieties of plants and techniques to increase added value	X	X
Drip irrigation and concentration of irrigation on growth periods	X	X
Protected and hydroponic irrigation	X	X
Integration between agriculture, livestock and forestry, and installation of wind breakers	X	X
Reforestation in arid and semi-arid zones	X	X
Techniques to ensure food security and quality	X	X
Methods for Combating pests	X	X
Hydroculture techniques	X	X

5.2.3.1 - Livestock

Cattle farming was one of the economic activities that took a big hit with the war; the number of animals decreased drastically. Huíla Province remains the leader in livestock production in Angola, with more than half of the country's bovine heads, and one quarter of goat, pork and poultry production. In livestock, technological needs are as follows:

Table 35- Technology Transfer Needs for Livestock Sector

Livestock	Transfer to Angola Of Technology	
	South-South	North-South
Supply of water and pasture		
Control and sanitation of bathing waters	X	X
Definition of the drinking points, and correct and cyclical drainage of these points	X	X
Controlled and intensive production of palatable pastures	X	X
Sanitation of livestock waste		
Treatment of residue and manure	X	X
Conversion of manure into domestic energy	X	X
Disease control		
Correct stocking of pesticides	X	X
Control of vectors and pathogenic agents	X	X

5.2.4 - Forestry

When it comes to forestry resources, 53 million hectares of land are considered to be forests (43,3% of the country's territory). Only 2% is comprised of dense, humid, high productivity forests, very rich in biodiversity. 65,2% is comprised of a mosaic of forest and savannah, as well as open forests called *miombo*, with medium productivity of wood, but socially and economically important for the production of wood fuel, construction materials, medicinal plants, and non-wood products for food. The remaining percentage is occupied by dry savannah, with sparse tress and/or bushes, desert and sub-desert steppe of low productivity.

The artificial forestry potential was considered in the 1970s to be approximately 148.000 hectares. The central plateau constitutes the main nucleus of these explorations. In the forestry sector, the technological needs are basically:

Table 36- Technology Transfer Needs for Forestry Sector

Forestry	Transfer to Of Technology Angola	
	South-South	North-South
Forestry extraction		
Seed production techniques	X	X
Energy production	x	
Modern use of biomass and electric cogeneration		
Technique for the promotion and carbonization of all forest species	X	x
Pyrolysis techniques and increase of stove efficiency		
Development of new techniques for reduction of consumption and energy conservation	X	X
Reforestation of arid and semi-arid zones	X	X

5.2.5 – Urban Waste and Basic Sanitation

Services connected to solid waste and sanitation has not yet been centralized. Provincial governments and communal administrations, according to the resources and abilities available, are trying to solve the waste problem. Common practices used have been combustion, disposal grounds with and without coverage and, in some cases, incineration of hospital waste.

Taking into account this lack of administrative focus regarding waste, as well as the lack of available data, the waste component of the GHG inventory focused on information about the Luanda regions. In the capital particularly, where a public service operates through ELISAL-E.P (the Luanda Cleaning and Sanitation Company), the Mulenvos landfill was built to handle 5.000 tons a day. The methane gas here is not reused and is sometimes burnt.

Table 37- Technology Transfer Needs for Sanitation Sector, Including Water Supply

Basic Sanitation	Transfer to Angola	Of Technology
Water supply	South-South	North-South
Increase in number and capacity of reservoirs	X	X
More efficient use of ground water	X	X
Improvement and expansion of the water treatment and distribution system	X	X
Industrial use		
More efficient use and recycling of water	X	X
Pollution control		
Promotion of treatments alternative to the chemical one	X	X
Reduction of volume of effluents, their treatment and use of recyclable water	X	X
Recycling industry and use of recycled products	x	x
Reducing the volume of effluents	X	X
Management of floods and leaks		
Reservoir construction	X	X
Protection and recovery of degraded areas	X	X
Landfills		
Landfill construction		
Capture, stocking and processing of biogas	X	X
Energetic valorization of biogas and waste management	X	X

5.2.6 – Transport Sector

Only about one tenth of all of Angola's roads was paved in 2004. Out of the 7953 km of paved roads, 88% were in "bad" or "very bad" conditions. The three railroad lines face operational problems, which make cargo transportation very difficult, this situation is changing with rehabilitation of all railways. The ports infrastructure also needs to be rehabilitated. An emergency transportation infrastructure reconstruction program was put in practice in 2004, and has already connected all provincial capitals. The railroads will be concluded and operational in 2012, which will improve the mobility of people and goods around the country and allow for the substantial reduction of road and air traffic.

Peace and several investment opportunities are increasing the flow of commerce in the country, with more trucks, ships and airplanes passing through or making stops, as well as an increased fleet of cars from abroad. The use of individual vehicles is also increasing more than ever before and there is no slowing down in sight, even though

the government has begun to set some restrictive measures. The measures set regarding technological transfer are:

Table 38- Technology Transfer Needs for Transport Sector

Transportation	Transfer	of Technology to Angola
Creation of residential and commercial areas, reducing the need for long movements	X	X
Promotion of public transportation with greater passenger capacity (convoy, subway, electric)	X	X
Use of integrated systems with different modes of transportation (road, water, rail)	X	X
Connection between urban transportation and use of land patterns	X	X

5.2.7 – Meteorology

The successive occurrence of extreme events has increased the vulnerability risk of the population and the inability of the civil protection services of ensuring them fundamental means of survival and protection of their possessions. To the authorities responsible for protecting lives and assets there is a lack of more and better information so that more effective contingency plans can be formulated; plans capable of minimizing the impact of extreme events. Thus, meteorology, hydrology and geophysics can play a crucial role in how Angola faces development challenges in areas such as handling natural disaster, food security, management of water resources, transport, tourism and pollution control.

Even though technological innovations are being generated at record speeds, in Angola many climate records available to the National Meteorology Institute (INAMET) remain in analogue format, with a lot of gaps in the sequence of climate data records between 1961 and 2000. Weather monitoring in Angola is made with the support of satellites from the INAMET network of meteorological stations, and is complemented with data obtained from the METEOSAT/EUMETSAT meteorological satellites, which are integrated into the Global Telecommunication System (GTS).

The meteorological observation network covers the country only partially and is not capable of meeting the needs of a territory of Angola's dimensions. Technological transfer needs in this sector can be summarized as follows:

Table 39- Technology Transfer Needs for Meteorology Sector

Meteorology	Transfer of Technology to Angola	
Extension and expansion of the meteorological coverage network around the country, including information about weather and climate, tides, seismic and hydrological events	X	X
Connection and interconnection of the national meteorological network with regional and international hubs	X	X
Establishment of the rapid warning system to prevent events	X	X

5.2.8 - Telecommunications

Communications are a key factor in development and are the basis for the establishment and operation of an information and communication society. The Angolan Government has recognized this need and has placed telecommunications on the list of rebuilding priorities.

The white book of telecommunication defines as the global objective of development policies the expansion of infrastructures that support the offer of diversified information and communication services. There is a need to create a supportive infrastructure for expanding the basic mobile phone network as well as all interconnected services.

Table 40–Technology Transfer Needs for Telecommunications Sector

Telecommunications	Transfer of Technology to Angola	
Extension and expansion of the basic network, including digitalization and use of information society services	X	X
Intensification of the use of Information and Communication Techniques around the country	X	X

5.2.9 - Healthcare

The healthcare situation in Angola is characterized by elevated rates of morbi-mortality caused mainly by the development of infectious diseases, being malaria the number one cause of morbi-mortality, representing more than 50% of medical consultations. The sanitary state is aggravated still by the occurrence of epidemic bouts of cholera, which has become endemic. The healthcare sector will continue to demand special care and large portions of the public budget, unless there are

substantial improvements in education, income, housing, sanitation, collective and individual hygiene and infrastructure.

It is assumed that the epidemiological picture in Angola will be altered in the context of climate change, with the more frequent occurrence of infectious disease cycles. The needs regarding technological transfer for this sector are listed below.

Table 41- Technology Transfer Needs for Healthcare Sector

Healthcare	Transfer of Technology to Angola	
Occurrence of Extreme Events	**South-South**	**North-South**
Planning of new laws	X	X
Creation of guidelines for public policies	X	X
Urban planning to reduce the effects of the "urban heat islands"	X	X
Rapid warning systems	X	X
Use of appropriate clothing	X	X
Air Quality		X
Emissions control	X	X
Traffic restrictions	X	X
Improvement of public transportation and adoption of cleaner modes of transportation	X	X
Catalytic converters	X	X
Higher chimneys with filters in industries	X	X
Use of alternative vehicles (bicycles etc.)	X	X
Diseases caused by vectors		
Control of vectors	X	X
Vaccination	X	X
Population education and awareness	X	X
More care with water storage	X	X
Water transmitted diseases		
Protection laws for water bodies	X	X
Regulation of water quality	X	X
Genetic/molecular studies of pathogens	X	X
Improvement in water treatment and sanitation	X	X
Early warning system	X	X
Aspects connected to sanitation stool control	X	X

5.2.10 – Human Settlements and Housing

Angola's population is divided between rural and urban regions. The inhabitants of the rural areas live in precarious housing, made, for the most part, of clay and covered with straw. These structures offer reasonable comfort, in spite of the high risk of fires.

In suburban areas, housing is also precarious in different ways. These poor and irregular constructions are completely out of order. The government is making large investments to improve living conditions in these neighbourhoods and change the current state of irregular constructions. Several of these settlements will probably be demolished and the people relocated.

In the context of intensification of extreme climate conditions, the government must make available to the population technologies and materials appropriate for the construction of housing that meets the climate needs of the regions in which they live. Green technologies related to human settlements are summarized on the table below.

Table 42 - Technology Transfer Needs for Human Settlements Sector

Human Settlements	Transfer of Technology to Angola	
Construction Sector	South-South	North-South
Constructions that favour the use of solar energy and improve energy efficiency	X	X
Reducing the area of paved structures in constructions, with use of vegetation to reduce the effects of urban heat islands and energy demands from air conditioning	X	X
Limiting the development of flooded areas	X	X
Establishing construction pattern codes	X	X
Promotion of local materials (ex. adobe) that generate less emissions	X	X

Chapter 6 – Research and Systematic Observation

Meteorological information plays an important role in sustainable development through prevention against extreme situations associated with weather, climate and water, as well as prevention and mitigation of their adverse effects.

Long-term climate records and the sectoral information related to them constitute an essential instrument to evaluate the sensitivity and vulnerability of communities, in the short and long term, to risky meteorological and climate situations, with the intention of ensuring prevention, directing planning and defining response strategies that develop enough of a resistance capacity to face future extreme events.

The occurrence of extreme events associated with weather, climate and water, observed in every scale, has been demonstrating man's growing vulnerability. According to the climate guide of the World Meteorological Organization about climatologic practices, data is more useful if it is edited, if it goes through quality control, and it is stored in a national archive or data centre, making it available in a ready-to-use format.

Even though technological innovations are occurring in an accelerated manner, many climatologic records available to the National Meteorological Institute (INAMET) are still in analogical format, with many sequencing flaws, which prevent a profound analysis of this data. For that reason, in this document, the analysis of climate variability will be done only in some cities considered to be representative, with data that presents a certain level of reliability. It is also important to emphasize that the data analyzed corresponds to the period between 1961 and 2000.

The climate of a place or region of the globe is the set of predominant meteorological conditions of this location or region during a certain period of time, which can be one year or less, understanding that meteorological conditions and weather are physical conditions of the atmosphere and of the globe's surface in the considered location or region.

Angola is located between latitude 4° S and 18° S in the inter-tropical and sub-tropical regions of the southern hemisphere. This region is characterized by high variability in precipitation and temperature. The country has two regions (coastline and countryside), and the climate is determined by the proximity to the ocean, the Benguela current.

The main systems that influence the quality of the rain season around the country are the Inter-tropical Convergence Zone (ITCZ), which is associated with rainfall in Angola during the months of March and April, and the anticyclone Saint Helena, which has a negative impact in the formation of convective clouds. When the anticyclone is located in the Atlantic Ocean, a deficit of precipitation is observed in the country. ITCZ is the convergence zone of winds from the southeast and northeast of the country, which oscillates between the Equator and Tropic of Capricorn, and its movement in the direction of the south generally marks the beginning of the rain season.

According to analysis made in relation to the spatial distribution of precipitation in Angola, it can be clearly concluded that in the country rainfall decreases from the north to the south and is greater in the countryside than on the coastline. The relief of the area in question can sometimes alter this distribution. The precipitation distribution happens in accordance with the distribution of the pressure systems that influence the territory, being that rainfall is greater in regions more influenced by the depression regime (north and countryside) and lesser in the regions not influenced by the anticyclone regime (south and coastline). The difference in precipitation between the coastal region and the countryside is due to not only the distribution of the pressure systems but also the great difference in altitudes.

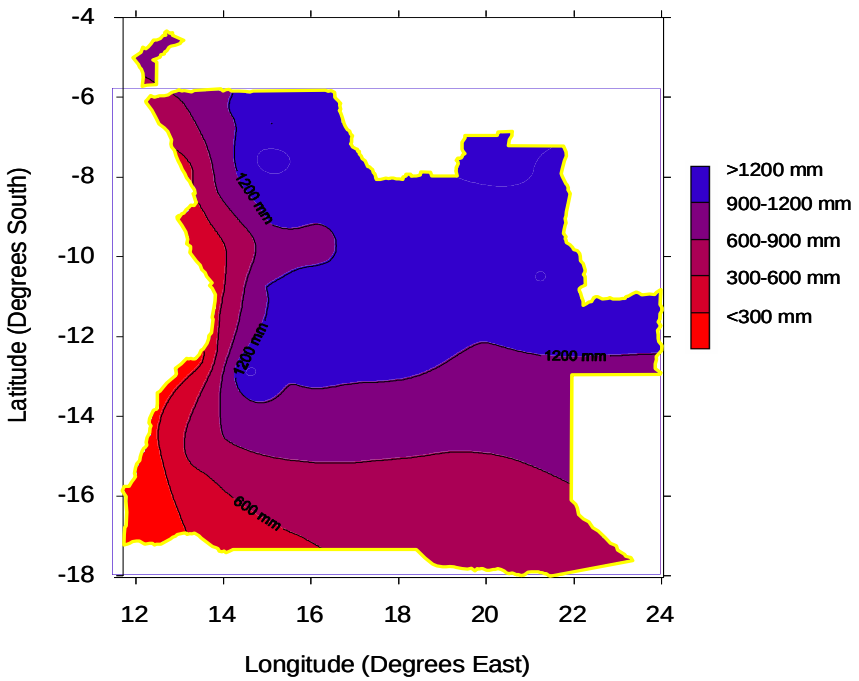
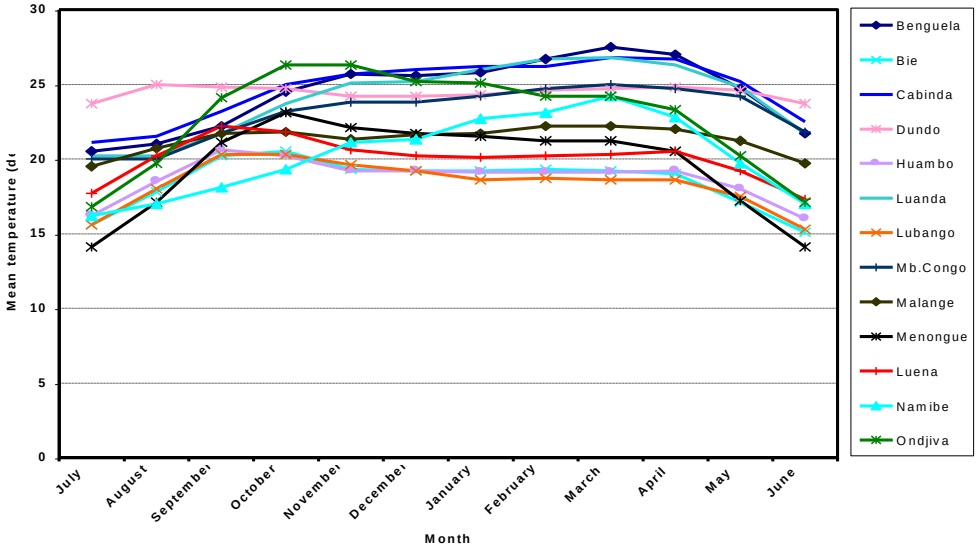


Figure 14– Spatial Distribution of Annual Precipitation in Angola

6.1 – Air Temperature

The monthly average air temperature figures vary during the year and in different ways for different regions of Angola. So, on the coastline and on a stretch of land by the coast (regions of low altitude), the air temperature is higher between January and April, remains stationary between November and April and presents its lower numbers in July or August.

Graph 9 - Monthly Average Temperature



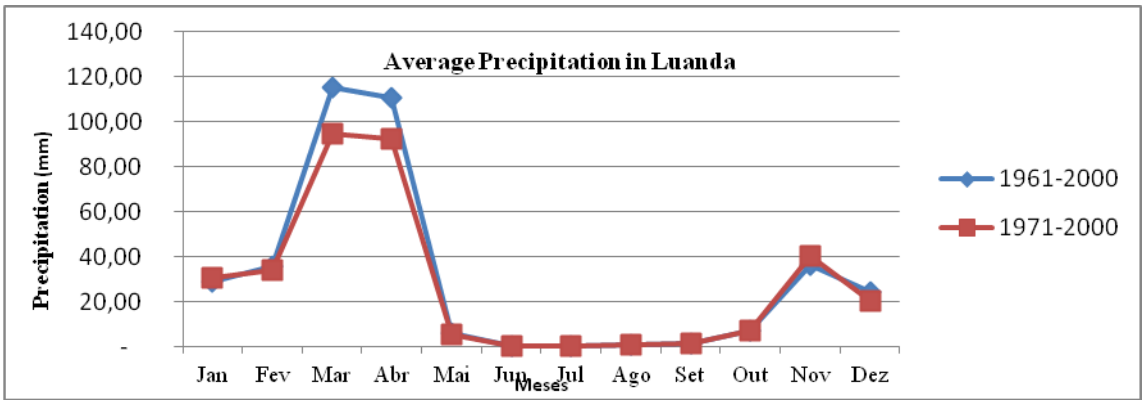
6.2 – Precipitation variability in Angola

The present document, prepared with precipitation figures observed during a period of 40 years 1961-2000 in meteorological stations located in Luanda, Cabinda, Namibe, Huambo and Moxico, aims to determine the annual average precipitation rates, as well as their variability during that same period, presenting also the monthly distribution of rainfall in these provinces. Due to a lack of available data for the other provinces, the work presented here was limited to the mentioned regions.

The period between 1971-2000 is considered to be the normal climatologic period, while 1961 to 2000 is the analysis period. For those 40 years, the monthly precipitation averages are expressed in mm on all tables. The precipitation average was calculated using the formula $M = \sum_{i}^{n} \frac{Xi}{N}$ in which Xi represents the observed precipitation and N is the total number of observations. In the majority of the cases, the record series had flaws, and filling the gaps was only possible using the mathematical method of correlation.

During the 40 years of records (1961-2000), the total amount of precipitation in Luanda was 14.677,5 mm, distributed throughout the months.

Graph 10– Monthly average precipitation variation in Luanda (Source: INAMET)



The graph shows:

- That the rainiest months for Luanda are March and April, representing 57,1% of all precipitation;
- That the months of January to April correspond to 76,8% of all precipitation;
- That 4,5% of all precipitation corresponds to the period between May and October, and June/July represents 0,0% of the total annual rainfall.

From a purely statistical point of view, the year can be divided into two semesters:

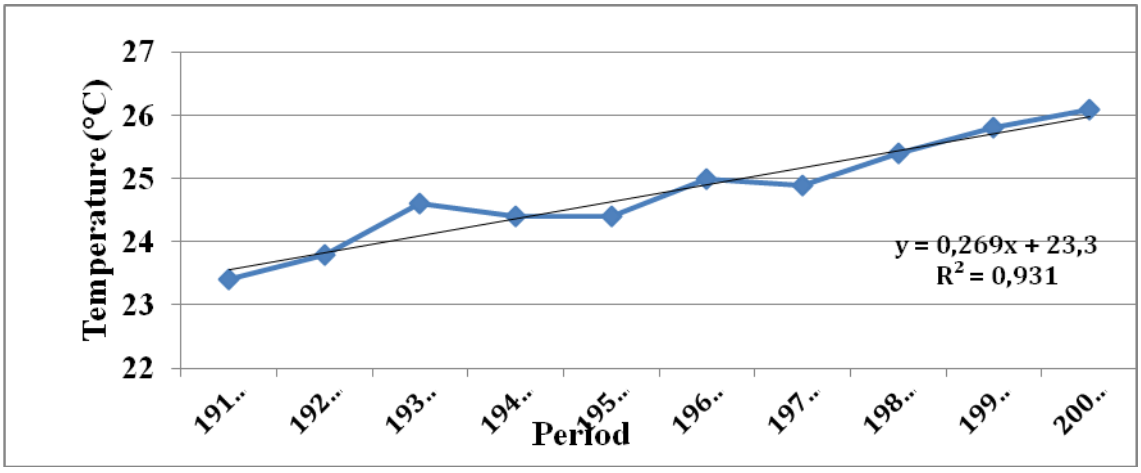
- The initial, from May to October (4,5% of all precipitation), representing the dryer season;

- The second, comprised of the remaining six months (95,4% of all precipitation), which corresponds to the rainy season.

6.3 – Average Temperature in Luanda and its Variability

Observations conducted between the years of 1911 and 2005 and measured in the climatologic station in Luanda show that the average air temperature in this station throughout the period of analysis registered an increase in the periods of 1911-20 to 1931-40, 1951-60 to 1961-70 and 1971-80 to 2001-05 respectively. During the period of analysis, three peaks were observed in the average air temperature in Luanda, in the years of 1931-40 (24,6°C), 1961-70 (25,0°C) and 2001-05 (26,1°C).

Graph 11 – Average air temperature variation in Luanda (1911- 2005) (Source: INAMET)



Graph 15 shows a significant increase of about 0,2°C/decade in the average air temperature in Luanda, meaning an increase of 1,9°C in the decades between 1911-20 and 2001-05.

6.4 – The Use of Satellite Technology

The general mission of the National Meteorological Service (SMN) is to observe and become familiarized with the weather and climate of the country in question and provide meteorological services to support national needs and the fulfilment of a series of international commitments that, ultimately, also benefit the national community. The institution usually assumes the main role on a national level when it comes to matters related to weather observation, analysis and prediction. It prepares weather predictions and warnings and provides current information and a series of climatology services, including pollution data supply and other environmental services, aimed at the general public and several economic sectors.

When it comes to weather monitoring, Angola counts on the support of satellite technology. Weather and climate monitoring is ensured through a network of meteorological stations run by INAMET and complemented with products and/or data obtained by the meteorological satellites METEOSAT (United Nations) and EUMETSAT (European).

INAMET is the institution responsible for weather and climate monitoring, has its sources of integrated meteorological data, including the Global Telecommunication Systems (GTS), connection to the Regional Telecommunication Hub of Pretoria (RTH), PUMA (satellite imaging) and SADIS (for aviation information), using a System of Commutation of Meteorological Messages.

6.5 – Evaluation of Climate Information Network in Angola

Meteorological and geophysical activity in Angola, in all its domains, namely in exploration and application to support several social and economic activities, falls into the responsibility of the National Meteorology Institute (INAMET).

6.6 – Meteorological Observation Network

The meteorological observation network is comprised of 29 synoptic stations, being 18 of them Automatic Meteorological Stations (AMSs). Twenty-three synoptic stations are currently operational, being 12 automatic and 11 conventional.

Table 43 and 44 – Provinces with Automatic Weather Stations (AWS) Within the Meteorological Observation Network

Provinces	N° of Automatic Weather Stations (AWS)	Date of Installation	Current Status
Benguela	1	Sep/2008	Not operational
Cabinda	1	Mar/2009	Operational
Caxito	1	Jan/2006	Operational
Dundo	1	Oct/2009	Not operational
Huambo	1	Jul/2009	Operational
Kuito	1	Feb/2009	Operational
Luanda	1	Apr/2008	Operational
Lubango	1	Dec/2009	Not operational
Luena	1	Oct/2009	Not operational
Malange	1	Dec/2008	Operational
Mb.Congo	1	2006	Operational
Namibe	1	May/2009	Not operational
Ndalatando	1	Aug/2006	Operational
Nzeto	1	2006	Operational
Ondjiva	1	Nov/2009	Operational
Saurimo	1	Oct/2009	Not operational
Sumbe	1	May/2009	Operational
Uige	1	Jan/2009	Operational

Provinces with Automatic Meteorological Stations (AMS) within the meteorological observation network (Source: INAMET)

Provinces with conventional stations	N° of conventional stations	Date of Installation	Current Status
Benguela	1	Unknown	Operational
Cabinda	1	Unknown	Operational
Dundo	1	Unknown	Operational
Huambo	1	Unknown	Operational
Kuito	1	Unknown	Operational
Luena	1	Unknown	Operational
Malange	1	Unknown	Operational
Namibe	1	Unknown	Operational
Porto Amboim	1	Unknown	Operational
Saurimo	1	Unknown	Operational
Uige	1	Unknown	Operational

Conventional meteorological stations from INAMET's meteorological observation network (Source: INAMET)

It is important to emphasize that the AMSs are not integrated into a system or a database. The data collected is manually released and sent monthly to Luanda, where it is recorded in an Excel supported database.

The dynamic of development and the needs in terms of meteorological and climate support of some institutions can generate negative consequences for the development process if there isn't a sufficiently rapid response.

Table 45– Proposal of a Minimum Network of Meteorological Stations

Province	Fundamental Synoptic and Main Climatological	Secondary Climatological	Udometric
1-Luanda	2	2	2
2-Cabinda	1	3	4
3-Benguela	2	14	20
4-Huila	1	25	9
5-Malange	1	10	7
6-Moxico	2	5	10
7-Huambo	1	11	14
8-Kwanza Norte	1	6	14
9-Kwanza Sul	3	15	20
10-Lunda Norte	1	7	13
11-Lunda Sul	1	7	13
12-Uige	3	5	7
13-Zaire	4	4	6
14 -Bengo	1	3	4
15-Cunene	2	15	6
16-Kuando Kubango	2	5	2
17-Namibe	1	7	3
18-Bié	1	6	10
TOTAL	30	150	164

(Source: INAMET 2010)

Currently, altitude observations are not conducted; there is no weather radar in operation and there is not one actinometrical station working. The special observations network is not operational, with the exception of the one in Luanda, which executes measurements of seawater temperature.
In 1974, the country had the following special observations network:

- Air radioactivity in Luanda, Cabinda and Lubango;
- Ozone concentration in Luanda and Lubango;
- Seawater temperature in Tiger Bay, Namibe, Sumbe, Porto Anboim, N'Zeto, Benguela, Porto Alexandre and a hydrographic ship;
- Sea conditions in Luanda and Namibe;
- Sampling of atmospheric pollutions (acid rain) in Mavinga;

- Seismological and geomagnetism stations network.

To monitor and research seismic events, there are four seismological stations installed in the Bengo (Porto Kipiri), Dundo, Lubango, and Kuito Provinces, and there are expansion plans for this network. In 1974, there were three seismological stations in Luanda, Lubango and Dundo and one geomagnetic station in Luanda.

For good meteorological surveillance, it is important to have an observation network spread throughout provinces and cities across the country, in good working condition and with an effective telecommunications system.

Considering the precepts mentioned above and Angola's territorial dimension, it can be concluded that the country's meteorological observation network is not ideal.

In order to present a reference for comparison, and taking into account what was mentioned above, there are two tables below, one with a summary of the operational network and the comparison with the one that existed in 1974, and another one with the density of meteorological network that existed before 1974.

Table 46 and 47 – Comparisons Between the Current Meteorological Observation Network and the one from 1974

Provinces	Synoptic Stations (1974)	Synoptic Stations (2010)	Climatologic Posts (1974)	Climatologic Posts (2010)	Udometric Posts (1974)	Udometric Posts (2010)
Cabinda	1	2	2	0	3	0
Zaire	3	3	4	0	7	0
Uige	4	2	7	0	6	0
Luanda	2	1	14	0	23	0
Kuanza	1	1	12	0	25	0
Norte	3	1	22	0	49	0
Kuanza	1	2	18	0	20	0
Sul	3	2	14	0	20	0
Malange	0	2	0	0	0	0
Lunda	2	2	23	0	43	0
Norte	1	2	18	0	23	0
Lunda	1	1	13	0	16	1
Sul	2	2	9	0	9	0
Benguela	2	2	13	0	8	0
Huambo	1	2	37	0	21	0
Bié	2	1	12	0	7	0
Moxico	3	0	7	0	2	0
Namibe	0	1	0	0	0	0
Huila						
Cunene						
K.						

Kubango Bengo						
T O T A L	32	29	225	0	282	1

Comparisons between the current meteorological observation network and the one from 1974 (Source: INAMET)

Provinces	Area (km²)	Nº of climate types	Nº of stations and posts				Average area by post (km²)	Average distance between posts (km)
			Stations	Meteorological	Udometric	Total		
Cabinda	7.270	3	1	3	5	9	808	28
Zaire	40.130	5	1	5	15	21	1.911	44
Uige	58.698	4	4	12	23	39	1.505	39
Luanda	33.789	3	2	20	38	60	563	24
K. Norte	24.190	4	1	15	41	57	424	20
Kuanza Sul	55.660	5	3	33	90	126	441	21
Malange	97.602	4	1	25	33	59	1.654	41
Lunda	148.432	3	3	16	31	50	2.969	54
Benguela	31.788	4	2	26	52	80	397	20
Huambo	34.274	1	1	23	29	53	647	25
Bié	70.314	1	1	14	21	36	1.953	44
Moxico	223.023	2	2	10	22	34	6.560	81
Namibe	58.137	6	2	16	12	30	1.938	44
Huila	75.002	3	1	40	26	67	1.119	33
Cunene	89.342	3	2	15	8	25	3.574	60
K.Kubango	199.049	4	3	7	6	16	12.441	112
Angola	1.246.700		30	280	452	762		

6.7 – Adaptation to and Mitigation of Local Impacts

Creating appropriate responses to the local impacts of global climate change can constitute a line of work and an opportunity to evaluate environmental impact studies that can be conducted in relation to the climate.

The proper combination of meteorology and climatology with eco-physiology is a challenge for INAMET, which needs training for the creation of this new area of application, if the investments in equipment and specialized technical personnel are made. Consequently, it will be possible to establish a warning and alert system for extreme climate events that affect lives and assets, and especially agricultural production, such as the occurrence of heavy rain, droughts, frosts in areas of high altitude or the development of plagues and diseases.

Improvement in the area of prediction, with the introduction of regional weather and sea models, called mid-scale or regional scale models, will allow the increase of quality and rate of success in weather and ocean state predictions, as well as the development of a warning and alert system about extreme climate events integrated into the National Civil Protection Services warning system. Expanding the modelling activity to broaden climate modelling will make it possible to establish regional scenarios about possible climate change.

The development of this area of specialization will be a fundamental instrument of support for political decision makers, who will have means to define mitigation and adaptation policies regarding the adverse effects of climate change, and this will have an incalculably positive impact on society.

Below are listed some areas where the specialization of Angolan personnel could become a crucial element of the work pertaining to climate change:

- Climatology and statistics applied to data management and quality control;
- Weather, climate and sea regional modelling;
- Development of conceptual models for several applications;
- Aeronautic meteorology;
- Climate and climate impact on development and public health, as well as future climate scenarios and adaptation/mitigation measures;
- Agro-meteorology and, in particular, aspects related to the optimization of the cultures' revenues, based on climate conditions, water management and nitrogen fertilization;
- Biometeorology;
- Air quality and impacts, especially on healthcare;
- Post-mortem analysis to asses modelling results;
- Development of *forecasting* techniques;
- Maritime meteorology;
- Relevant information related to weather and climate to support decision making;
- Influence of the Benguela Cold Current in variability and/or climate change and its relation to biodiversity, particularly when it comes to maritime resources and the occupation of coastal areas;
- Renewable and alternative energy;
- Management of water resources, occupation and use of soil and its influence on climate change and variability in Angola.

6.8 – Public services

The Luanda Weather Prediction Center prepares public predictions 24 hours a day.

- Warning and alerts about the occurrence of extreme events;
- Predictions for Civil Protection;
- Meteorological bulletins for maritime navigation, with predictions about sea conditions for the coastal areas as well as the high sea;

- Special request predictions;
- Charts about comfort levels;
- Charts about the distribution of climate variables;
- Climatologic data and averages;
- Meteorological bulletins for agriculture;
- Meteorological information for the investigation of accidents;
- Elaboration of diverse opinions for other sectors;
- Certificates for several ends, including insurance;
- Preparation of studies for special purposes.

Currently, INAMET answers requests from several users, providing data about meteorological variables and historic series, and also information about climate descriptions and studies for several regions.

Chapter 7 – Education and Public Wwareness

Angola's constitutional law states in article 39th that all citizens have the right to live "in a healthy unpolluted environment", being the Government in charge of adopting the necessary measures to protect the environment. One of these measures, according to the basic environmental law (Law 5/98), is access to environmental education, in order to ensure each citizen's participation in the management of the country's environment.

In December 1992, the initial formal contacts between the Ministry of Education and Culture and the entity responsible for the environmental policy began to take place. Some experts from the Environmental Secretariat, created at that same year, visited the National Investigation and Educational Development Institute (INIDE), with the purpose of coordinating actions related to environmental education within the formal education system.

INIDE as indicated two experts, one from the Geography area and other from the Biology area, to represent the Ministry of Education and Culture on the National Commission for an Environmental awareness rising and Education Campaign. The commission began its activities in 1993.

In 1994, the Commission approved the Environmental Education activities project (non formal), to be developed in the schools belonging to the National Education System, prepared by the Ministry of Education and Culture and signed by the titular authority of that governing body.

7.1 – Training for Experts and Teachers

In 1998 in coordination with the Ministry of Education and Culture, the Ministry of the Environment conducted the initial training of trainers about environmental education, which had the participation of 66 education professionals, between principals, deputy principals, coordinators of pedagogical courses, aiming to:

- Sensitize teachers about environmental issues;
- Convey the concept of Environmental Education;
- Transmit indispensable experiences for the use of specific methods and resources that would allow the development of environmental education in schools;
- Ensure that the target audience understands the fundamentals of developing an ecological conscience in students, in order to allow for a change in behaviour with relation to environmental problems.

In both actions, themes were presented on:

- Ecology;
- Structure and function of the ecosystem;
- Environmental education in general education curricular planning;
- Methods and resources for the development of an environmental education;
- Ecological impacts on water ecosystems;
- Environmental Law;
- Environmental situation in Angola;
- Angola's national parks and reserves.

In partnership which the Environmental Education Program of the Southern African Development Community (SADC), nine teachers from different institutions participated in a course for environmental educators and teachers, conducted between January 31st and February 25th, 2000, in Luanda. Participation was decided by evaluation of applications, and the final group was comprised of:

- One technician from INIDE;
- Four teachers from the Antonio Jacinto Pedagogical Education Institute, in Luanda;
- One teacher from the Garcia Neto Pedagogical Education Institute, also in Luanda;
- Two teachers from the Cazenga pre-University course, in the province of Luanda;
- One teacher from the Ingombota pre-University course, also in the Luanda province.

The course was coordinated by a specialist from South Africa, professors from Agostinho Neto University, experts from the Ministries of Education and Culture, Health, Energy and Waters, as well as members of the Angolan Ecological Youth.

7.2 – Special Awareness Activities

Two experts from INIDE took the post-graduate course in Environmental Chemical Engineering, between November 17th and 26th 1997, conducted by professors from Lás Palmas University, in Spain, Witwatersrand University, in South Africa, and Porto University, in Portugal, as part of the University Twinning and Networking

Programme (UNITWIN), by UNESCO (UNESCO Chair in Chemical Engineering and the Environment at Agostinho Neto University).

After training the experts from INIDE, the Ministry of Education guided INIDE in developing some actions such as the organization, in January 2002, of the Methodological Seminar on Pre-School Education and Initiation. The seminar was held with the presence of 83 educators and initiation teachers from different provinces around the country. Its goals were to:

- Convey to the participants the importance of environmental education;
- Develop competencies that would foster the development of environmental education activities with children.

The following themes were discussed:

- Environmental ethics through time;
- The genesis of environmental education;
- Principles of environmental education;
- Global environmental problems;
- Essential aspects of a child's mental development (stages and phases);
- Learning strategies that allow the understanding of the natural environment's importance;
- Methodology for the development of environmental education with 5 to 7-year old children.

The National Direction of Education the in Ministry of Education conducted in 2002 the awareness rising seminar for those responsible for education as well as school inspectors. The approach focused on:

- Main occurrences during the different geological eras;
- Concerns about environmental weather problems;
- The genesis of environmental education;
- Concepts of environmental education;
- Principles of environmental education;
- Threads of environmental education;
- Examples of activities that allow children to interact with nature;
- Suggestions of extracurricular activities on environmental education.

7.3 – Some of the work and Communications Presented from 1998 to 2005 in Events Related to Environmental Themes.

- "The Coastline – Knowing and Conserving. A specific methodology for Environmental Education", presented at the 2nd Seminary of the Environmental Nucleus of the Agostinho Neto University's School of Sciences;

- "The Importance of Environmental Education in a New Environmental Culture", presented at the 1st National Forum on Environmental and Natural Resources Management;
- "How to incorporate Environmental Education into the School Curriculum", at the awareness rising course for teachers of environmental education – Luanda;
- "Environmental Education and Environmental Policy at the School", presented at the Environment Journey, promoted by the Angolan Ecological Youth to mark World Environment Day;
- "General methodology for the analysis of environmental problems associated with the flora, particularly the urban forest and Cape Island", presented at the 4th Seminary of the Environmental Nucleus of the Agostinho Neto University's School of Sciences;
- "Reflections about the environmental education situation in Angola" presented at the 6th Seminary of the Environmental Nucleus of the Agostinho Neto University's School of Sciences;
- "The participation of education in sustainable development", presented at the seminary about the biologist's role in sustainable development and the fight against poverty;
- "The new challenges for Environmental Education in Angola's current context", presented at the workshop about the contribution of the initial Nature Conservancy Journeys to the Angola's Social and Economic Development Policies.

Experts from INIDE and teachers from several educational institutions have also participated in seminars organized by governmental entities and civil society organizations.

7.4 – Partnership Among Ministry of Education, the Ministry of the Environment and Non-Governmental Organizations.

From 1999 to 2004, the Ecological Angolan Youth (JEA), the Environmental Nucleus of the Agostinho Neto University's Faculty of Sciences (NAFC) and the Angolan Action for Environment and Rural Development (ADRA), in partnership with the Ministry of Fishing and the Environment, and the Ministry of Education and Culture, organized the "Environmental Olympics", directed at pre-university pedagogical students as well as students from Technical/Professional schools. The competition aimed to promote knowledge and interest in a diversity of environmental themes.

In 1990, the Angolan education system, even before the Conference on Environment and Development, held in Rio de Janeiro, Brazil, in 1992, based on the recommendations of the 1977 Intergovernmental Conference on Environmental Education, started the project of introducing environmental education to the population's, by elaborating course materials for 2nd and 3rd grade students, as well as for teacher sensitization courses, on disciplines such as Natural Sciences, Biology, Moral and Civic Education, Geography and Portuguese. The proposed themes were: population, sexuality, family, human rights, poverty and the environment. These materials were tested on the Benguela, Cabinda, Huíla, Huambo, Lunda-Sul and Luanda Provinces.

Over 41 thousand school manuals for students and 600 methodological guides for teachers were edited and distributed.

In 2007, three experts from INIDE participated in the project "Strengthening Environmental Education in Angola", as a result of the complementary protocol of technical cooperation between the Ministry of the Environment and its Brazilian counterpart. The objective of this project was to prepare the National Environmental Education and Awareness Program for Angola, with a time frame of eight years, corresponding to the period between 2008 and 2015. The goal was to provide the population with the possibility of developing knowledge, values, attitudes to participate in the protection and management of the environment, thus generating a better quality of life.

General Objectives:

- Giving all people, students in particular the opportunity to acquire basic knowledge about the Environmental Sciences and biology, allowing them to understand the complexity of both the natural environment and the one created by human beings; fostering the necessary values, attitudes and aptitudes to protect and improve the environment, using several methods;
- Fostering a global, systematic and interdisciplinary outlook on the environment;
- Analyzing problems at individual, collective (local, regional, national and even international) levels, comparing situations in different provinces and countries;
- Using, whenever possible, the situation of the community to which the individual belongs (as a starting point to analyze problems that may exist in other scales – regional, national etc.);
- Showing the relation that exists between technical knowledge, problem solving and the influence of established values;
- Promoting inter-sectoral cooperation between entities from the State Central Administration, investigation institutes, public and private companies connected to environmental issues.

Several specific objectives were also set for each of the environmental education sectors in the Action Plan, for formal, non-formal and informal education, such as:

- Involving different entities from the State Central Administration, institutes, public companies, as well as environmental defence movements, in the execution of the National Environmental Education and Awareness Program;
- Progressively promoting new standards of conduct in citizens, social groups and society as a whole, when it comes to the environment and, consequently, quality of life;
- Promoting an environmental culture, through the schools, that allows, especially the younger generation, to clearly understand the importance and need of harmony between development and the defence of the environment, fostering respect, positive feelings, as well as a conscientious and responsible

attitude from each individual in relation to the conservation and use of national natural resources;

- Developing awareness rising processes (seminars and courses) about the environment, sustainable development and environmental legislation in formal and non-formal education;
- Progressively introducing environmental concepts and themes into formal and non-formal education, beyond the health, environment and education programs and manuals, prioritizing the local problem approach and its solutions;
- Encouraging education for the promotion of health and hygiene practices within communities, through the creation of coordination mechanisms with intervening institutions in the health, environment, education and communication sectors.

In this project, were also discussed directives and principles on which the National Environmental Education and Awareness is based, as well as some actions to be developed in formal, non-formal and informal education.

7.5 – Curricular Plan

Curricular reform is a fundamental component of the educational system, where a critical perspective helps establish a reflection about the responsibility of all fronts in relation to environmental matters. This means that environmental education issues cannot be focused on Biology and Geography. The results obtained considered the following categories: Primary Education, with six grades, and two cycles (1st and 2nd of Secondary Education), each with three grades.

The existence of an open curricular plan that accompanies the cultural mosaic that is the slogan "Think Globally and Act Locally", with interdisciplinary content about environmental education, contributes to the assurance of the right to live in a healthy, unpolluted environment, stated in the Angolan Constitution.

These are some of the main threats to the environment in Angola:

- Soil erosion, originated by agricultural over-exploration, over-use of pastures and deforestation of certain areas, leading to poorer soil in terms of nutrients and its exposure to aggressive agents;
- Water pollution and silting of rivers, dams and hydroelectric plants, with impacts over biological resources and the supply of potable water;
- Loss of biodiversity due to over-exploration of resources, illegal hunting, burnings, wood and vegetal coal exploration and itinerant agriculture;
- Deforestation;
- Over-exploration of fishing and disrespect for the established off seasons;
- Air, soil and water pollution and contamination in the cities due to the absence of an adequate management of solid, liquid and gas waste;
- Others are man-created pressures, such as industry and changes to the course of rivers, which contribute to the pollution and destruction of the ecological balance in rivers and humid zones.

It's in this scenario, with the perspectives from the process of National Reconstruction and improvement of quality of life, that the role of environmental education and awareness is of vital importance and must be an integrated as part of the country's development.

In 1994, the work to reform curriculums in the subsystems of General Education and the Teacher sensitization courses began, in conformity with the Education System Base Law (Law 13/01 of December 31st), which defined a new structure for the education system and new content that meets "the new demands for creating awareness for human resources, necessary to the socioeconomic progress of the Angolan society".

7.5.1 – Primary Education – Characteristics

The basic intentions of the pedagogical choices made for primary education are:

- Adoption of a basic curricular development scheme, based on the components of General awareness creation;
- Articulation of different components, both from the vertical and horizontal points of view;
- Orientation of all pedagogical actions toward the integral education of the student, based on the development of attitudes and value awareness, and considering the multiplicity of cultures and ethno-linguistic variations present in the country as well as the acquisition of knowledge that is interconnected with aptitudes and capabilities that favour the continuation of studies.

Primary education has the social function of providing necessary knowledge with the required quality, developing capabilities and aptitudes, and generating awareness for the acquisition of values for social life and continuation of studies.

The Education System Base Law determined, in article 18th, that primary education has the following goals:

- Developing and perfecting the mastering of communication and expression;
- Perfecting habits and attitudes that tend towards socialization;
- Providing knowledge and opportunities for the development of mental capabilities;
- Stimulating the aesthetic spirit, with the intention of fostering artistic creation;
- Ensuring the systematic practice of physical education and sporting activities, in order to perfect motor skills.

Being sixth grade the end of the primary education cycle, the referred objectives allow for, after their dimensions have been expanded, the completion of the student's exit profile from this cycle, with the following points:

7.5.1.1 – To know

- Knowing and applying basic instruments of oral and written communication and expression;
- Displaying the acquisition of knowledge and the development of work capabilities, such as research, organization, study, memorization, and rational thinking, appropriate to the tasks at hand;
- Knowing the natural and social environment that surrounds you;
- Knowing the body and its functions, as well as the importance of hygiene and health conservation.

7.5.1.2 – To do

- Applying work techniques (study, research, memorization and rational thinking) to new situations;
- Expressing the spirit based on newly acquired skills, knowledge and competencies (physical, technical and artistic).

7.5.1.3 – To be

- Demonstrating correct attitudes towards rules and norms of conduct;
- Revealing attitudes of appreciation and respect for Angola's cultural reality;
- Revealing attitudes of respect for the environment, and for health

7.5.2 – Secondary Education

In the Education System's Curricular Reform, the 1st Cycle of Secondary Education encompasses three grades, namely 7th, 8th and 9th grades, with a set of corresponding disciplines listed in the study plan. This cycle generates a deepening of knowledge and skills acquired during Primary Education. Based on the Education System Base Law, a reorganization proposal for the study plans was prepared, beginning with research, listening, reflection and development of projects with the participation of several educational institutions and civil society. In this cycle, there is a progression of the knowledge and skills acquired by the students throughout the three grades, taking into account the harmonious distribution of themes, content and disciplines during the three years that comprise the cycle. The content is articulated both horizontally and vertically, considering potential crossovers.

The age of 1st Cycle Secondary Education students is 12 to 16 years old. The Education System Base Law determines in article 19th that General Secondary Education, which comes after the Primary Education cycle, encompasses two cycles of three grades each, as follows:

- 1st cycle: 7th, 8th and 9th grades;
- 2nd cycle: 10th, 11th and 12th grades;

In the study plan for the 1st cycle of Secondary Education there are a total of twelve disciplines that enable the students to, after the completion of 9th grade, go on to the 2nd cycle of Secondary Education or roll in technical or pedagogical institutes.

7.5.3 – Secondary Education – Characteristics

Based on the Education System Base Law (Law 13/01 of December 31st), a reorganization proposal for the study plans pertaining to the pre-university stage was prepared, beginning with research, listening, reflection and development of the project, with the intervening participation of several educational institutions. To conceive and design the curricular model, similar structures from several countries were taken into account, as well as the desirable profile of the student upon conclusion of the Secondary Education.

The Education System Base Law determines, in article 19th, that the 2nd cycle of Secondary Education is organized in areas of knowledge according to the nature of the courses to which it gives access, encompassing 10th, 11th and 12th grades.

Within this context, there are two main objectives:

- Preparing the students for entry into the professional market and/or the superior education subsystem;
- Developing logical and abstract thinking and the capacity to evaluate the application of scientific models in solving real life problems.

It is known that the 2nd cycle of Secondary Education is constituted simultaneously as the end of general education and a basic preparation for a future academic or professional career. On this cycle, experts from INIDE did not prepare the adopted pedagogical materials, so they do not contain interdisciplinary content. The same is true for the materials used in the 2nd cycle of teacher awareness rising and professional technical education courses, with the exception of the Geography and English manuals, which contain themes such as: 10th Grade: Tropical Forest, Pollution, Life Changes; 11th Grade: Natural Resources (forests in Angola), Desertification, Water; 12th Grade: Sharing Ideas for the Future; Burnings and their Consequences; Geography 10th Grade: Our atmosphere: problems and possible solutions, The influence of human activity on air quality, The great ecosystems of the Earth, The Forests, The importance of forestry nucleuses for environmental balance, Man's action over water resources; 11th Grade: The hole in the ozone layer in Antarctica; 12th Grade: Protection of the Earth's resources, and Fight against soil degradation and desertification.

The Ministry of Education, through INIDE, has been committed not only to including interdisciplinary content in school manuals, but also forming students and sensitizing communities. According to paragraph "C" of article 3rd of the Education System Base Law, to the 7th millennium goal (Ensuring Environmental Sustainability) and to the United Nations Decade of Education for Sustainable Development, the Ministry has joined the Community of Portuguese Language Countries (CPLP) education program, and developed, between 2009 and June 2010, the Childhood and Youth Conferences

at the school, provincial, national and international levels, under the slogan "Let's take care of Angola and the planet", having climate change as a theme, divided into four sub-themes: water, air, earth and energy.

7.6 – Other Actions

To deal with the problem of climate change, the implementation of the Environmental Education and Awareness Program, the Ministry of the Environment has reinforced the non-formal and informal components of Environmental Education. Several seminars have been conducted on all 18 provinces, discussing issues such as forest preservation, global warming, GHG emissions, and matters related to vulnerable locations, the coastal zone, rises in sea level, desertification, floods etc.

All these actions have been accompanied by public and private social sectors, media such as radio and TV broadcasts, newspapers and news agencies, considering how interested Angolan society is on issues related to climate change.

7.7 – General Considerations

Taking into consideration the gravity and intensity of the problem of climate change, it becomes necessary to intensify education, awareness rising and dissemination of matters related to it. Actions to be developed at the formal, non-formal and informal levels, that count on a solid base already developed in previous years, should reinforce content such as gases that contribute to climate change.

Environmental education is the responsibility of all and is a task that must be undertaken from the perspective of the society to which the pedagogical project will be applied. Concerns, affections, risk characterization, knowledge, worldview, predictions, responsibility, trust, opinions, behavioural predisposition and political leanings must all be taken into account.

It can be concluded that, progressively, the issues of climate change and environmental education have been discussed formally, non-formally and informally, with the work done by government institutions in partnership with organized civil society.

The actions developed have been significant in terms of content and constitute a valid basis for the continuation of this approach, but, due to other priorities, resources are limited for the development of more initiatives.

Evaluating what has been mentioned above about the different educational stages, it can be concluded that in almost every manual it is visible the inclusion of content about nature conservation and preservation, as well as elements that cause climate change. However, Geography is the only discipline that deals with this issue as a theme.

The ability to teach this content is still deficient, since there are few teachers trained in the field of Environmental Education (climate change). The theme is new and there is little information available. But teachers specialized in other areas can be habilitated since this content can be taught using the interdisciplinary methodology.

To undertake the inclusion of climate change content in curriculums, it is recommended:

• More policies for the inclusion of interdisciplinary content on school materials;
• Reviewing curriculums to identify the points of inclusion of environmental and climate change content;
• More seminars/courses for the awareness rising of teachers on methodologies for teaching environmental themes, including climate change;
• More workshops on themes related to climate change;
• More lectures in schools dealing with climate change issues, especially ones that pertain to Angolan reality;
• Promoting extra-school activities such as: planting trees, reawakens creation and conservation of parks and natural reserves, visits to factories that emit pollutants or are vulnerable to climate change;
• Putting up posters in schools that depict climate change related issues, as well as photographs of catastrophes caused by this phenomenon;
• Encouraging activities that discuss the issue, such as plays, short stories, poetry, songs, recycled art, games, film festivals, radio and TV broadcasts, newspapers, magazines etc.; • Conducting awareness raising campaigns within communities, taking into account their exposure to and the impact of climate change in their daily lives;
• Involving mass media and "opinion makers" (public figures) in dissemination information about climate change and its potential local impact;
• Making public institutions (and maybe the private sector as well) adopt and apply environmentally friendly measures, producing and promoting (in and out of the institutions) material connected to environmental education and climate change;
• Elaboration of material aimed to educating, informing and sensitizing the population, to be used in teacher training, community awareness raising as well as informing the international community;
• Improving incentives in order to stimulate the intensification of issues related to climate change and environmental education.

Chapter 8 – Integration of Climate Change Considerations into Different Programs

8.1 – Multi-sectoral Commission on the Environment

Issues related to climate change within the context of UNFCCC have been debated at the Multi-sectoral Technical Commission of the Environment (CTMA), created in 2000. Consultative in nature, CTMA is managed by the Ministry of the Environment and is comprised of representatives from all ministries that handle activities with potential impact on environmental policy.

CTMA has, among its responsibilities, to issue official opinions on:

- Sustainable development measures for several sectors of national life;
- The formulation and implementation of strategies, policies, programs and

actions to protect the environment;
- The preparation of legislation projects related to the environment, and the sustainable use of natural resources;
- Creating awareness of specialized personnel.

CTMA is also in charge of promoting agreements among the several sectors in relation to inter-sectors information, communication and social awareness actions and programs on environmental management.

The Government order 201/10 of September 13th, which approved the Ministry of the Environment Organic Statute, established the composition, competencies and inner workings of CTMA, which is comprised of the Ministries of Agriculture, Rural Development and Fishing (MINADERP), Energy and Waters (MINERGA), Oil (MINPET), Geology, Mining and Industry (MINGEMIN), Administration of the Territory (MINAT), Planning (MINPLAN), Hotel and Tourism (MINHT), Telecommunications and Information Technology (MINTETI), Health (MINSA), as well as the Ministries of Education, Culture, Social Communication, Defence and the Interior. CTMA also includes representatives from institutions that work under the tutelage of the Ministry of the Environment, experts from provincial administration involved with environmental management, representatives from national environmental defence associations, and national experts recognized in the field. This ensures public participation in environmental management, which is an excellent practice.

8.2 – Designated National Authority

Resolution 113/09 of December 17th indicated the Ministry of the Environment as the Designated National Authority to implement the Clean Development Mechanism (CDM). Later, the Decree 2/10 of January 13th, from the President, created the Designated National Authority (DNA) and approved its regulations and annexes. DNA is charged with, among other things: approving projects according to international requirements; harmonizing these projects with national sectors policies; defining additional criteria of eligibility; verifying and certifying emissions reductions; sending the annual activities report to the UNFCCC Government Council. DNA is comprised of one coordinator; a Technical Evaluations Commission (CTA); and a secretariat. The Ministry of the Environment nominates the coordinator. However, the minister herself was nominated by Government Order 68/10 of October 28th. This order establishes a responsibilities of the coordinator: to submit to the President all CDM projects considered eligible; the certification requirements that a project must adhere to in order to be validated and registered, beyond those established by the UN; prepare the monthly schedule of actions to be developed; generate quarterly reports about the actions developed in terms of implementing the instruments from Kyoto Protocol.

CTMA is comprised of representatives from MINAMB, MINADERP, MINERGA, MINPET, MINGEMIN, the Ministry of Superior Education, Science and Technology (MINESCT), Ministry of Transportation (MINTRAN), MINTETI, Ministry of Commerce (MINCO), Ministry of Finance (MINFIN), and MINAT. The Technical

Evaluation Commission can request the participation of representatives from other Ministries or other relevant entities, for the execution of specific tasks.

Annex III of DNA's regulations contains the basic criteria for evaluating CDM projects from the environmental, social and economic points of view. The secretariat is charged with coordinating the reception and transmission to and from the respective ministries of new potential projects; calling and elaborating reports on CTA meetings; creating a database about CDM projects, which must be publicly available; preparing the annual report on CDM implementation. DNA normally meets once a month, but the coordinator, with a minimum notice of five days, can call an extraordinary meeting. MINERGA has created, with order 36/10 of May 13th, the work commission that integrates CTA.

8.3 – National Commission on Civil Protection

Law 28/03 of November 7th established the Civil Protection organization hierarchy in Angola. The National Assembly frames the civil protection policy and inspects its execution. The Government defines the main policy orientations and ensures the means necessary for their execution. The Government is also in charge of declaring an emergency or disaster situation, by its own initiative or due to a request from the Ministry of the Interior or one of the Provincial Governments. In this case, the central Government is also charged with gathering funds and adopting exceptional measures designed to reinstall normalcy in the hit areas.

The President is responsible for coordinating and guiding the actions of members of the government in matters related to civil protection; assuming the direction of operations in situations of national catastrophe or disaster; The National Council on Civil Protection is the inter-ministerial entity that counsels the President on matters pertaining to civil protection and must issue opinions about the organization and functioning of civil protection entities, legislation and approval of the National Emergency Plan.

Provincial governors participate in Council meetings that deal with issues of interest for their respective provinces. On the other hand, the National Commission of Civil Protection (CNPC) is the entity specialized in technical assistance and operational coordination of the activities of all the civil protection institutions. It functions under the tutelage of the Ministry of the Interior and is comprised of: representatives from the ministries that are part of the Council, the General Commander of the National Police, a representative from the Major General of the Angolan Armed Forces, a Commander from the Fire Department, the Director of the National Service of Civil Protection, the Director of Civil Aviation, the Director of Merchant Marine and Ports, and the Director of the Meteorology Institute.

CNPC is charged with proposing: legislative measures and technical norms; institutional collaboration and technical/operational coordination mechanisms between all the entities and services involved; criteria and technical norms on the organization of the public and private resources and means inventory, specifically the ones that can be mobilized locally, regionally and nationally in case of serious accidents, disasters or catastrophes; as well as on the preparation of general and

specific local, regional and national emergency plans, thus defining priorities in terms of civil protection.

CNPC is also responsible for public awareness rising to the need for self-protection and collaboration with the civil protection authorities; defining actions to be developed, within the educational system, in order to spread theoretical and practical knowledge about the nature of risks and the way each individual can contribute to limit the effects of grave accidents, disasters and catastrophes; and developing awareness creation, updating and improvement programs for personnel from the entities that integrate the national civil protection system. Within the space under the jurisdiction of the maritime authority, the inherent responsibility for civil protection falls on the services provided by that authority. In provinces, local civil protection commissions must be created.

Civil Protection Agents are the entities that execute civil protection functions on warnings, alerts, interventions, support and help, according to its own attributions. The agents are: the Fire Department; the Security and Public Order Forces; the Angolan Armed Forces; the National Direction of Civil Aviation; the National Direction of the Merchant Marine and Ports; the Direction of Maritime Inspection from the Ministries of Fishing, Urbanism and the Environment; the Angolan Red Cross, according to the organization's own statute. Cooperating closely with the civil protection agents are: healthcare services; social security institutions; help and social solidarity institutions, which are subsidized by the state; entities responsible for forests, parks and natural reserves, industry, energy and water resources, transportation, communications, fishing and the environment.

Therefore, Civil Protection is an unavoidable partner when it comes to climate change. There is a partnership within the realm of vulnerability and adaptation to climate change, which is operated within CNPC, with participation from MINAMB. It is recommended that active members from CNPC, namely representatives from some of the more operational ministries when it comes to civil protection, are also involved with CTMA and DNA.

8.4 – Inter-ministerial Commission on Energy Security

The Inter-ministerial Commission on Energy Security was established by Resolution 8/09 of January 30th, with the intention of proceeding to the coordination of all works related to the preparation of an energy policy and strategy, as well as the energy security program, the definition of a institutional structure responsible for the coordination, follow-up and control of the implementation of these instruments, and the orientation of the preparation of the energy balance and the energy matrix.

Coordinated by the Minister of Planning, the commission is comprised of the following entities: MINPET, MINERGA, MINFIN, MINADERP, MINAMB, MINGEMIN, MINESCT, the Secretary of Waters, the Director of National Reconstruction Cabinet, the Economic Advisors to the Presidency, the Economic Prime-Minister and Deputy Prime-Minister, the President of SONANGOL's Administration Council, the President of the National Energy Company (ENE) Administration Council, and the General Director of the Mid Kwanza Improvement

Cabinet (GAMEK). It is therefore possible to integrate adaptation and mitigation of climate change in the energy sector, at the highest level.

So, this way, the institutional conditions for the integration of climate change into the different economic sectors at the national level are created. When it comes to the ministerial structure, the main ones are described below in relation to climate change.

8.5 – Ministry of Environment

The MINAMB's Organic Statute (approved by Government Order 201/10) establishes that among the National Environmental Directive's competencies are: i) Promoting and coordinating the development of policies, programs and actions for the control and reduction of GHG emissions; ii) Adopting and promoting strategies to educate citizens about the environment; iii) Participating in and conducting studies and programs to collect environmental indicators that would contribute to the equilibrium and quality of the environment.

This way, the Department of Environmental Quality and the Department of Environmental Education have an important role to play in establishing plans and programs for the adaptation to and mitigation of climate change, in elaborating GHG emissions inventories, as well as in sensitizing and educating the population about climate change. On the other hand, the new National Directive of Environmental Technology (DNTA) is a fundamental entity for the transfer of technology necessary to deal with climate change.

Among the DNTA's responsibilities, there are: i) fostering and promoting the use, in all sectors of economic activity, of environmental technologies, so that pressures over natural resources, emission reductions and sustainability are reduced; and ii) ensuring quality and approving technologies to be used in the environmental management systems, particularly those related to environmental quality, emission reductions, and effluents.

The National Directive on Prevention and Evaluation of Environmental Impacts is the service responsible for the conception and implementation of policies and strategies for prevention of environmental impact. It works namely on the identification and prevention of impacts from human activity over the environment, on the evaluation and management of natural and industrial risks, in partnership with other entities, as well as on the orientation and monitoring of environmental audits of projects developed by public and private entities. It is, therefore, an important player in the inclusion of climate change considerations on environmental licensing of economic activities that require Environmental Impact Evaluation, according to the current legislation.

Similarly, the National Directive on Biodiversity is the service responsible for the conception and implementation of policies and strategies for nature conservation and sustainable use of natural resources. This includes the promotion, description and evaluation of ecological systems, namely their abiotic factors, composition, structure and productivity, as well as technical and scientific studies about nature and renewable natural resources conservation; preservation and promotion of the sustainable use of biodiversity resources; guiding the implementation of recovery and awareness rising policies on natural sites that have been affected by any anthropic or natural process, particularly zones that have been ecologically degraded by non-

renewable natural resources exploration activities; proposals for the creation of new environmental protection and conservation areas at the regional, national and international levels, and ensuring their management; proposal of mechanisms for publicizing and adopting policies with the goal of educating citizens to respect protected areas.

8.6 – Ministry of Agriculture

At MINADERP (Organic Statute approved by Government Order 92/10 of June 4th), the National Directive on Agriculture, Livestock and Forestry is of fundamental importance to the issue of climate change. In fact, it is part of its responsibilities to: promote the fostering of agricultural, pastoral and forestry production; defend cultures, animal and vegetal species and the national territory against plagues and diseases; prepare policy studies that aim to conserve and sustainably manage forestry and fauna resources; guide the execution of rules for the defence and use of soil; ensure compliance with commitments made in international agreements.

The Forestry Development Institute (IDF) was created by Decree 41/89 of July 22nd, to plan, methodologically guide, follow-up and control the implementation of rules and precepts directed at conservation and rational use of forestry and fauna resources; propose investment projects necessary for the sector; and propose or advise on which areas constitute natural reserves or national parks. On the other hand, it is part of the Agronomic Investigation Institute's responsibilities (Decree 72/89 of December 30th) to conduct investigations on agricultural and forestry domains in order to develop production. The objects of investigation are chosen according to their economic and social importance and can be related to climate change adaptation.

8.7 – Cabinet of Food Security

The Cabinet of Food Security (GSA), created by Government order 79/05 of August 3rd, is a technical support entity within MINADERP that has, among others, the following attributions:

Defining and following-up on the implementation of policies and strategies that allow the improvement of food security; calculating the food deficit, alerting the government about the magnitude of the situation and proposing alternative measures to mitigate its effects through a rapid alert system; conducting studies about the use of the safety stock in case of emergencies; elaborating socioeconomic studies to track the evolution of the poverty level in rural and urban areas, and its effect on the country's different social classes.

Activities are implemented by a structure that is on line with early warning and detection of vulnerabilities, which is comprised of: the Rapid Alert Department, the Vulnerabilities Analysis Section and the Department of Food Security Monitoring. It is recommended that GSA becomes more involved in the inter-ministerial entities that deal with climate change.

8.8 – National Directorate on Renewable Energy

The National Directive on Renewable Energy (DNER), Government Order 161/10 of October 29th, is the MINERGA (Ministry of Energy and Water) service responsible for the conception, promotion, evaluation, execution and follow-up of renewable energy policies. It is comprised of the Alternative Energy Department and the Biomass Department. DNER plays an important role on climate change mitigation, namely when it comes to reduction in deforestation for the production of wood and coal, used as domestic energy.

The Biomass Department's responsibilities are: participating in the preparation of policies for the development and use of biomass; issuing opinions about the licensing of projects for use of biomass as energy source, such as the use of solid waste and biofuels; issuing opinions on energy conservation, energy security and environmental preservation; elaborating proposals about the use of biofuels for energy production, namely sugarcane and biogas sub-products; promoting rural electrification using biomass; promoting research about the possibility of using organic waste for energy ends; and spreading technologies for heat and electricity use.

The Department of Alternative Energy is responsible for: participating in policy preparation, promoting studies about environmental impact, issuing opinions about project licensing and keeping the respective records; tracking activities related to the use of renewable energy, ensuring the necessary coordination and collaboration; elaborating technical norms related to the efficient use of renewable energy systems; promoting the dissemination of technologies for the production of heat or electricity; promoting rural electrification using renewable energy; elaborating proposals and discussing quality standards to be adopted in technological systems that use renewable energy; coordinating the creation of centres for the investigation and demonstration of new and renewable energy.

8.9 – Cabinet of Security and Environment

The Cabinet of Security and Environment (GAS), from MINPET – Ministry of Oil, and established by the Government Order 79/09 of August 6th, is part of the Department of Environmental Protection. This department has the following responsibilities: issuing opinions about licenses for Oil exploration, production, treatment and refinery activities, petrochemicals, biofuels and distribution, as well as about the shipment and transportation of Oil-based products, with the intention of preventing, controlling and mitigating pollution; ensure the inclusion of clauses about environmental protection and nature conservation in all contracts and projects related to the Oil, gas and biofuels industry; promoting studies about the effects of Oil production on the flora and the fauna, about strategic means and points for the allocation of these means toward reducing Oil pollution, and studies related to the definition of a policy about environmental defence; ensuring the execution of the environmental policy and the implementation of legislation about environmental protection from the Oil, gas and biofuels industry; inspection and control of discharges of Oil pollutants in collaboration with all other sectors in the country;

maintaining a database of updated information about the causes and consequences of oil spills, detailing the volume spilled in different accidents.

GAS's role is also reinforced by its responsibility of articulation with other ministries and duty to inform the public. In fact, GAS is bound to participate in multi-sectoral and regional integration projects related to environmental protection, and collaborate in the preparation and enforcement of legislation about environmental protection and the fight against pollution.

It is still part of GAS's attributions to compile and prepare for public distribution informative and pedagogical materials about the environment, so as to maintain the public enlightened about the need to protect the environment from Oil pollution. So GAS plays a crucial role in the mitigation (development of strategies, legislation and information/awareness creation) of climate change related to the production of Oil and Oil-based products, which, as mentioned previously, constitutes the country's largest source of GHG emissions.

8.10 – Policies, Strategies and Plans

The Poverty Reduction Strategy (ECP), approved by Resolution 9/04 of June 4th, includes environmental considerations, in conformity with the Millennium Goals, some of which related to climate change. In fact, the measures presented in relation to the Sustainable Development of Natural Resources, include: evaluation of the natural resources' state of degradation, with mapping studies of vulnerable areas, reforestation, promotion of pilot-activities against ravines, using biological techniques. ECP establishes that the measures must be implemented according to intervention plans to be prepared by the tutoring Ministries (namely Environment and Agriculture), in collaboration with Provincial Governments and a public consultation.

Beyond the public consultation, ECP predicts the engagement of traditional authorities and community organizations in environmental preservation and management of communal land. One of the measures planned for strengthening the production capacity of the traditional sector is the creation of environmental publicizing units integrated into the Agrarian Development Stations, with collaboration from the IDF.

The Integrated Rural Development and Poverty Reduction Program operates the ECP, predicting the implementation of actions in several areas, such as education, healthcare, water supply, social assistance and integration. The Program is divided into two sub-programs: the Population Sedentary and Rural Community Support Sub-program and the Rural Housing Fostering Sub-program. In 2010, fifteen locations should be benefitted through program interventions and, by 2011, this number should gradually increase to encompass other regions of the country. Financial difficulties have led to delays and limitations to previously planned activities, but the sub-programs are operational.

The National Plan for 2010-2011, approved by Law 1/10 of January 15th, has, among others, the following goals: implementing a rural and suburban development policy that would mitigate the unbalance in quality of life between rural and urban areas; rehabilitating and developing the necessary infrastructure for the country's reconstruction; promoting an accelerated industrial development, so that imported

products can be replaced by local ones; ensuring the rapid urbanization of slums and the modernization of urban communities. One of the measures contemplated in this National Plan is to develop the process of implementing the National Climate Change Program.

Below are activities included in the 2010-2011 National Plan that are relevant to the issue of climate change:

- When it comes to knowledge generation, it is contemplated the development by MINAMB of a National Environmental Indicators Control System. Beyond this, the following activities are planned at the Meteorology and Geophysics Institute: awareness rising of meteorological observation networks with coverage of, at least, all provincial capitals; awareness rising of the national seismic surveillance network, aiming to cover all areas that are sensitive to this natural phenomenon; beginning operations at the National Centre for the Awareness rising of Specialized Meteorology and Environmental Personnel (CREFORMA); and adjusting services to public needs, using the observation networks and fostering investigation and development. The Plan also aims to create a strong National Traditional Knowledge System.
- As far as territorial planning is concerned, is part of the planned actions: regulation of cartographic and record keeping activities; execution of the land database; modernization of the national geodesic network, and updating all national cartography to the 1:100.0000 scale; implementation and management of the national geographic information system, elaborating instruments for territorial planning (Provincial and Municipal Plans); and strengthening of the institutional and technical capacity of central and local services for the preparation and implementation of these instruments.
- When it comes to adaptation measures for the agriculture and fishing sector, the Plan predicts: promoting action to sensitise all players that are part of the process of developing the agrarian sector for the sustainable management of natural resources, specifically soil, water, forestry and biodiversity; creating pilot-projects in natural resources management and, based on the obtained experience, formulating an environmental policy; afforestation and reforestation of areas close to communities, encouraging the creation of community forests; revitalizing and diversifying the rural economy, contributing to the fight against hunger and poverty, and the improvement of the quality of life for rural families, as well as to greater food security. The National Plan also calls on MINADERP to, in collaboration with the commerce sector, ensure the existence of strategic food reserves on recommended levels, and promote the creation of logistical platforms that serve the dual purpose of articulating the territory and valuing Angola's geostrategic position. In fishing, the National Plan requires the encouragement of scientific investigation, innovation and promotion of traditional knowledge, improving the management of resources and managing the coastal areas in an integrated way.
- In relation to water resources, both superficial and underground, the Plan requires the preparation of a permanent inventory, turning rational management into plans for integrated use in relation to every hydrographic basin, and adopting measures designed to improve the control over adverse natural effects, such as floods and droughts; promotion and development of the traditional

irrigated areas, building dams and gravity irrigation or introducing pumping systems.

- In environment, the Plan gives priority to the inventory and management of national wet zones, gradually rehabilitating the Parks and Natural Reserves, developing a National Waste Strategy and institutionalizing the participating provincial entities. Once again, atmospheric emissions are not contemplated. Another priority is the improvement of environmental management mechanisms in geology and mining, through the tracking and inspection of corporate activities and the conduction of environmental impact studies.
- For the energy sector, the National Plan establishes as priorities some measures with potential positive impact on mitigating climate change. One of them is to begin the implementation of the National Electrification Program, which includes: defining a plan for rural electrification, followed by the decentralization for provincial governments and municipal authorities of medium and small distribution; promoting the development of local sources, such as mini and micro hydroelectric plants; increasing and diversifying electricity production with the use of water, solar, aeolic and biomass sources; and creating a logic of producing entities that are connected and sell energy to a national network.
- On the construction sector, the highlights are: continuing to mitigate erosion and adopting measures for its contention; removing accumulated sand from and regulating riverbeds in critical condition; consolidating a structured network of public passenger transportation at the municipal, provincial, inter-provincial and inter-city levels, ensuring greater mobility for people as well as an inter-mobility between the different means of transportation.

The activities predicted in the 2010-2011 National Plan are being implemented at different speeds.

Angola counts on a National Implementation Strategy for the UNFCCC and the Kyoto Protocol. According to Resolution 52/2008 of June 5th that approved it, the Ministry of the Environment should prepare, in 120 days, the Action Plan, and its respective budget, which was not done.

The Strategy aims to: a) prepare inventories and reports about GHG emissions in Angola and their impact on the environment and on public health; b) produce programs and projects with measures to mitigate the effects of climate change; c) developing actions for technical/professional awareness rising in areas related to climate change; d) fostering international cooperation in the climate change field, particularly in the transfer of knowledge and experiences; e) encouraging and developing actions that involve the transfer of technology and the use of clean technologies; f) coordinating actions for the implementation of the Convention's and the Protocol's commitments; g) creating a structure and appropriate instruments for the management of Kyoto Protocol's flexible mechanisms.

From the eight groups of activities proposed in the Strategy, Angola is concluding its Initial National Communication to UNFCCC, which contains a national GHG inventory, and created the Designated National Authority. Beyond that, education, awareness rising and investigation actions are being conducted. Other activities are also being implemented, but at a slower pace.

It is important to emphasize that the Strategy also presents recommendations for the following sectors: Deforestation (forestry exploration, agricultural practices and forest fires, use of wood and coal); Energy production and use; Burning of natural gas; Transportation Systems; Industry (plan of measures that avoid GHG emissions; obligation to invest in less polluting and more efficient technologies in regeneration and energy use processes, projects that can be considered for CDM); Treatment of solid waste.

The Biodiversity Strategy and Action Plan (EPANB), Resolution 42/06 of July 26th, proposes a series of measures that aim to ensure the conservation and sustainable use of components of biological diversity that would allow the just and equal sharing of the benefits from the use of biological resources. Beyond the improvement of legislation and institutional reinforcement, EPANB covers several other areas, with relevance to climate change.

- In the area of investigation and studies, it proposes to deepen knowledge related to Angola's several ecosystems, specific species of flora (including spots of specific forestry), species of high biological value, studies related to the mortality of mangroves in certain rivers and the deforestation of the mangroves, proceeding to a mapping and zoning of the ecological sensitivity of coastal and marine areas, studies about pressure in different ecosystems, including deforestation, coastal zone and impacts on fishing. All these studies would be gathered in a Documentation and Information Centre (CDI), which would also include older studies that in many cases are out of the country.
- At the information level, CDI would also keep updated indicators related to biodiversity and a database on sources of oral information, and practices used in resource conservation by local communities. It is also planned the creation of a national information network, for resource sharing and information exchange, so that every province and city can have access to the information.
- EPANB includes also education and awareness raising actions for sustainable development and measures to strengthen the role of communities in the management of biodiversity.
- In biodiversity management within areas of environmental protection, it is prescribed the preparation of plans for the management and recruiting of human, technical and financial resources for such management, and the generation of knowledge.
- The Plan also requires concrete measures to ensure the sustainable use of biodiversity components outside of the protection areas, including measures for agriculture, forestry, fishing, the coast and Combating invasive species.

According to Resolution 42/06, each sector must include in its programs and projects biodiversity activities in accordance to the priorities defined by EPANB, in order for the financing to be cleared. On the other hand, MINAMB must annually present to the Permanent Commission of the Ministry Council a report about the execution of actions from the Action Plan.

The National Policy on Forestry, Fauna and Areas of Conservation (PNFFSAC), approved by Resolution 1/10 of January 14th, indicates that MINADERP and MINAMB must prepare the respective implementation plans of the Policy, which must contain the specific properly quantified actions to be developed in order for the

goals to be reached. The formulation, approval and publicizing of the Forestry, Wild Fauna and Areas of Conservation Law, including the three specific regulations, are also prescribed by the policy. The implementation of the policy is currently halted.

PNFFSAC is comprised of several threads. The economic thread aims to promote ways of using and generating revenue from forests, wild fauna and areas of conservation, as well as promoting the role and the intervention of the private, community and cooperative sectors in the management and rational use of resources from forests, the fauna and areas of conservation.

The social thread calls for the creation of mechanisms to encourage the participation of local communities, the private sector and organized civil society in the management and sharing of benefits resulting from the sustainable exploration and use of forestry and fauna resources, as well as the promotion of gender equality and treatment of HIV/AIDS issues in plans and programs of protection, conservation, management and use of forestry, wild fauna and areas of conservation. The institutional thread aims to create mechanisms for strengthening institutional capacities, in order to ensure efficiency, transparency, professionalism and trust in the management of resources from forests, fauna and areas of conservation.

Beyond these, PNFFSAC has an environmental thread that aims to contribute to the conservation and protection of terrestrial biodiversity, as well as the national sustainable development through the following specific goals: i) improvement of the protection, conservation and management systems for forests and wild fauna in free areas, including the integrated management of natural resources with emphasis on ecologically sensitive areas and arid, semi-arid and humid zones, as well as mangroves; and ii) reclassification and awareness rising of existing areas of conservation, proposing the creation of others, to include important ecosystems, habitats and species of high biological and cultural value that are still not properly protected.

This thread contemplates, among other measures, the implementation of programs to fight desertification, soil erosion and ravines, and the mitigation of drought effects, with the intention of recovering degraded areas through reforestation and management of the natural regeneration of forests, with the involvement of administrative authorities and local communities; introduction of alternative sources of domestic energy production, improvement of sources of raw materials and traditional systems of production, distribution and consumption of coal, accompanied by the introduction of better stoves, especially in suburban areas and areas with fragile ecosystems; promotion of the use of natural gas and electricity as domestic energy. This thread also includes the preparation of studies and inventories, as well as the environmental education of urban and rural populations about measures of protection, conservation and use of the resources at their disposal.

The National Food and Nutritional Security Strategy and its Action Plan, approved by Resolution 130/09 of December 29th, recognizes the right to food as a fundamental human right and aims to create conditions to ensure that every Angolan citizen experiences lasting food security, decreasing the level of inequality in income distributions and reducing extreme poverty.

The objectives that can be connected to climate change are: increasing and diversifying the agricultural, livestock and fishing production in a sustainable way, to improve the level of food storage and the population's quality of life; creating and implementing national and local rapid alert systems, food and nutritional security monitoring systems, as well as family communication and information mechanisms; and creating a inter-sectoral platform for the coordination of policies and actions related to food and nutritional security with the participation of civil society.

The Food Security Action Plan is developed, beyond the production diversification component, on the following strategic threads: a) strengthening of social protection to children and other vulnerable groups, as well as of family competencies and community food and nutritional education, acting on the level of access to food, health and nutrition, food and nutritional education, water, energy and sanitation, and family competencies; b) fostering of scientific investigation applied to all the food and nutrition chain, where research and investigation actions on food security are prescribed; and c) a system of information about food and nutritional security (SISAN), which acts on monitoring agricultural activities, agro-meteorological factors, availability of water resources, predictions about harvests, analysis of the vulnerability of certain populations and the monitoring of market prices.

On the other hand, the document about the Revision of the Agrarian Sector and the Food Security Strategy, in its Volume I, defines as a central objective of long-term development ensuring that the social and economic community remains open and flexible, with resources for adaptation to internal and external changes and the ability to use development opportunities. The Agrarian Sector's objectives, defined in the same document, can be summarized as follows: i) increasing agricultural production; ii) reducing poverty and food insecurity in the rural areas; iii) promoting rural commerce and the processing of agricultural products; and iv) managing natural resources.

The 2006-2010 Fishing and Aquiculture Organization Plan, Resolution 9/06 of February 6th, contains several programs. The Ecosystem Functionality Program aims specifically to study and evaluate the incidence of disturbance factors (such as the variability of environmental and meteorological conditions due to climate change) in interactions between environment, fishing exploration and other human activities; foreseeing probable impacts of climate change in coastal areas and contributing to the definition of measures that avoid or mitigate its effects, taking into account the predictable changes in the coast's occupation (including urban expansion and tourism projects). In its Ports program, the plan establishes the need to ponder the kind of impact that climate change could have, especially when it comes to constructions or foundations right on the shore line, remembering that sandbanks are particularly vulnerable. In the midterm (2006-2010) there also is a bet on production systems with low general energy consumption, but particularly when it comes to fossil fuels. This plan is currently being implemented.

The tourism policy and strategy, Resolutions 7/97 and 9/97 respectively, don't contain any environmental considerations. The tourism sector in Angola needs to be deeply reformed.

The Biofuels Development Strategy, Resolution 122/09 of December 23rd, established that MINADERP, MINUA, MINUH, MINGEMIN, MINPET and MINERGA must,

within 180 days, starting from the date of publication of said resolution, prepare and submit for government approval, the National Biofuels Production Program, which must contain the zoning of agro-ecological areas, as well as a plan for the development of a strategy to use biofuels and an indication of the means necessary to make that happen.

The program hasn't been concluded yet. The Strategy aims to: being able to count on a source of renewable energy for the future; reducing emissions of gases that damage the atmosphere; making it possible for the country to participate in the carbon trading market within the Kyoto Protocol. This at the same time as it contributes to increase cultivated areas, agriculture, and well as all the productive chain, favouring the creation of industries and increasing both the jobs offer and the income of rural families.

Aware of the fact that even though the use of biofuels reduces emissions of harmful substances and allows the production of renewable and sustainable energy, it also involves risks, the strategy lists among its principles some preventive ones, which are crucial.

The "environmental preservation and sustainable development" principle indicates that the production of biofuels should balance its environmental, social and economic impact and that, to determine such impact, it is necessary to consider the difference between emissions avoided with the use of biofuels and the emissions of gases associated with the energy used in its production cycle directly (ex. emissions from tractors used in agricultural activities) and indirectly (ex. destruction of forests, use of fertilizers);

The "non competition with food production" principle states that the implementation of cultures for the production of biofuels must not compete with food production. On the contrary, the projects to be implemented must include a component of production and supply of agricultural products, complementing the offer of food products for animals and human beings.

The "community energy autonomy" principle states the importance of providing rural communities and farmers with the means to generate their own energy, especially in areas where, due to the poor state of the roads, fuel transportation is too difficult; the "scientific and technical promotion" principle recommends the promotion of the investigation and development of agricultural, livestock and industrial technologies that are appropriate to chains of cultures dedicated to the production of biofuels, providing competitiveness, value-adding and reduction of environmental impacts.

The "adherence to environmental policy" principle states that the biofuels production programs must be in accordance with the international conventions that the country has joined, as well as with national environmental laws, prioritizing the reduction of GHG emissions in conformity with the Kyoto Protocol's Clean Development Mechanism (CDM).

The Biofuels Strategy also promotes mixing biofuels with fossil fuels, with the intention of consolidating ethanol and biodiesel as complementary alternatives to the country's energy reserves and establishing that the priority is the internal market. The Strategy also recommends starting the program in some regions of the country with oil seeds plantations that don't compete with food production, involving areas that are

more degraded and with less concentration of family farmers, so that the more fertile areas remain dedicated to food production, giving the possibility of market entry to small and medium companies, and defining technical and commercial specifications for biofuels. For now, the Strategy is still being nationally publicized, while some projects are already under analysis.

The Industry Sector Government Program for the period between 2009 and 2012, approved by Resolution 21/09 of March 13th, comes from the need to readjust development goals due to the international economic and financial crisis. The Program points as its most significant investments: the LNG project, the Lobito refinery, the new steel industry, the aluminium industry, the construction and agro-industrial materials industries, and the industries that support agriculture, the food and milling industries, beverages, textiles, packaging, chemistry, paper, school books and electrical equipment.

There are plans to construct thirteen industrial poles in different areas of the country, fifteen agro-industry and food industrial installations (with special incidence of sugar, alcohol and oils factories), building industries with thirteen ceramic factories, four cement factories, four steel plants, five paints and varnishes plants and one explosives plant, among others. In Benguela, it is planned the construction of an aluminium plant with the production capacity of 600 thousand tons per year, equipped with a hydroelectric dam with installed power of 1635 MW, of which 1000 MW will be consumed during the production process and 635 MW will be available for other ends.

The construction of an ammonia and urea factory, using the natural gas produced in Soyo by the LNG project, is also planned, along with methanol and ethylene plants. The program has a total budget of 8.690 million dollars, financed by the State's General Budget (1,89%), commercial bank loans with state guarantees (19,35%) and external sources, including concession funds and direct foreign investment (78,76%).

So, the program focuses on industries with great potential impact on the environment, which can increase Angola's GHG emissions level not only during the manufacturing process, but also in terms of waste (unregulated in the country). Despite the fact that the program has a human capital reconstitution component, as well as a component for the institutional reinforcement of the Ministry of Industry, it doesn't make considerations about the environment of energy efficiency. It is recommended that the 2009-2012 Industry Sector Government Program be implemented through the use of environmentally friendly technology, with great energy efficiency. This can be demanded/promoted if direct foreign investment is properly regulated and the tax incentives are put in place.

At the civil protection level, progress is being made, with the approval of the 2009-2014 National Calamity and Natural Disaster Preparation, Contingency, Response and Recovery Plan, approved by Government Order 205/10 of September 21st. The general goal of the Plan is to define the guidelines for an opportune and correct response, and the conditions and means that are indispensable to the minimization of adverse effects of a severe accident or catastrophe that affect the Angolan population. The response is planned according to the Civil Protection legal framework and international norms.

The involvement and participation of national and international partners, when necessary, should consist of supporting the government's efforts in providing assistance, in a coordinated way, to save lives at risk and satisfying the population's humanitarian needs. The Plan traces scenarios for: 1. Floods and torrents that can be Localized (the Provincial Plan is activated); Medium (the National Plan is activated); Exceptional (activation of the National Plan, declaration of a state of emergency, and request for international aid); 2. Drought: Activation of provincial and national plans, depending on the magnitude of the event.

The National Commission on Civil Protection prepared a Strategic Disaster Risk Management Plan with emphasis on reducing poverty, adapting to climate change and institutional development (2010-2014). The Plan, which is currently being discussed in inter-ministerial consultations, expands the reach of the existing National Plan in it that it includes geological and geotechnical threats (including ravines and landslides), technological and anthropic threats (including plane and shipping accidents, large-scale fires and the vulnerability of population conglomerates next to industrial development poles, and HIV/AIDS).

At the risk management level, the strategic plan proposes the development of actions in matters of knowledge, information, research management and support for monitoring systems; namely the development of a research and scientific/territorial information program, connected to similar existing programs. Research is guided by the aspects considered to be priorities by the CNPC, such as: the situation of rivers and basins responsible for floods; conditions of environmental degradation, climate change and possibilities of adaptation through local risk management; urban risk situations in the main cities. It also prescribes: the creation and development of a Integrated Information Management System about risks, threats and disasters, the strengthening of the threat monitoring and evaluation systems, with emphasis on the intensification of the national hydro-meteorological network, and a process of incorporation into school curriculums of matters related to the management of ongoing disasters.

The Strategic Plan identifies the SNPC's territorial management program as a direct contribution to the processes of adaptation to climate change, given that territorial management and risk management constitute direct and effective adaptation options. Territorial management is one of the instruments where different strategic and thematic lines coincide: management of hydro graphic basins, forestry ecosystems and marine-coastal ecosystems, risk management, and, in general terms, development management.

So, the Strategic Plan proposes the development of risk management and adaptation criteria within the territorial planning instruments and the processes of sustainable management of resources, as well as supporting the inclusion of indicators and measures for risk reduction in evaluations of environmental impact, and the implementation of adaptation measures in more sensitive socioeconomic sectors, such as health, agriculture, water resources, energy, tourism, and infrastructure.

The Strategic Plan also includes the Local Management and Early Warning Plan, which is guided to develop capacities in decentralized civil protection commissions, as well as in more vulnerable communities, and consolidate the national early warning system. Generally, the Plan also proposes: promotion of gender equality and of

traditional knowledge in the processes of risk analysis and planning; promotion of the inclusion of risk reduction and financial protection (insurance) criteria in public investment processes; support of the national decentralization processes; and creation of the National Solidarity and Assistance Fund.

8.11 – Legal Framework

The main areas in need of adaptation to climate change in Angola are: water resources, ecosystems, agriculture, forestry, coastal areas, infrastructure and healthcare. The main mitigation areas are energy, industry, forestry and soil degradation, agriculture and waste.

The decree about Environmental Impact Evaluation (Decree 51/04, of July 23rd) determines the norms, types and obligations of studies that identify the foreseeable consequences, as well as mitigation measures of certain types of projects. Being environmental impact evaluation a requirement for approval of projects within the Clean Development Mechanism (CDM), the legal conditions are created for its implementation. It is also operational the decree on Environmental Licensing (59/07, of July 13th) which establishes the requirements, criteria and administrative procedures related to the environmental licensing process, an activity that is inherent to the environmental impact evaluation process.

Decree 1/10 of January 13th establishes the need to conduct environmental audits on public and private activities that can provoke significant damage to the environment. Despite having as objectives, among others, to determine compliance with energy sources, raw materials and water preservation, and with measures dedicated to avoiding or reducing water and soil emissions, waste production and sound pollution, the decree doesn't state anything specific about atmospheric emissions.

The Water Law (6/02 of June 21st), which applies to superficial and ground water, establishes the following general principles: i) water is a social, renewable, limited and economic valuable asset; ii) citizens and collective entities have a right to water; iii) unity of the hydrological cycle, which implies the institution of a single legal regime for its management; iv) unit and coherence in managing the country's hydro graphic basins; v) integrated management of water resources; vi) integration of the water management policy with the general territorial planning policy and the environmental policy; vii) institutional coordination and participation of communities; viii) appropriate promotion of the participation of the public and private sectors in managing and developing water resources; ix) complementing water supply with liquid waste sanitation; x) relation between pollution and social and financial responsibility for fixing environmental damages.

Promoting the efficient use of water and encouraging particular initiatives related to the rational use of the available water resources are the main goals of the Angolan policy on water resources. Integrated management techniques and the balanced management by basin (a challenge in a vast country, with climatically diverse regions) constitute good management practices that open the way for climate change adaptation in the sector.

The law also states the obligation to prepare General Development and Use of Water Resources Plans, which should be developed with the participation of communities and according to the principle of multiple uses; the National Water Resources Plan, which aims to nationally integrate the management of water resources and is prepared according to national interests, eventual inter-basin transfers of torrents; and the General Development and Use of Each Basin Plans. Until the date of this publication, only the Water Sector Development Program (Resolution 10/04 of June 11th) had been published.

The law establishes the obligation to evaluate the environmental impact of all hydraulic constructions and forbids any activity that presents the danger of water pollution or degradation, or any alteration to the water regime that could jeopardize the population's health, the country's natural resources, its environment and national sovereignty. This allows the integration of considerations related to climate change into the AIAs and environmental audits. The law needs regulation and the plans established by the legislation will have to be prepared. There will be, therefore, conditions to include climate change considerations in these instruments.

The Land Law (9/04 of November 9th) establishes that the occupation, use and enjoyment of the land are subjected to environmental protection norms, specifically related to landscape, flora and fauna protection, preservation of the ecological balance and the right of citizens to a healthy unpolluted environment. These activities must be executed in a way that doesn't compromise the regeneration capacities of fertile land and the maintenance of the respective productive aptitude.

The Territorial Planning and Urbanism law (3/04 of June 25th) attributes to the state the duty to organize the territory, with local authorities being obliged to intervene in areas under their jurisdiction, and rural communities having the power to participate in actions related to the organization and preparation of territorial plans. Inhabitants have a right to information about the content of and alterations to the plans, both in the publicizing stage of projects and after their publication. The principles guiding State interventions are: environmental defence; rational use of natural resources; sustainability and public participation.

The organization of the occupation and use of spaces within the territory is promoted through national, provincial and municipal territorial plans.

Decree 2/06 of January 23rd approves the General Regulation of Territorial, Urban and Rural Plans, with which the territorial plans, and other territorial management instruments, must be in accordance. Among the principles that must exist in every plan are: rational use of land as a finite resource, through the correct location of productive and non-productive activities, as well as the qualification and classification of soil according to its characteristics; using natural resources, conserving nature and protecting and rehabilitating the natural and urban environment in order to achieve sustainable development, foreseeing natural and technological disasters. In this sense, climate risks must be contained in the territorial planning instruments. The Decree establishes that special kinds of territorial plans are the object of special regulations. These include natural lagoons protection areas or coastlines.

The Decree 4/01 of February 2nd (revoked by Government Order 31/11 of February 9th) used to regulate the preparation and approval of the Coastline Organization Plans (POOC), comprised by marine and interior waters, the respective banks and margins

with a "ground protection zone" with a maximum of 500 meters in length, to be defined by each plan. The Decree established that POOCs should define conditions, vocations and main uses, as well as the location of infrastructures to support such uses, guiding connected activities to be developed in each area, aiming to achieve the following goals: protecting the space's biophysical integrity; valuing the coastline's existing resources; conserving environmental and landscaping values; protecting local populations. With the decree being revoked, there is a legal void related to the planning of adaptation measures for rises in sea levels.

Current legislation in the Forestry, Wild Fauna and Areas of Conservation sector, namely the Decree 40.040, of January 20th 1955, which established precepts for protection of soil, flora and fauna, as well as some complementary regulation, namely forestry regulation (Decree 44.531 of August 21st 1962), hunting regulation (Legislative Diploma 2873 of December 11th 1957) and the national parks regulation (Legislative Diploma 22/72 of February 22nd) are completely disconnected from the country's current reality. They don't contemplate international law developments connected or not connected to Angola. However, different proposals of new legislation prepared by the Forestry Development Institute have never been approved.

The Agrarian Development Base Law (15/05 of December 7th), which included forestry as part of agriculture, integrated the sustainable development principle and environmental considerations explicitly. The law aims to foster the rational use of natural resources in order to achieve a sustained and sustainable increase in productivity, having as fundamental principles the protection of the soil's productive capacity (respect for regeneration), the preservation of the availability and quality of water resources, and the conservation of the biodiversity associated with the flora and the fauna. The law charges the State with the responsibility of supporting the development of activities associated with agricultural exploration, especially in rural areas or specific ecosystems. This implies the need for climate change adaptation activities.

The law establishes among other things, incentives to agricultural companies that implement actions to promote environmentally compatible agricultural practices; foresees the attribution of compensatory benefits to eventual negative effects on revenue to productive activities subject to restrictions (in methods and production techniques) that aim to maintain biological diversity; encourages a policy of rewarding farmers for providing services that contribute to resource conservation and preservation of the landscape in rural areas, based on the adoption of technologies, systems and activities compatible with those objectives.

The law establishes also that agrarian investigation must be guided towards solving real problems, among which the one related to the sustainable use of natural resources and environmental defence. Even though it doesn't explicitly refer to climate change, Law 15/05 contemplates actions and incentives necessary to adaptation. The law needs regulation and its preparation could be used to include financial considerations and mechanisms focused on climate change adaptation and mitigation.

The Industrial Activity Law (LAI), adopted by Law 5/04 of September 7th, aims among other things to prevent, reduce and eliminate industrial risks to people, the flora, the fauna, assets and the environment (Art 14). The law establishes as one of the reasons for denial of the authorization to conduct industrial activities – necessary to

any industry regardless of nature or nationality – environmental protection (Art 5). The classification of industrial plants, taking into account, among other things, environmental impact and the degree of risk for people and assets, prescribed in LAI, was published in the Decree 44/05 of July 6th, about Industrial Licensing.

The list of activities and establishments (which need EIA) is less encompassing than the one published by the 51/04 Decree. However, for class 2 activities, even though there is no EIA obligation, the National Environmental Directive is called upon to issue an opinion about the attribution or not of the industrial license, having 10 days to do so. The law makes the industrial sector responsible for preventing risks to people, assets, work conditions and the environment, which is present in specific regulation and in rules and norms defined by the manufacturer of equipments or materials, as well as for taking measures considered appropriate to avoid or correct abnormal situations (or increased risk of an occurrence) and for the suspension, if necessary, of all activity until the situation is resolved. The law promotes public participation, given that it predicts complaints by third parties, properly identified, about risks, accidents or damages related to industrial activity, to the entity that regulates the activity in question, provincial governments, municipal administrations and authorities. The preparation of the LAI regulation may constitute a good opportunity to include considerations related to climate change.

The Oil Activity Law (10/04 of November 12th) defines the rules of access to the implementation of Oil operations. It contains concrete dispositions about environmental protection, establishing that in the exercise of such activities, the licensed companies, the National Concessionaire, and its associates must take the necessary precautions to protect the environment. For that, the exploration agreements, which must be approved by the governments of all the countries involved, must contain, among other things, the standard health, security and environmental management system.

The law is regulated by the Decree 37/00 of October 6th, related to transformation activities (refinery, for example). Storage, distribution, transportation and commercialization of Oil products are regulated by the Decree 39/00 of October 10th, which aims to ensure the preservation of health, water, soil, air, flora and fauna, ecosystems, landscapes, atmosphere and cultural values; by Decree 1/09, Regulation on Oil Operations, and Decree 38/09 of August 14th, Regulation on Security, Hygiene and Health in Oil Activities.

All Oil activities are subjected to licensing by MINPET. The EIA process obligations for the execution of Oil activities in new installations are defined, as well as for modifications to be made in any existing installation that, on MINPET's opinion, could significantly affect the environment. Licenses are valid for 10 years and can be renewed in case no systematic violation of hygiene, health, environmental protection or public and worker security is verified.

Licensed entities are obligated to subject to inspections by the competent authorities – Technical Commission – on the compliance to technical security and environmental protection rules. The Concessionaire and its associates have to proceed to the preparation and implementation of a spill prevention plan and have the obligation to inform MINPET about "all spills that cause environmental damage", being

responsibility of the operator to "take all necessary effective measures to control, combat and clean the spill" individually or in collaboration with other oil companies that may have business in the country, in case the original company does not have the necessary resources.

Failing to comply with the aforementioned legal obligations constitutes an infraction punishable by a fine of at least US$ 5,000.00 and US$ 500,000.00 at the most, to be determined according to the nature and gravity of the infraction. It is also prescribed the temporary suspension of all operations, as well as the charging of the reparation costs to the entity that cause the damage. The security, hygiene and health plan contemplated operational security and monitoring plans. However, Oil activity legislation does not contemplate the monitoring of atmospheric emissions.

Government Order 48/11 of March 9th creates the Oil Fund (FP), which is a collective entity with administrative, financial and patrimonial autonomy. FP aims to promote, foster and support, in Angola and abroad, the investment in the development of projects related to the energy and water sectors, as well as other sectors considered to be strategic, including, particularly, infrastructure projects, such as for the generation, production, storage, transportation, distribution and commercialization of energy and water, as well as stopping, operating, maintaining, managing such projects, and developing any auxiliary, connected or related activities. The Fund can be a good financing mechanism for climate change adaptation.

The Geological and Mining Activities Law (1/92 of January 17th) establishes that environmental and nature protection constitute obligations of the entities that hold exploration rights which include extractive powers, treatment and commercialization operations for mineral resources, as well as alteration of the natural configuration of the soil, subsoil and continental platform.

The damage caused by geological and mining activity is defined as "harm caused to life or health of people, animals, things, soil, vegetation, superficial or ground waters, and other natural elements", subjecting the licensed entities to legal sanctions and restitution obligations.

Geological and mining activities are subjected to inspection by the Angolan government's competent entity, according to the rules contained in the Government Decree 38/92 of August 21st, which doesn't contemplate any environmental considerations. The 16/94 Diamond Law, of October 7th, also doesn't contemplate environmental concerns. Despite the fact that Dispatch 23/06 of July 5th created a Technical Commission to review both of these laws, this hasn't happened yet. Adaptation measures related to water resources and the fight against ravines are possibilities for inclusion in the current legislative reform.

The extraction of inert is also poorly regulated. Resolution 41/03 of December 19th approved recommendation measures about the exploration of sanded areas along the coastline, with particular incidence in the Luanda Province. These recommendations are about elaborating studies on viability, control and limitation of extractions (license holders with the ability to operate only on delimitated zones, regulate the market etc.). However, the implementation of this resolution has been limited.

Preparation against calamities is ruled by the Civil Protection Base Law (28/03 of November 7th), as well as activities developed by the State and by citizens with the intention of preventing collective risks inherent to situations of severe accidents, catastrophes or calamities, be it natural or technological in nature, and attenuating or eliminating negative effects and helping to save people and assets. Beyond defining the institutional framework for civil protection, the law establishes the following goals for the sub-sector: a) preventing the occurrence of collective risks resulting from severe accidents, catastrophes or calamities, natural or technological; b) attenuating collective risks, as well as dealing with their effects, in the case of occurrence; and c) helping in the assistance of affected people or people in eminent risk.

The law establishes that civil protection activities are conducted in the following domains: a) surveying, predicting, evaluating and preventing collective risks of natural or technological origin; b) permanent analysis of vulnerabilities before risk situations resulting from human action or natural causes; c) information and education of populations, aiming to sensitise and instruct them for prevention, self-protection and collaboration with authorities; d) study and publicizing of appropriate ways to protect general edifications, monuments and other cultural assets, installation of essential services, as well as the environment and natural resources. This, beyond the planning of emergency solutions, aiming to search, rescue and aid, as well as evacuation, lodging and stocking of populations; and inventory of available resources and means that can be more easily moved at the local, provincial and national levels.

In order to achieve its civil protection goals, the law can be used for, in terms to be defined by a decree from the Ministries Council, requesting the cooperation of public and private entities and institutions specialized in technical and scientific investigation.

The law cites a) the National Meteorology Institute; b) the Angolan Engineering Laboratory; c) the National Geology and Mining Directive; d) the MINAGRI National Forestry Development Institute; and e) the Geodesy and Cartography Institute. The law also establishes that the emergency plans, according to the territorial extension of the situation in question, are national, provincial or municipal and, according to their intention, are general or specific. The emergency plans are subjected to periodical updating and must be the object of frequent exercises to test their operationalization. National emergency plans are approved by the Council of Ministers, via opinion issued by the National Civil Protection Commission. The provincial and municipal emergency plans are approved by the National Civil Protection Commission, via opinion issued by the respective Governor.

The UNFCCC and Kyoto Protocol National Implementation Strategy (Resolution 52/2008) professes, in the legislative area: elaborating, reviewing, perfecting and completing the country's air quality rules system, taking into account international rules; elaborating a system of specific norms related to climate preservation, taking into consideration international rules for the agricultural, industrial, transportation, energy and Oil production sectors; establishing economic and financial mechanisms (tax incentives, imposition of rates and lines of credit) and legal control (preventive systems and civil, penal and administrative sanctions), as well as access to information and participation (information, citizen participation, education and investigation). However, these activities have not been accomplished. It is also

important to state that there is no legislation about waste in Angola, and there is also no legislation related to energy efficiency and renewable energy.

8.12 – General Considerations

To strengthen adaptation/mitigation capacities and management of climate risks, it can be said that the main challenges for Angola are at the knowledge, governance and lack of financial resources level.

Greater efforts are needed to ensure the integration of climate change and economic development. Consequently, the country needs to make a commitment to improve the connection between climate change and planning economic development and mitigation, and maximize synergies between reducing poverty and adapting to climate change (see orientation of policy recently published by OCDE about "The integration of adaptation to climate change in the cooperation for development that defines ways of making this integration operational in the decision making process of developing countries in every level").

With the intention of integrating climate change into the national sustainable development plans, in the socioeconomic sectors, and to strengthen the cooperation between the public and private sectors, four fundamental threads need to be worked on: i) generation and publicizing of knowledge; ii) improvement of planning; iii) improvement of legislation and implementation mechanisms; iv) improvement of financial management.

At the knowledge level (Meteorology Institute, Ministry of the Environment and other Ministries for thematic studies):

- Improving climate prevention systems at the national level and increasing the capacity of turning to climate models from smaller networks, in order to adequately represent the different regions and climate areas of the country;
- Promoting research/action projects, to understand the effective vulnerability of the country's productive sectors. For that, it is necessary to proceed to objective identification, quantification and analysis of the risks of climate change at the national level, in a significant scale, both in terms of time and space.

At the governance level (CTMA, CTA and ministries that belong to these organizations, and joint work between the Ministry of Planning and the Environment):

- Promoting sensitization and publicizing actions directed at political decision makers, parliamentary members, private sector and civil society. These actions should be implemented, according to a multi-annual plan, with different activities for different target audiences;
- Basing implemented climate change activities on the needs, visions and priorities of the country, so that development is sustainable on the long term.
- Developing a broadly consultative process, with the National Adaptation Programme of Action (NAPA) and the Nationally Appropriate Mitigation Action (NAMA), as well as other national and provincial instruments that

would allow its implementation. Articulation between these instruments must be assured with policies, plans and programs in all relevant sectors (for instance, agriculture and rural development, management of water resources, Oil and diamond exploration etc.);

- Creating a technical secretariat, on DNA or on CTMA, with the ability to prepare proposals, conduct project monitoring, prepare studies and opinions etc. In this model, DNA would be responsible for not only managing CDM funds but also other funds related to climate change. The Technical Secretariat could also assist CTMA, when required;
- Increasing inter-ministerial coordination so that the national sustainable development strategies, the poverty reduction strategies and public policies take into account instruments related to existing or developing climate change;
- Habilitating national experts to ensure that the country has the capacity to integrate climate change adaption actions into the national plan.

At the level of legislation strengthening and enforcement:

- Legislation strengthening in several areas, including: reform that leads to the obligation to proceed to a strategic and social environmental evaluation, as well as to "climate proofing" strategies, programs and plans in key sectors of the national economy (including territorial planning instruments) and public infrastructure (roads, railroads, ports, hydroelectric plants and other embankments, dams, buildings, social urbanizations etc.);
- Proceeding with the regulation of territorial planning, namely the coastline, establishment of agricultural and ecological reserves, implementation of protection zones along riverbanks, and designation of inert extraction areas;
- Air quality and emissions control, including monitoring demands;
- Management of water resources – regulation of the water law, with incentives for effective management and reducing waste; development of plans established in legislation;
- Waste – appropriate waste management (avoiding burnings and open air sewage), taking into account landfill emissions;
- Reform of the forestry, flora and wild fauna, and protected areas sectors, with strengthening of the inspections of tree cutting, hunting techniques and co-management;
- Regulation of the Agrarian Development Law, namely the creation of incentives to permaculture and diversification of agricultural, livestock and forestry cultures;
- Proceeding with the regulation of areas of Oil activities, geological and mining activities (diamonds) and industry in order to integrate mitigation obligations and climate change adaptation;
- Reform of the energy sector (legislation on energy efficiency and the use of renewable energy, creating incentives for its implementation);
- Establishment of financial incentive mechanisms (tax incentives, bonus interest rates to national companies etc.) for investments in environmentally friendly and highly efficient technology for the development of industry;

- Establishment of financial incentive mechanisms for the cultivation of species for food, so as to avoid that farmers adhere massively to the production of biofuels, in detriment of food production;
- Strengthening of inspection and legislation enforcement capacities in areas such as forestry, fishing, inert removal, environmental performance of constructions and connected activities;
- Strengthening of capacities for monitoring emissions and inspecting and enforcing legislation in areas such as Oil production and industry.

At the financial management level (Ministry of Planning, Ministry of Finance, and Ministry of Foreign Relations):

It is known that the mobilization of "adequate, foreseeable and sustainable" financing is a priority to minimize the effects of climate change in developing countries. There are a number of estimations about the amount of necessary financing and evidences show that existing commitments are very far from these estimations. Climate change financing presents formidable challenges not only for the international community, given that funds must be additional to cooperation, but also for the non-Annex I countries. The mobilization of sufficient resources for climate change adaptation and mitigation will require express political will, so as to generate confidence in the international community, as well as creativity, given the current economic environment. In gathering new funds, there will be advantages in innovative sources, such as the voluntary carbon trade. On the other hand, it is crucial that climate change financing contributes to poverty reduction and other sustainable development goals.

One of the great challenges is the integrated control of funds. Since in Angola the basis of the economy is Oil exploration, and with its industry in development, the country has the possibility to generate Certified Emissions Reductions (CERs), which is exposed to investors, some more scrupulous than others. There is a need for being able to select only the more relevant and effective projects and do it within the strategic framework of CDM implementation.

Another great challenge, in the adaptation realm, is ensuring that Angola has the capacity to absorb and effectively use additional financial resources for its own purposes. Angola's public institutions, at the central and provincial levels, that are players in the implementation of adaptation measures, have displayed difficulties executing the State General Budget, with investments in particular.

Therefore, it is recommended:

- Evaluating, within the existing climate change adaptation/mitigation instruments, activities that can be covered with national funds autonomously without the need to turn to donors, and the activities that the Government prioritizes for larger co-financing;
- Elaborating a strategy for mobilizing financial resources for the implementation of several programs/plans/projects related to climate change and management of climate risks;
- Promoting coordination between donors to avoid complex and fragmented sources of climate change financing and getting larger financing (co-

financing) for integrated programs, with extended time periods, and a well-designed system for monitoring and evaluation;

- Simplifying information sharing procedures and encouraging the coordination of donors to avoid the proliferation and duplication of isolated actions;
- Integrating climate change financing into the planning and mechanisms of the state general budget and investment programs, which will allow the country to plan, manage and control these financial resources in the simplest and most transparent way possible – integrating the resources into the budget, so that their use is subjected to the control and inspection of parliament, other national institutions and civil society, increasing the trust of investors and donors;
- Elaborating a portfolio of possible investment projects within the clean development mechanism, aligned with development policies and strategies, and susceptible to certified emissions reductions and voluntary emissions reductions. The files of the projects must contain minimum implementation goals, targets and deadlines, potential threats and an investment estimative;
- Habilitating national experts to ensure that the country has the capacity to absorb and control climate change financing.

Chapter 9 – Capacities Needs Assessment

Reaching the goals and objectives set as part of UNFCCC is only possible through the integration of actions, measures and strategies related to different areas of intervention. Therefore, Angola, as other countries, has been trying to use existing capacities in different intervening institutions pertaining to climate change.

Awareness rising is being made gradually and according to the needs and objectives of the different stages of the process, meaning, within projects developed with the intention of implementing UNFCCC. The existing specific technical capacities are different in every level of intervention: politicians, decision makers, and experts, among others.

In Angola, there is an urgent need for a decentralized institutional awareness rising of civil society organizations, so that changes in the attitudes and behaviour of the population are accompanied by an increase in the resilience toward climate change and the spread of sustainable development throughout the territory.

Provinces still have a diminished capacity in terms of sustainable development and civil protection in relation to prevention and climate change. It is necessary to generally reinforce capacities in several environmental and climate change issues. NGOs, through sensitization and information activities, and the implementation of environmental protection activities, have contributed to the changes in attitude and behaviour of individuals as far as conservation of natural resources is concerned, and has started to focus on climate change issues. However, their knowledge about the issue is still deficient and these organizations need better structures.

The process of implementing UNFCCC assumes the involvement and participation of

different partners, as well as of the population as a whole. Awareness within local communities about climate change is starting to be raised, but it is still thin. It is necessary to educate, habilitate, inform and sensitize the general population about climate change, its impacts and the adaptation measures that need to be implemented at the local level. For that to happen, there must be a reliable and effective information providing system in place, which means habilitating institutions in terms of specialized technical personnel, equipment and materials.

In order to increase the country's ability to respond to current and future challenges, it is necessary to develop an increasingly stronger balance between capacities in different levels of performance and sectors. This means that capacity-reinforcing strategies must be adopted in order to achieve a satisfactory level of balance between different types of partners (public administration, civil society organizations and the private sector) and between central and local levels.

9.1 – Specific Capacities from Several Institutions

The process of elaborating the National Communication revealed a series of difficulties, namely in the preparation of the GHG Inventory, vulnerability and adaptation, mitigation, transfer of technology etc., which led to a preliminary study about the country's existing capacities, conducted in 2010.

The main difficulties found were: limited comprehension and/or familiarity with the theme of climate change, limited data availability, limited technical cooperation between institutions, difficulties in preparing data for processing in the IPCC's inventory software.

In order to assess these capacities, a questionnaire was distributed to several ministries, institutions, local administrations, as well as universities. Given the crucial role they play, follow-up interviews were conducted within the Ministries of Agriculture, Rural Development and Fishing, Energy and Waters, Oil, Industry and Territorial Administration.

This gathering of information demonstrated that in most institutions there wasn't sufficient sensitize on climate change, or correct notions about the impact of climate change in each institution's area of responsibility. Only a minority of respondents considered that climate change could interfere in their work. These same people also stated that climate change is a global challenge that should be undertaken with the implementation of actions at the local level.

The institution's perceptions about their own capacity for different types of actions are balanced. About one third of institutions believe they are better prepared for adaptation activities, about 30% claims to be better suited for education/awareness rising activities, and about 30% believes it should be conducting investigation activities.

A significant portion of those inquired answered that their institutions don't have the ability to respond to the climate change problem. The vast majority of respondents (90%) indicated that there is a need for institutional reinforcements in order for them to be able to face climate change. Representatives from these institutions are aware of

the need to prepare Angola for participation in the global challenge that is climate change.

About half of all responses indicate that in Angolan institutions information is not organized in a way that facilitates investigation. This was apparent with the difficulties founded during the preparation of this national communication.

About a quarter of institutions know that they have been implementing adaptation activities, namely reforestation activities and sensitization workshops.

9.2 – Other Potential Capacities

A study conducted in 2006 indicated the main gaps in terms of capacities to implement climate change adaptation and mitigation activities. Since then, actions to fill these gaps have been limited. The most important gaps that still remain are:

- Limited knowledge about quantitative and qualitative vulnerabilities and their geographic distribution;
- Inexistence of any study about the impacts of climate variability and extreme meteorological events on key socioeconomic sectors;
- Introduction of the climate change theme on the country's legislation and strategies still happens sporadically;
- Inexistence of legal and economic instruments for the promotion of mitigation measures. Even the processes that allow access to the Clean Development Mechanism (CDM) are still in their initial stages and are very dependent on international cooperation;
- Inexistence of a national strategy for GHG mitigation.

9.3 – Areas of Knowledge

The fact that few studies have been conducted is due to limited existing means for measuring meteorological and hydrological parameters or the limited national coverage of this data. There are no decentralized networks for information monitoring and sharing. In many areas of Angola, there is only meteorological data from 1950 to 1975. The understanding of factors that contribute to climate variations in Africa is deficient, especially in the Angola region, which also makes it difficult to generate models. Information pertaining to hydro graphic basins is also very limited.

In general, there is little updated information about ground biodiversity and its state of conservation. The lack of information about possible climate change in Angola and its impact, and the lack of a vulnerabilities map, prevents the preparation of specific recommendations about adaptation strategies.

Institutions that conduct systematic monitoring and investigations are, among others, the National Meteorology Institute, the Secretariat of Waters, the National Natural Resources Directive, the National Water Resources Directive, the National Biodiversity and Areas of Conservation Institute, and the National Biodiversity Directive, the National Forestry Development Institute (INDF), the Agronomic Investigation Institute (IIA), the National Fishing Investigation Institute (INIP), the

National Territorial Planning and Urban Development Institute, and the Ministry of Superior Education, Science and Technology, through the proper directive and institutes.

These institutions, namely the ones that are also dedicated to investigation, could contribute to the generation of knowledge about Angola's baselines and, together with Civil Protection and the Ministry of the Environment, could proceed to the definition of more vulnerable zones, providing responses to the related extreme climate events. Some of these institutions could also generate climate change scenarios to determined possible impacts in the country. However, there is very little contact between the institutions and they have limited resources (human and technical) to proceed to this kind of work.

In parallel, the country is not habilitated to conduct integrated studies on vulnerability and adaptation (including generating models). Technical awareness rising in this area (V&A) is needed. This limited capacity has led to delays in the preparation of the National Adaptation Action Plan (PANA), National Communication and the preparation of projects related to climate change adaptation. The same happens with mitigation, where considerable delays are verified in the preparation of CDM projects, even though a National Designated Authority has been specifically created for that. As of now, this component remains limited to international cooperation.

There is a limited technical capacity in terms of the analysis of mitigation measures and technologies appropriate for different sectors, as well as analysis and adaptation to the national context of approved methodologies.

It should be emphasized that as a Party on UNFCCC, Angola has made the commitment to, among other things:

- Introduce systems of analysis and scientific investigation;
- Create systematic and continuous follow-up mechanisms;
- Reinforce education, awareness rising and information destined to all of those who influence the environmental process.

There are financial and technical support mechanisms that industrialized countries have committed to providing. Angola lacks the capacity to attract these means.

9.4 – Information, Education and Communication

The attitudes and behaviour of citizens translate their level of awareness. Awareness about climate change is closely connected to access to information and knowledge in related areas. Society's level of awareness is thus determined by the work developed by institutions in different fields, in which the sharing of knowledge takes place. Reinforcing institutional capacities in terms of public education and awareness rising must be an absolute priority.

It can be said that there already is in the country a certain level of awareness and sustainable management of natural resources, achieved thanks to the intervention of different projects and programs. Certain types of players (professionals, investigators,

students, NOGs etc.) have been awaken to the nefarious consequences of climate change, but the general level of understanding of this matters is still lacking.

There are several lines of action that require back up: the introduction of climate change in school curriculums on different levels, the continuity of education and scientific and technical awareness rising programs, the generalized reinforcement of the work conducted by NGOs pertaining to sensitize rural and urban populations, the real integration of environment and climate change to all development programs, as well as to different institutions, governmental departments and private sector.

9.5 – Technology Transfer and Awareness

In Angola, the transfer of technology is necessary on two levels. On the one hand, there is the transfer of mitigation technologies, considering sectors such as energy, industry, transportation, agriculture, forestry and land use, as well as the management of solid waste. On the other, there is the transfer of general technology for water, agriculture, public health, infrastructure, energy and transportation. Meaning, there is a need for the technology necessary to the establishment of efficient climate change programs.

Through the Clean Development Mechanism, it is possible to obtain funds for development projects that aim to limit GHG emissions. Several countries have been able to increase the presence of last generation technology by attracting direct foreign investments, forming partnerships with national entities, conditioning the issuance of licenses to the compliance to environmental legislation and providing incentives to companies that invest in this type of technology.
It is crucial that the process of technological transfer is accompanied by the respective reinforcement of capacities, so that the process becomes more efficient and useful in the locations where these technologies are installed.

In the country's developing industrial sector, it is important to invest in less pollutant and more efficient technologies. This brings savings on working costs, beyond limiting emissions, and is important when there is a need to conciliate the acquisition of new technologies, that are expensive and mostly produced in developed countries, with the country's own development.

One of the most important environmental pressures in Angola is deforestation and forest fires, which are connected to agriculture, hunting, energy and some traditional practices. On the energy level, the country's infrastructure and development will lead to an increase in the amount of transportation.

Still on energy, it is important to create an infrastructure for hydroelectric production and management of the reduction of losses so that electricity is available throughout the country. The introduction of renewable energy equipment adapted to the reality of the country in general as well as to the most isolated areas can contribute to mitigation. Transfer of technology is also necessary on the domestic energy level. In fact, the use of gas for more efficient stoves can reduce emissions and pressure on the forests. Building the country's infrastructure, it is expected to be an increase in the

number of vehicles, so it is important to strengthen legislation and its enforcement to ensure that less pollutant vehicles are imported and to implement transportation policies that favour the use of public transportation, regulating it.

On the water level, Angola possesses important water resources, both in superficial and ground water, but those are not evenly distributed throughout the country, and the expected climate change is not geographically homogenous either. Thus, it is important to transfer technology and increase awareness rising for storage, inexpensive irrigation methods that would ensure efficiency in the use of water, and integrated management techniques of resources. As far as agriculture is concerned, it is important to investigate to define the most resistant cultures to climate change, as well as water and soil conservation techniques, to diminish erosion, and the sustainable management of forests.

When it comes to construction, urbanization and housing, it would be important to adopt technologies that can be adapted to the local natural resources and atmospheric conditions, habilitating architects and construction entrepreneurs so that future residential or hotel complexes consume as little energy as possible.

It is important not only to import technology, but also strengthen the capacity for technological investigation and development nationally. There are areas in which it is crucial to work with local raw materials or adapt techniques to the national reality. However, limited information/awareness creation, the insufficient or inadequate management of human resources and other institutional limitations make this process very difficult. In order to overcome these difficulties, it is necessary to strengthen research institutes; publicize relevant research results, using different means of communication, from the central ones to community radio stations etc.; create/improve the conditions necessary to the effective transfer of research results to the users of mitigation and adaptation technologies, as well as to decision makers; strengthen the awareness rising of institutions dedicated to the publicity and expansion of improved/adapted technologies.

9.6 – Legislation and its Implementation

With the Initial National Communication, an analysis of Angolan climate change legislation was conducted. The main areas that require strengthening are:

- Legislative reform that leads to the obligation of proceeding to a strategic and social environmental evaluation, as well as “climate proofing” of strategies, programs and plans in key sectors of the national economy (including instruments for territorial planning) and public infrastructure (roads, railroads, ports, hydroelectric plants and other dams and barriers, buildings, social urbanization projects etc.);
- Continue with the regulation of the territorial planning, namely the coast, the establishment of agricultural and ecological reserves, the implementation of protection zones along the rivers and estuaries, and designation of inert extraction areas;
- Emission and air quality control, including a limit amount of emissions and

monitoring demands;

- Management of water resources, regulating the water law, with incentives for effective management and reduction of waste; development of plans established by legislation;
- Waste – adequate waste management (avoiding burnings and out-door waste), taking into account landfill emissions;
- Reform of the forestry, flora and fauna sectors, as well as protected areas, reinforcement of inspections about tree-cutting, hunting techniques and co-management resources;
- Regulation of the Agrarian Development Law, namely with the creation of incentives to perennial cultures and the diversification of agricultural, pastoral and forestry cultures;
- Proceeding with the regulation of areas of Oil geological, mining (diamonds) activities and industry, integrating mitigation obligations but also adaptation to climate change;
- Reform of the energy sector (legislation about energy efficiency and the use of renewable energy, creating incentives to its implementation);
- Establishment of financial incentive mechanisms (tax, lower interest rates for national companies etc.) for investing in environmentally friendly and highly efficient technology for the development of industry;
- Establishment of financial incentive mechanisms for the cultivation of food products, avoiding the risk of farmers turning in mass to the production of biofuels.

All the areas mentioned above are related to climate change, mitigation, vulnerability and adaptation, technological transfer, education and public awareness, in which it is necessary to strengthen capacities with some specificity.

Beyond the existence of legislation, it is necessary to strengthen inspection and enforcement capacities. This is particularly important in areas such as forestry, fishing, territorial planning, inert removals, environmental performance in construction and connected activities. When it comes to mitigation, it is necessary to strengthen emissions monitoring and inspection capabilities, as well as the enforcement of legislation in areas such as Oil exploration and industry.

9.7 – Catastrophe Prevention and Management

In civil protection, Angola has been making a lot of progress. The civil protection organization hierarchy is established by Law 28/03 of November 7th and included a large number of centralized and decentralized entities. The National Assembly frames the civil protection policy and inspects its execution. The Government defines the main policy guidelines and ensures the means for their execution. It is also the Government's responsibility to declare a state of emergency or disaster, by its own initiative or at the request of the Ministry of the Interior or Provincial Governors. In

this case, the Government gathers funds and adopts exceptional measures to reinstall normalcy in the affected areas.

The President, as chief of the Government, is responsible for directing the operations in situations of national disasters or catastrophes. The National Council on Civil Protection is an inter-ministerial entity that councils the president on matters of civil protection and must issue official opinions about the organization and inner workings of civil protection institutions, sector legislation and approval of the National Emergency Plan. Provincial Governors participate in Council meetings that deal with issues pertaining to their respective provinces. The National Commission on Civil Protection (CNPC) is the entity specialized in technical assistance and operational coordination of the civil protection institutions' activities.

CNPC functions under the tutelage of the Ministry of the Interior as is comprised by: representatives from the ministries that are members of the Council; the National Policy General Commander, one representative from the Angolan Armed Forces, the Fire Department Commander, the Director of the National Civil Protection Service, the Director of Civil Aviation, the Director of the Merchant Marine and Ports, and the Director of the Meteorology Institute. It is CNPC's responsibility to propose: legislative measures and technical norms; institutional collaboration mechanisms, and technical and operational coordination between all entities and services involved; technical criteria and norms about the organization of inventories on public and private resources and means that can be moved locally, regionally and nationally in case of severe accidents, disasters or catastrophes, as well as the preparation of local, regional and national emergency plans, both general and specific, and the definition of civil protection priorities. CNPC is also in charge of public sensitization and collaboration with civil protection authorities.

Angola has a National Calamity and Natural Disaster Preparation, Contingency, Response and Recovery Plan 2009/2014 (Government Order 205/10 of September 21st). The general objective of the plan is to define the force lines that guide an opportune and appropriate response, the indispensable conditions and means for the minimization of adverse effects of severe accidents or catastrophes that affect the Angolan population.

The planned response is given within the legal frame of Civil Protection and international norms. The involvement and participation of national and international partners, when necessary, should consist of support of the government in providing assistance, in a coordinated way, to save lives at risk and satisfying the population's humanitarian needs. The Plan established scenarios for: 1. Floods that can be: local (the provincial plan is activated); Medium (the national plan is activated); and Exceptional (the national plan is activated, declaration of a state of emergency and request for international aid); 2. Droughts: activation of provincial and national plans, depending on the magnitude of the phenomenon.

The National Commission on Civil Protection prepared the Disaster Risk Management Strategic Plan with emphasis on Poverty Reduction, Adaptation to Climate Change and Institutional Development (2010-2014). The Strategic Plan is currently on an inter-ministerial consultation and discussion phase. It expands the range of the existing National Plan given that it includes Geological and Geotechnical Threats (including ravines and collapses), Technological and Anthropic Threats

(including plane and boating accidents, large fires and vulnerabilities related to population conglomerates next to industrial development spots, HIV/AIDS).

As far as risk management is concerned, the strategic plan proposes, among other things, the development of a scientific and territorial research and information program, connected to existing similar programs. Research is guided to aspects considered to be priorities by the National Commission, such as: the situation of rivers and basins responsible for floods; environmental degradation, climate change and adaptation possibility conditions through local risk management; and urban risk situations in the country's main cities. It also predicts: creation and development of an Integrated System of Information Management about risks, threats and disasters, the strengthening of threat monitoring and evaluation systems, with an emphasis on the intensification of the national hydro-meteorological network, and a process of introduction into the school curriculums of matters related to management of ongoing disasters. The strategic plan identifies the National Service on Civil Protection's territorial management program as a direct contribution to the process of adapting to climate change, given that territorial management and risk management are both direct and effective adaptation options. Implementing these actions requires a response capacity on the local institutional level. Awareness rising actions on this level ensure an appropriate response to emergency plans, in order to deal with extreme climate events, and facilitating the identification of other local vulnerabilities, so that adaptation programs can be developed.

9.8 – Synergies Related to the Three Rio Conventions

The three Rio conventions – Climate Change, Biodiversity and Combating Desertification – together provide an adequate platform for the promotion of sustainable development in the next decade. When it comes to implementation on a national level, there are several actions taken, by different players, on common domains, namely soil and water conservation, forestry, agriculture, coastal zones etc.

Analyzing the commitments made by ratifying all three conventions, it is evident that there is a need and opportunity for synergies that ensure the respect for those commitments and the country's sustainable development. If the idea is to make the best possible use of resources, it is possible to adopt an integrated approach in terms of joint realization of certain activities, in specific domains, such as: Information, Education and Communication; Investigation; Systematic Observation and Monitoring; Catastrophe Prevention and Management; Technological Transfer.

The resolution of inter-sectoral issues passes through the strengthening of joint activities between the Convention's Focal Points. In the case of Angola, the focal points of the three conventions are on the Ministry of the Environment, which facilitates the articulation and preparation/implementation of joint actions. For decision-making and implementation, it is important to create National Coordination Teams comprised of elements from other ministries/institutes, namely the ones that are members of the Technical Multi-sectorial Commission for the Environment (CTMA).

9.9 – General Considerations

The theme of climate change is still not a priority for Angola. In a time when the country is in full development, especially when it comes to infrastructure (roads, railroads, airports), urban planning and housing, agriculture and industry, this is the ideal opportunity to integrate climate change considerations with development models.

The preparation of the national communication allowed the creation of some climate change capabilities. However, limited resources and short-term awareness rising actions make it necessary to continue the awareness rising process.

In order to make crucial decisions, decision makers need reliable and understandable information. It is necessary, therefore, to strengthen capacities in investigating and publicizing information about variations and changes to the climate and related systems. In Angola, research institutions, in a limited way, develop activities related to climate change. It is necessary to deepen the contact between institutions that are dedicated to investigation and promote joint multi-disciplinary tasks, in order to generate integrated models that would allow the production of more complete scenarios, offering a scientific basis for the formulation of public policies in the country.

In relation to the Designated National Authority (DNA) and the Carbon Market, in 2010 and 2011 courses were developed about elementary concepts in the identification of CDM projects and preparation of the National Indicative Program (PIN), as well as for national and international evaluation of projects. The courses involved about 70 people, among them members of the DNA's technical commission, representatives from public and private companies, and from the Ministries.

A key aspect is the strengthening of synergies between the ministries and institutes, and between the central and provincial levels. Inter-institutional coordination and cooperation is crucial for information sharing, awareness rising and implementation of joint activities, necessary so that the country can respond to the climate change challenge. Besides, the government must promote participative management in order to prepare and implement public policy that is appropriate to the treatment of the theme.

Within each institution, it is necessary to strengthen human, technical and methodological capabilities. A good place to start are the institutions that comprise the Supervisory Committee, created to monitor the implementation of the National Climate Change Strategy, the institutions that participated in the preparation of the Initial National Communication, those that are part of the Designated National Authority and the CTMA. The awareness rising process then must continue to include civil society and private sector partners.

Strengthening institutional capacities is accomplished through the enhancement of human resources in different fields, be it in relation to climate change issues, be it through the introduction of improvements in the management of the current existing resources.

The continuous awareness rising of personnel in relation to institutional objectives will contribute to performance improvement both individually and institutionally. It should be emphasized that reaching increasingly higher levels of technical performance requires access to information technology and being able to operate it. Specific awareness rising actions must be designed taking into account and academic and professional profile of the human resources and aiming to increase the efficacy and efficiency of the exercise of different institutions' attributions and responsibilities.

Awareness rising priorities include:

- Strengthening the capacities of institutions involved in the effective implementation of the convention, including the preparation of national communications, so that they can truly participate in the Kyoto Protocol's processes;
- Strengthening capacities where they exist and creating them where necessary to ensure the sustainability of the reinforcement programs;
- Particularly strengthening the capacities of the Meteorology Institute, IIA, and IDF;
- Developing integrated programs of investigation and awareness creation;
- Creation of a systemized document database providing scientific support in relation to climate change to the Ministry of the Environment;
- Exchange of data and experiences between provinces;
- Encouraging organized civil society to travel abroad to share information concerning climate change;
- Improving the means and techniques of information sharing and creation of the necessary capacity for its evaluation.

The sustainability of institutional capacities requires policies that foster motivation and productivity in human resources. This because reinforcing the incentive measures can contribute to the attraction of more capable technical personnel and to the reduction of professional mobility. It is therefore necessary to combine human, material and financial resources, in order to improve conditions for the effective application of knowledge acquired by the institution's experts.

There are several international financial and technical mechanisms that can support the strengthening of capacities, which is also necessary for the mobilization of funds, preparation of project proposals and monitoring of their implementation. Knowledge needs to be reinforced to ensure an effective participation in the Clean Development Mechanism as well as other existing mechanisms. In the case of Angola, which possesses more financial capacity, it is important to remember that this type of initiative is accompanied by international technical assistance that can benefit Angola while strengthening the country's capacities.

However, an effort must be made to improve the climate change information system, through specific awareness raising actions and employing material, financial and human resources to ensure the country's development.

Chapter 10 – Information and Networking

In this day and age, it is becoming increasingly clear that climate change is a real problem, with the occurrence of severe climate events that tend to affect all countries societies and economies. The fight against poverty, the sustainable development of Angola and reaching the millennium development goals becomes affected by these events. These facts give us a clear indication that climate change is a development problem that needs to be addressed in an interdisciplinary way, exploring any synergies that may exist. The causes and consequences of global climate change are multiple, involving several areas, which require a systemic approach to the subject. Considering this approach, it is crucial that there is a constant exchange of information between these areas; on the contrary, we run the risk of making reductionist and misguided analysis.

10.1 – Information Exchange

Climate change coordination in Angola has sought to promote the exchange of technical, scientific, technological, socioeconomic and legal information related to climate change, as well as to the social, economic or political consequences of different response strategies, between several government institutions, the private sector and civil society organizations, as it has been demonstrated in previous chapters. This inter-sectoral cooperation aims, most of all, to mobilize different institutions towards the problem, so that all, within their sectoral programs, can plan and implement activities related to climate change into relevant policies and socioeconomic and environmental measures, minimizing negative effects on the economy, public health and quality of life of all Angolans.

The degree of complexity of the issues related to climate change and their interdisciplinary nature have caused the establishment of appropriate institutional arrangements to deal with these realities. One of the main examples of this is the Multi-sectoral Technical Commission for the Environment, created by the Ministry of the Environment and comprised of other institutions. It enables the full exchange of information as well as a network based work process, which allows the decision-making process to take place in a more informed and ample way.

Beyond these actions, Angola has sought, when it comes to climate change, to develop the following initiatives:

• Regional exchange within the Southern African Development Community (SADC);

• Cooperating with the Regional Climate Change Program (RCCP), and participating in its information system;

• At the African level, efforts have been made to cooperate with the Ministers of the Environment Committee (AMCEN) and the African Union, in terms of strategy implementation;

• Angola has sought to develop bilateral partnerships with several countries when it comes to aspects related to climate change.

10.2 - The Portuguese Speaking Expert Network on Climate Change (RELAC)

The Community of Portuguese Language Countries (CPLP) was formalized in 1996, with the goal of being a forum for political and diplomatic agreements; promoting active cooperation, supporting or framing actions from several areas of government and civil society activity; contributing to the promotion and expansion of the Portuguese language. The creation of the CPCL came to drive or frame governmental meetings, on the technical or ministerial levels, in several sectors.

Therefore, in the field of climate change, RELAC was created in 2005 with the goal of promoting cooperation in relation to climate change mitigation and adaptation, and encouraging the creation of closer ties between the governmental units that deal with these issues in each respective country. The countries involved in RELAC are the same that comprise CPCL: Angola, Brazil, Cape Verde, Guinea-Bissau, Mozambique, Portugal, São Tomé and Príncipe and East Timor.

Cooperation within RELAC, so far, has been mostly bilateral. Brazil is particularly engaged in building capabilities in Portuguese-speaking African countries, as well as East Timor, in relation to climate change issues. Several activities have been conducted so far in that regard, not only promoting training to support these countries in the preparation of their National Communications, but also in the establishment and functioning of their Designated National Authorities for the implementation of the Clean Development Mechanism.

Chapter 11 – Constraints, Gaps, and Financial, Technical Capacities

During the process of elaborating Angola's National Communication, a series of constraints and technical difficulties was registered, emphasizing the complexity of a project such as this.

When it comes to human resources, there were constraints related to the fact that some specifications of the National Communication, such as GHG Inventory, Vulnerability and Adaptation, as well as Mitigation, required the use of software not mastered by enough personnel. Another example is the fact that sometimes, within the same institution, there were different data about the same activity.

Another difficulty refers to the dispersion of data by many institutions. For example, for the energy sector alone, there is information dispersed between more than five institutions. The absence of an annual aggregated balance for the energy sector delayed in some respects the process of elaborating the GHG inventory and, as a

consequence, all other components were delayed as well, since the development of the chapters obeys an order of precedence.

Thus, the initial Angolan National Communication suggests a basic model for the creation of an energy balance, enclosed with this report, as a way of facilitating the preparation of subsequent GHG inventories.

The inexistence of data in a large portion of the institutions was a general constraint for all components of the national communication. In several institutions, information is based on estimations, which makes it difficult to prepare, for example, mitigation scenarios.

During the preparation of this process, it was possible to notice that at the higher levels of the institutions there is a spirit of cooperation and partnership, but at the technical level it still needs to be improved to ensure the success of future projects.

With the preparation of the Angolan National Communication, the foundation was laid for the sustainability of the country's national communication process, which will still require significant improvements, awareness rising and interaction with international institutions.

It is also important to deepen regional connections at the SADC level, in terms of harmonization of information and methodologies to be used on national communications, as well as the implementation of different regional projects. A large part of the models and researches developed on impact of climate change in the region doesn't include information pertaining to Angola.

There is still a limited understanding of and or/familiarization with the issue of climate change.

One of the great lessons learned from the preparation of this document that there is a magnitude of what still needs to be done to ensure the stable and continuous flow of information between the several institutions that operate within the country. It is important to emphasize this fact, since there is not enough data or the existing data are based on estimations made as a result of precepts that have already changed. Future reports must close these gaps.

As much as possible, the intention was to convey the most recent information, but it became apparent that the processing and storing of data in public institutions is still extremely deficient.

One of the main factors that contribute to this situation is the fact that the information is a result of projects executed by, or with funds from, international entities, which invariably leads to a termination of the flow of data once the project is completed.

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ANNEX

Glossary

Adaptation – In the context of climate change, it is defined by the Intergovernmental Panel on Climate Change as "adjustments in practices, processes and structures that can reduce or eliminate the destruction potential or the use of advantages and ooportunities created by climate change".

Accredited Independent Entity (AIE) – Entity accredited by JISC, which is responsible for determining if a project and the reduction of anthropogenic emissions by sources or the increase in removals by draining meet the requirements of Article 6 of the Kyoto Protocol and JI directives.

Additionality – A project is considered to be additional when it can't be implemented without the financing from carbon projects. To know if a project is additional, a list of criteria is used: the project's financial viability without carbon financing; what is predicted in the countries' legislations about these kinds of projects; what are the most common practices within countries in relation to environmental projects.

Afforestation and Reforestation Projects (A/R) – Direct anthropogenic activities for converting into forests non-forested areas or areas that have been deforested, through planting or promotion of natural regeneration.

Annex B Countries – Set of 39 countries committed to controlling their GHG emissions in the priod between 2008-2012, including OECD (Organization of Economic Cooperation and Development) countries, Central and Eastern Europe countries, the Russian Federation, and that are listed on the Annex B of the Kyoto Protocol.

Annex I Countries – On the Kyoto Protocol framework, there are 40 countries listed on the Annex I, that qualify as developed nations. Countries not included on Annex I are the ones that don't have biding objectives of emissions reductions established for the initial period (2008-2012) of the Kyoto Protocol. Even though it is possible that these countries already have GHG emissions reduction policies, the Kyoto Protocol does not recognize these as climate change commitments.

Anthropogenic – All that is generated by human action.

Assigned Amount (AA) and Assigned Amount Unit (AAU) – The GHG total that each country from Annex B can emit during the initial commitment period of the Kyoto Protocol (2008-2012). An Assigned Amount Unit (AAU) is a tradable unit that equals one ton of carbon dioxide equivalent (1 tCO_2e).

Attribution (Alocation) – Distribution of emission licenses by installations/sectors that emit GHG, enabling the establishment of a market for trading emission licenses. The allocation of licenses can be based on the use of historic data or benchmarking, and they can be distributed free of charge or in auctions.

Avoided Deforestation – It's the reduction in the deforestation rate of an area, so that the resulting deforestation is smaller than it would have been in a scenario without intervention to slow down the forest's conversion process.

Banking – Use of Kyoto Protocol units (AAUs, CERs, ERUs) from the initial commitment period in subsequent commitment periods (post-2012).

Baseline and Baseline Scenario (or Reference Scenario) – The baseline consists in a projection of GHG emissions in a business-as-usual scenario, many times referred to as baseline scenario or reference scenario, representing the expected emissions if reduction activities are not implemented.

Biomass – The woody mass (trunks, barks, branches and roots) of trees and bushes (alive or not) in a vegetation area.

Biomes – The great vegetal formations found in different continents, with characteristics that are related mainly to climate factors, such as temperature and humidity, and the latitude where it is located.

Cap and Trade – Trading system for emission licenses, where total emissions are fixed or limited. The Kyoto Protocol is a cap and trade system in the sense that emission from Annex I countries are fixed and excess units can be traded. However, cap and trade systems normally don't include mechanisms such as CDM, which allows the entry of new units into the system beyond the fixed limit.

Carbon Capture and Storage (CCS) – Process that consists in the separation of CO_2 from industrial, energy and transportation sources into a long-term storage location, where it is isolated from the atmosphere.

Carbon Dioxide (CO_2) – Chemical compound, it is a gas that exists in the atmosphere and one of the most frequent GHGs. CO_2 is also generated as a by-product of fossil fuel combustion or alterations in land use.

Carbon Dioxide Equivalent (CO_2e) – Unit used by the Kyoto Protocol. It is the concentration of CO_2 that generates the same environmental impact of other GHGs, such as, for example, methane or nitrous oxide. The amount of CO_2e of any GHG is the amount of CO2 that would produce the equivalent potential of global warming.

CDM Log – In the 13th Meeting, the Government Council nominated the UNFCCC Secretariat as CDM's log administrator. The secretariat operationalized a version of the log that, despite being capable of communicating with ITL, is temporarily operating as an isolated system, being used for CERs emitted from logged CDM projects.

Certified Emission Reductions (CERs) – Carbon credits generated through CDM projects.

Clean Development Mechanism (CDM) – Mechanism that allows the acquisition of carbon credits (CERs) through investment in and promotion of projects that aim to reduce GHG emissions in developing countries (non-Annex I).

Clean Development Mechanism Government Board (CDM-EB) – It is the UNFCCC entity that oversees CDM, being responsible for logging validated CDM projects, CERs issues and management of a series of technical panels and work group meetings (see Methodology Panel).

Community Independent Transaction Log (CITL) – Electronic program initiated

on January 1st 2005 in conformity with Directive 2003/87/CE, that underlines the need for a independent record of operations that logs emissions, transfers and cancelations of emissions licenses in the European Union.

Compliance – Situation when a country reaches the commitment stipulated in the Kyoto Protocol regarding GHG emissions.

Compliance Period – The Kyoto Protocol has a compliance period of five years, from the beginning of 2008 to the end of 2012.

Compliance Period Reserve – To avoid the excessive sale of Kyoto Protocol Units (AAUs, CERs, ERUs and/or RMUs), Annex I parties have always to maintain a determined minimum level of units in their log during the Protocol compliance period, called compliance period reserve.

Conference of the Parties (COP) – COP is the supreme entity of the UNFCCC, which has as a main goal to establish rules for the implementation of the Convention. It takes place, normally, once a year, on rotation in different parts of the world.

Credit Period – It is the time interval in which a project generates carbon credits, that shouldn't surpass the project's operational lifecycle. For CDM projects, the credit period consists of seven years, with a possibility of renewal twice, totalling 21 years at the most, or 10 years without the possibility of renewal. For JI projects, the credit period coincides with the Kyoto Protocol initial compliance period (2008-2012) and can be extended with the approval of the host country.

Deforestation – It is the removal of forests from the soil. It should be noted that forests are an important drainage system for carbon dioxide.

Degradation – Negative alteration in the environment.

Designated National Authority (DNA) – To implement a CDM project, the host country must nominate a Designated National Authority (DNA), which issues the Letter of Approval (LoA) necessary for the registration of the project with the UN.

Designated Operational Entity (DOE) – Entity created and appointed by the CDM Government Board (CDM-EB). Its role is to validate and require the registration of a proposed CDM project and also verify the emission reductions of a registered CDM project.

Determination – Process of independent evaluation of a JI project by an Accredited Independent Entity (AIE). AIE verifies the conformity of the project with Article 6 of the Kyoto Protocol and with the JI directives and validates emissions reductions.

Domestic Project – JI project developed without the participation of another Annex I country.

Double accounting – When the emission reduction units (carbon compensation or carbon credits) are counted on multiple objectives. This can happen when the same amount of carbon compensation or credits is sold to two or more entities.

Drainage – Carbon drainage refers to the removal of GHG from the atmosphere through soil management and forest activities. This removal can therefore be added to the GHG total a country is allowed to emit during the compliance period.

Emission – Instruction given by the CDM Government Board to the CDM log administrator to issue a determined amount of CERs of an activity project. The CERs issued stay on the pending account of the Government Board on the CDM log.

Emissions Reduction Purchase Agreement (ERPA) – Agreement that commits both parties (buyer and seller) in the future purchase and sale of emission reductions (CERs or ERUs).

Emission Reduction Units (ERUs) – Units obtained from JI projects.

Emissions Trade – The emissions trade is a mechanism of the Kyoto Protocol that allows the transfer of AAUs across international borders. The term is also used in the realm of the EU ETS, referring to the transfer of EUAs between companies encompassed by the Directive 2003/87/CE.

European Union Emission Trading Scheme (EU ETS) – Initial market instrument specifically designed by the EU in relation to climate change (independently from the Kyoto Protocol but with the same purpose). EU ETS was approved via the 2003/87/CE and predicts the trading of emission licenses within the European community by operators of certain installations that develop activities encompassed by the directive. The initial compliance period for EU ETS went from 2005 to 2007; subsequent periods were defined as five years (EU ETS's second period [2008-2012] coincides with the initial period of compliance of the Kyoto Protocol).

European Unit Allowance (EUA) – EUA is a tradable emission credit, which gives the industry that holds it the right to contaminate a metric ton of CO_2eq, following the rules of the EU ETS.

Flexible Mechanisms – Aid instruments with which Annex I countries can trade carbon credits and meet their GHG emissions reduction goals. There are three flexible mechanisms: Clean Development Mechanism, Emissions Trade and Joint Implementation.

Initial Period of Commitment – Refers to the period between 2008 and 2012.

Focal Point – Contact person within a country's administration that signed the UNFCCC.

Futures Contract – A contract traded in a futures exchange that requires the delivery of a specified quality and quantity of a certain assets in a certain month, if it is not liquidated before the contract expires.

Global Warming Potential (GWP) – GWP is the impact that GHG has on global warming. By definition, CO_2 is used as reference, having a GWP of 1. Since GWP changes with time, the IPCC has suggested a specific time interval of 100 years for comparisons, which are presented below:

Gas	**GWP**
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	150 – 11 700
Perfluorocarbons (PFCs)	6 500 – 9 200
Sulfur Hexafluoride (SF_6)	23 900

Greenhouse Gases (GHGs) – GHGs are residual gases that control energy flows into the Earth's atmosphere through the absorption of infrared radiation. Some GHG exist naturally in the atmosphere while others result from human activity. There are six GHGs encompassed by the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). CO_2 is the most important GHG that results from human activity.

Green Investment Scheme (GIS) – Green investment schemes aim to promote environmental effectiveness in AAUs transfers, through the use of revenues from the transfer in GHG reduction projects on the seller country.

Gold Standard – A methodology of good practices and a level of high quality carbon credits for regulated and voluntary markets. This standard is applied in CDM, joint implementation and voluntary projects, which have an elevated number of sustainable development credentials, required by CDM rules, and that also contribute to local sustainable development. The Gold Standard was developed in 2003 by a group of environmental NGOs that intended to develop high quality projects, paying special attention to sustainable development.

Host Country – Country where the CDM or JI project is physically located and that has to approve the project, so that the associated CERs or ERUs can be issued.

Intergovernmental Panel on Climate Change (IPCC) – The IPCC resulted from a joint action by the World Meteorology Organization (WMO) and the United Nations Environmental Program (UNEP) in 1988. It was started as an attempt to provide technical, scientific and socioeconomic information that is relevant to the understanding of climate change, its potential impact and adaptation options. It is open to all members of the United Nations and the WMO (www.ipcc.ch).

International Transaction Log (ITL) – Database designed to centralize and verify all international transactions of tradable units within the realm of the Kyoto Protocol and their conformity with the Protocol's policies.

JI Reserve – The National Allocation Plan for Emissions Trading for the period between 2008 and 2012 of a country that hosts or intends to host project activities predicted by the Protocol's flexibility mechanisms (CDM or JI) must establish a reserve of emission licenses, which shall be cancelled in the case of projects that would directly (projects in installations encompassed by the EU ETS) or indirectly (projects that affect the emissions of encompassed installations) lead to a double count of emission reductions.

JI Track 1 and Track 2 Projects – To host JI Track 1 (fast track) projects, the host country must comply with six eligibility requirements: a) by a Party in the Kyoto Protocol; b) having its assigned amount calculated; c) having in operation a national system to estimate emissions by sources/removals by drainage; d) having in operation a national logging system; e) having annually delivered the most recent emissions inventory, including the NIR (National Inventory Report) and the CRF (Common Reporting Format); and f) submitting supplementary information about the assigned amount. If all requirements are fulfilled, JI projects can be implemented through Track 1, which means that the emissions reduction and the project approval are put into effect according to the rules established by the country. If only requirements a), b) and d) are fulfilled, projects must be verified by Track 2. This verification procedure is put into effect under the tutelage of JISC and the emissions reduction must be verified by an AIE.

Joint Implementation (JI) – Mechanism that allows the trading of ERUs between Annex I countries (with a commitment inscribed on Annex B) through the investment and promotion of projects, in such a way that the generated emission reduction units are added to the investing country's quota and subtracted from the beneficiary's country quota.

Joint Implementation Supervisory Committee (JISC) – For projects of joint implementation that are subjected to the verification process under the tutelage of JISC (verification through Track 2 procedure), this entity oversees the verification procedures for the ERUs generated.

Kyoto Protocol – The Kyoto Protocol was established COP-3, which took place on December of 1997, in Kyoto, Japan. This instrument specifies obligations in terms of GHG emissions for Annex B countries and defines three flexibility mechanisms that the countries can use to meet these obligations: Clean Development Mechanism (CDM); Joint Implementation (JI) and Emissions Trading. Russia's ratification, in 2004, allowed the Protocol to come into effect on February 16th 2005, making it biding for the signatory countries.

Land Use, Land Use Change and Forestry (LULUCF) – The Land Use, Land Use Change and Forestry sector was included in the Kyoto Protocol so that these anthropogenic activities that influence the amount of GHG in the atmosphere would be taken into consideration.

Leakage – Reduction or increase of GHG outside of the border that has been defined to calculate the reduction of emissions resulting from a project activity.

Letter of Endorsement (LoE) – Document that confirms to the proponent of the project that the host country will support the development of the project activity that the proponent intends to submit to CDM or JI.

Letter of Approval (LoA) – Document that establishes the formal approval of an activity as a CDM or JI project to be prepared by one of the countries involved.

Linking Directive – Directive 2004/01/CE, generally designated Linking Directive, provides EU ETS operators with the possibility to use emission credits generated through project activities eligible via the Kyoto Protocol to comply with their emission limits.

Logging – Logging is the formal acceptance of a project activity (validated by a DOE) as a CDM project by the Government Board. Logging is a pre-requisite for the verification, certification and credit emission of a certain project.

Long-term Ceritified Emission Reductions (ICERs) – Credits issued for an afforestation or reforestation project that expire at the end of the project's credit period. L CERs are issued for the liquid increase of carbon stocks that have occurred since the last verification.

Marrakech Agreement – The Marrakech Agreements, adopted in 2005 at the 1st Conference of the Parties, during the meeting of the Kyoto Protocol Parties (COP/MOP-1) in Montreal, Canada, allowed for the full operationalization of the Kyoto Protocol, since they established the formal aspects to which the projects from flexibilization mechanisms must adhere.

Meeting of the Parties (MOP) – MOP is the supreme entity of the Kyoto Protocol. The initial MOP happened in December 2005, in Montreal, Canada, during COP-11.

Memorandum of Understanding (MoU) – A bilateral agreement between two parties, which formally recognizes a joint desire to reach goals in partnership or, ultimately, to conclude a specific agreement. It may or may not define sanctions, depending on the construction moulds. MoUs between investing country and host country are sometimes used as a basis for CDM and JI projects.

Methodology Panel – The Methodology Panel was established to develop recommendations for the Government Board in relation to methods for determining the baselines and monitoring plans, including directives for the application of existing methodologies or commentary about newly submitted methodologies.

Mitigation – All kinds of human intervention directed at reducing GHG emissions, in order to reach the central goal of the UNFCCC and the Kyoto Protocol, which is the stabilization of these gases in the atmosphere in a level that avoids dangerous human interference on the climate.

Monitoring – Collection and organization of all relevant data to determine the emissions reduction caused by a project activity, namely the data necessary to determine the baseline, measure GHG emissions resulting from the activity and defining the leakage (when applicable).

National Allocation Plan for Emission Trading – Document prepared within each member state that specifies an amount of emission licenses to be attributed (total or by installation) within the realm of EU ETS in a determined period.

Non-Annex I Countries – UNFCCC's Annex I lists the Convention's signatory countries that have committed to reduce their 2000 emissions to their 1990 levels.

Non-Annex I countries are developing countries, which don't' have emission reduction goals.

Permanence – A criterion for quality compensation that certifies the durability and irreversibility of the emissions reduction generated by a compensation project.

Project Design Document (PDD) – It is the project activities report, where all points, characteristics and contributions to GHG emissions reductions are included. PDD is prepared on the initial phase of a CDM project's cycle.

Project Idea Note (PIN) – Summarized form that describes the project (in about six pages), providing basic information such as type of project, dimension, location and emissions reduction estimative.

Purchase Option – An option that gives the holder or buyer the right, but not the obligation, to purchase, at a previously accorded price and within a determined period of time, a specific asset. The seller has the obligation to sell the asset if the buyer or holder chooses to exercise the option.

REDD+ – It is REDD (Reducing Emissions from Deforestation and Degradation), including the role of conservation, sustainable management of forests and increase of carbon stocks in forests in developing countries.

Removal Units (RMUs) – A RMU is a unit of removal issued for activities related to land use, change of land use and forestry and it is equal to one metric ton of carbon dioxide equivalent. RMUs can't be used in compliance periods subsequent to the initial compliance period of the Kyoto Protocol.

Rio 92 or Eco 92 – UN Conference on Environment and Development, held in June of 1992, in Rio de Janeiro, Brazil, with the participation of more than 180 countries. It was at Rio-92 that the UNFCCC was opened to signatures.

Sale Option – An option that gives the holder or buyer the right, but not the obligation, to sell, at a previously accorded price and within a determined period of time, a specific asset. The seller has the obligation to buy the asset if the buyer or holder chooses to exercise the option.

Small-scale CDM Projects – Small-scale CDM projects are subjected to a more simplified verification process, for being associated with smaller reductions. Fit into the small-scale category renewable energy projects with power of less than 15MW or energy efficiency projects that reduce energy consumption by up to 15 GWh per year, for example.

Spot Market – A market where deals are made with the assumption of immediate or almost immediate liquidation (normally two business days after the transaction).

Temporary Certified Emission Reductions (tCERs) – Credits issued for an afforestation or reforestation project that expire at the end of the compliance period subsequent to that when the credits were issued. tCERs are issued for the liquid increase of carbon stocks that has occurred since the beginning of the project.

United Nations Framework Convention on Climate Change (UNFCCC) – Established at Rio-92, it came into effect in 1994. Its main goal is the "stabilization of

the GHG concentrations in the atmosphere in a level that avoids a dangerous human interference over the climate".

Verification – For the emissions reduction of a CDM project to be considered valid, a Designated Operational Entity (DOE) has to confirm that the claimed emission reduction has actually happened.

Verified Emission Reductions (VERs) – VERs are emission reductions generated by small-scale projects that are evaluated and verified by organizations and not through UNFCCC.

Voluntary Carbon Standard (VCS) – Quality standard for the voluntary compensation of carbon. Having as a base the Kyoto Protocol and the Clean Development Mechanism, VCS establishes criteria for the validation, measurement and control of emission compensation projects.

Voluntary Market – Voluntary markets for emission reductions encompass VERs buyers and sellers that aim to manage their GHG emissions without the need of legal or regulatory motivations.

Vulnerability – In the context of climate change, vulnerability is defined as the degree to which a natural or social system is capable of dealing with the damage resulting from climate change. It is, therefore, an indicator of a system's sensitivity to these changes and its ability to adapt to them. In other words, the ability to respond to positive and negative effects of climate change, as well as how much the adjustments made to day-to-day practices, processes and structures are capable of moderating or eliminating the destruction potential, or even seizing opportunities created by global climate change.