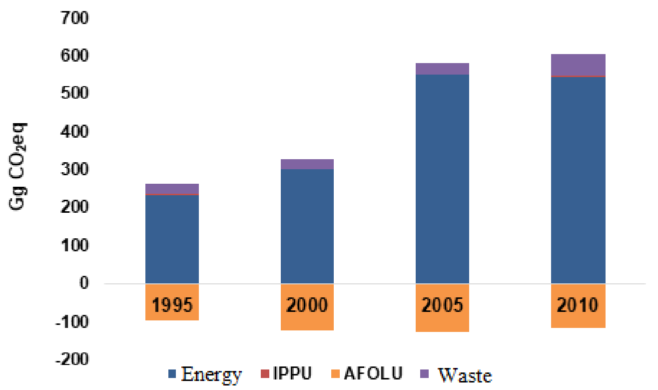
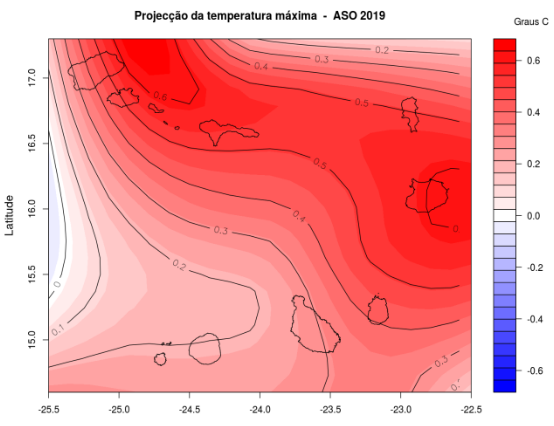
REPUBLIC OF CABO VERDE

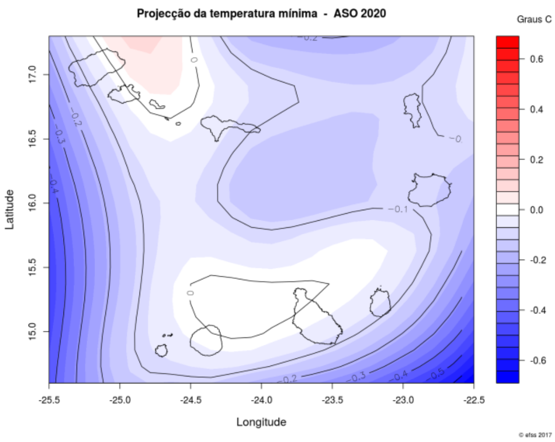
THIRD NATIONAL COMMUNICATION ON CLIMATE CHANGE

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE



Evolution of CO_{2eq} Emissions and Removals by sector, 1995-2010





MINISTRY OF AGRICULTURE AND ENVIRONMENT

NATIONAL INSTITUTE OF METEOROLOGY AND GEOPHYSICS

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FOREWORD

The global warming of the Planet is mainly a result of the increase of the greenhouse gases effects (GHG) generated from human activity and comprises the main cause of climate change. We are facing a phenomenon of unpredictable consequences for nature and humanity, whose fight call for due and a strong political commitment from all the countries in the world. Cabo Verde ratified the **United Nations Framework Convention on Climate Change** (UNFCCC) since 1994, through the Resolution Nº 72/IV/94, and under the commitments, it has assumed as a contracting party it presents this Third National Communication.

It is a document, which updates the national GHGs inventory and reports in detailed and informed manner the country´s progress in the implementation of measures to reduce climate changes impacts. It considers the making of new knowledge in the fields of impacts, risks and vulnerabilities, produced through studies, important inputs for the national plan on adaptation and mitigation of climate change effects and, in the fulfillment of new obligations that the country assumed with the ratification of the Paris Agreement.

The Government of Cabo Verde attaches great importance to this problem. After all, our small island state contributes very little to global warming, but it pays a very large bill. Among its consequences, it is increasingly exposed to climatic aridity and the risk of degradation of ecosystems (especially coastal ecosystems) and is subject to increasingly frequent extreme weather and climatic events (hot and cold waves, droughts, floods, among others).

Adapting to this situation, which poses a serious threat to the environment, economy and development process, and strengthening the country's resilience to these extreme phenomena, is one of the great national priorities, mirrored in both the Governance Program of the IX Legislature (2016-2021), as in the Strategic Plan for Sustainable Development (2017-2021) and other strategic sectoral planning instruments. With regard to initiatives to reduce emissions, it is important to highlight the goals to achieve in the field of renewable energy use and afforestation actions, as reflected in the document on Nationally Determined Intentional Contribution (INDC) recently submitted to the UNFCCC.

I am convinced that the presentation of this Third National Communication to the UNFCCC will contribute to the consolidation of policies, strategies and actions aimed at reducing the emission of greenhouse gases. The Third National Communication will certainly be the target of dissemination and ownership by all parties involved with this cause. The task is huge, after all, but no one should be left out.

Gilberto Silva, PH. D
Minister of Agriculture and Environment of Cabo Verde

CABO VERDE'S
THIRD NATIONAL COMMUNICATION
REPORT TO UNFCCC

TECHNICAL SHEET

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EXECUTIVE SUMMARY

Recognizing the importance of the topic and the need for solutions, on March, 29 1995 Cabo Verde ratified the United Nations Framework Convention on Climate Change (UNFCCC). Since then, the country, as a contracting party to the Convention, has undertaken to develop, among other documents to be requested, the National Communication to the Conference of the Parties (COP), where it reports on the national circumstances in which the country evolves in terms of concrete action in climate change context.

- Thus, over the period, with funding from GEF / UNDP, the Government of Cabo Verde and other development partners, the country has developed and implemented projects and programs under this issue, such as:
- First and second National Communications to the UNFCCC (2000 and 2010)
- National Strategy and Plan of Action on Climate Change (2000)
- First and Second National Inventories of Greenhouse Gas Emissions and Removals (2000 and 2010)
- National Program of Action for Adaptation to Climate Change (NAPA, 2007)
- NAPA-Follow-Up Project, to implement adaptation measures of the Water Resources sector
- Clean Development Mechanism (CDM) Project (2012)
- Low Carbon and Resilient Development Strategy (2015)
- Intended Nationally Determined Contribution (INDC, 2015) for the 2015/2030 horizon
- Signed and ratified the Paris Agreement through the National Assembly with the approval of Resolution 35 / IX / 2017, of May 12. Acceptance of ratification of the Paris Agreement by the UNFCCC secretariat on April 22, 2016 which entered into force on October 21, 2017.

For better follow-up on climate change issues, through Resolution No. 16/2009 of 2 June, Cabo Verde created the Multiministerial Committee on Climate Change, which also functions as the Designated National Authority, with the purpose of articulating governmental actions resulting from the United Nations Framework Convention on Climate Change, the Kyoto Protocol and its subsidiary bodies of which Cabo Verde is a party.
In view of the new ambitions and instruments developed within the UNFCCC framework, the Government of Cabo Verde is preparing and aligning the tools required for better monitoring and actions that allow it to access the Funds and Programs created to ensure countries sustainability in climate change context.

This Third National Communication on Climate Change, which reports the national circumstances on the evolution of the country in relation to Climate Change related issues is developed according to the following chapters:

- **National circumstances**

Cabo Verde archipelago is located between the Equator and the Tropic of Cancer, between parallels 17º 12' and 14º 48' North latitude and meridians and 22º 44' and 25° 22' west longitude. The country consists of 10 islands, nine of which are inhabited, and several uninhabited islets, divided into two groups by their location relative to the prevailing winds- the Barlavento (windward) group to the north, consisting from west to east of the islands of Santo Antao, Sao Vicente, Santa Luzia (uninhabited), São Nicolau, Sal and Boa Vista, and the Sotavento (leeward) group to the south, consisting from the east to the west of the islands of Maio, Santiago, Fogo and Brava.

The climate in the Cabo Verde Archipelago is considered mild and strongly influenced, in terms of temperature, by the cold Canarian current. The archipelago is, throughout the year, under the influence of the Azores anticyclone. In the summer, Cabo Verde is particularly affected by convective systems associated with eastward undulating disturbances, which provide moisture penetration, especially between the months of July and October, when precipitation usually occurs over the islands. Cabo Verde is located in a region where the variability of the Azores subtropical acts as regulatory factor of the anomalies of rainfall, by controlling the seasonal oscillation characteristics of the trade winds of maritime and continental features during the dry months (November to June). In the rainy season (July to October), there is the oscillatory movement of the ITCZ, characterized by southeast winds and disturbances from the east. Between December and February, the islands are affected by air masses from extra-tropical latitudes. The climate is classified as dry sub-tropical.

Annual temperatures indicate low temperature range. The average annual temperature is around 25ºC for coastal areas, reaching 19ºC in areas with 1,000 meter altitudes. The minimum values between 20ºC and 21ºC, correspond to January to April, and the maximum values of 26ºC to 28ºC are recorded in August-September. The monthly lowest temperature is usually recorded between December and February and differs from one island to another.

Of volcanic origin, the islands generally have quite uneven topography, with steep, deep and ramified valleys. However, the eastern islands (Sal, Boavista and Maio) have similar topographies, with predominantly flat areas from where isolated erosive volcanic cones raise.

The land is generally hilly, especially in younger islands, including the islands of Fogo, Santiago, Santo Antão and S. Nicolau, and relatively flat in the older islands namely Sal, Boavista and Maio, culminating in very high altitudes (2,829 m Fogo, S. Antão 1,979 m, Santiago 1,395 m, São Nicolau, 1,340 m.

Dimensions and configurations of the topography are different from one island to another resulting in their wide-ranging landscapes. These settings highlight the following features: vast flat and wavy areas, slopes, valleys, mountains on high altitude islands and mountains and hills (typical volcanic cones).

The highest point in Cabo Verde is located on the Fogo Island (2,829m), at the top of the Fogo Volcano. The volcano is still active and it last erupted from 11/23/ 2014 to 02/08/2015.

Of 4,033 km^2 making up the country, approximately 41,000 hectares is arable land; currently 36,000 ha is cultivated (V Agriculture Census, 2015), indicating a 1.9% reduction in cultivated land compared to 2004 (MAA, 2017). Therefore, soil resources are extremely limited.

Of arable land, more than 90% is dedicated to rainfed or dryland, while a little more than 5% is used for irrigated agriculture. About 23% of the country's surface is reforested. It should be noted that the highest proportion of arable soils is located in semi-arid and arid areas (MDR, 2013).

Soils are mostly of volcanic origin, developed on basaltic substrate of coarse to medium texture, hilly, rich in mineral elements, but poor in organic matter (& lt; 2%) and shallow, showing significant signs of degradation. Although they are naturally fertile due to their volcanic origin, fertility has been decreasing over time due to water erosion, weak vegetation soil and continuous use without proper replenishment of nutrients extracted by crops.

It should also be noted that most of the crop residues are used as fodder and fuel. Deeper soil with higher organic matter content can be found in less marked slope lands. In the bottom of the valleys or streams predominate the alluvial soils that are used for irrigated agriculture.
Poor plant coverage, low organic matter, steep slopes and heavy rains make soil prone to water erosion and susceptible to degradation.

In Cabo Verde, water is one of the resources by which the population will recognize the effects of climate change, considering the likely changes in rainfall models and the consequent water availability. There is a well-marked seasonality with dry and rainy seasons in the country, so that at the end of the dry period caudal, underground and surface water can be observed well below the average and even absence of water in some sources.

Groundwater is among the most important natural resources. The increasing use of groundwater, the reduction of potable water and the consequent demand, salt water intrusion and contamination of coastal aquifers have become one of the most disturbing problems in the management of groundwater resources, since they are considered strategic reservoirs.

Climate change is taking place at an accelerating pace, with increasing social, environmental, economic and political vulnerability. Uncertainty and risk continue to persist as preponderant systemic variables that condition decision-making processes and make sustainable management of water resources the focus of the entities.

Cabo Verde, in general, has a reduced supply of water and this natural resource is distributed in a heterogeneous way in the national territory and has different origins. Among freshwater sources, ground water and surface water resources stand out. Other sources of water may also be evaluated, such as the desalination of brackish or sea waters and the reuse of wastewater in some municipalities for irrigation.

In order to determine the volume of water needed to meet growing consumption demand, the National Strategic Plan for Water and Sanitation (PLENAS) was intended to supply 40l/inhab/day with fountain and 90l / hab / day in home connections to the public network.

The evaluation of the water availability, as shown in this paper, is fundamental for the establishment of Water Resources Plans, which will allow to make compatible the consumptive and non-consumptive uses, licensed or not, for the different islands.
On the islands of Santiago, Santo Antão, Fogo and São Nicolau, agricultural activity is practiced on a larger scale, which restrains groundwater availability.

Despite being a small island state, with poor and ecologically fragile natural resources, Cabo Verde hosts a wide range of ecosystems, according to topographic and climatic diversity. Natural vegetation is rare, especially in arid and low regions. However, during the rainy season, the atmosphere changes completely with the appearance of herbaceous plants that cover altitude areas. These characteristics have determined the modes of occupation and the actual use of space by local communities, making the archipelago to face economic, social and environmental vulnerabilities, posing critical challenges to the country and population.

Cabo Verde has a relatively rich biodiversity, with more than 5000 species identified in both terrestrial and marine environments (Arechavaleta, et al, 2005), typical of tropical regions, usually characterized by very diverse populations but of relatively low abundance.

The natural characteristics of the archipelago make its biodiversity important in all its aspects - genetic, specific, taxonomic, ecological and functional. In addition to the ecological importance, biodiversity represents the support of all economic activity, with emphasis on (i) agriculture, forestry and livestock; (ii) fishing; (iii) beach and beach tourism; (iv) water sports, recreation and leisure, and (v) ecotourism / nature tourism (MAHOT, 2014).

According to data from the National Institute of Statistics (INE) on demographic projections from 2010 to 2030, the population of Cabo Verde, in the period 2012-2016, grew at a rate of 1.23%. In 2016, 531,239 residents were estimated, with an increase of 6,406 inhabitants, compared to 2015.

The analysis by municipality indicates that Praia and São Vicente present a higher concentration of the population, representing, in 2015, 28.9% and 15.4% of the total, respectively. The lowest concentrations of the population were registered in the Municipalities of Tarrafal de S. Nicolau (1%) and Santa Catarina do Fogo (1.1%), see table 2, Resident Population in Cabo Verde by Municipality (2012-2016). Statistical Yearbook, 2016 (AECV.2016).

The natural growth rate declined from 1.5% in 2012 to 1.3% in 2016. As regards the annual average growth rate (TCMA), it maintained the same value (1.2%) registered in 2015.
In 2016, the average life expectancy for men was 71.8 years, while for women it was 80.0 years, pointing to an average age difference of 8.2 years.

According to the 2016 Statistical Yearbook, the average age of the Cabo Verdean population has been around 27 years, from 2012 to 2014, reaching the average value of 28 years in 2015 and a slight increase (28.3) in 2016. At municipality level, it was noted that, in 2016, the municipality of Santa Cruz appears with the lowest average age (26.2 years), while Ribeira Grande de Santo Antão presents the highest (32.9 years).

The Total Dependency Ratio has been steadily declining from 2012 to 2016, mainly due to the significant number of working-age men and women, compared to the population of children and the elderly. In 2012, this indicator was 57.7% and dropped to 52.6% in 2016.

For the Youth and the Elderly Dependency Ratio, the observed behavior has been similar to the Total Dependency Ratio, that is, both have been decreasing in the period under analysis (AECV.2016).

Particularly on the reality of Cabo Verde, statistical data point to a country where the population is expanding, with the resident population going from 531,239 inhabitants in 2016 to 621,141 inhabitants in 2030, a scenario that presents opportunities and challenges. (AECV.2016).

According to the Cabo Verde 2016 Statistical Yearbook, the percentage of the population that never attended school dropped by 4.6 percentage points between 2010 and 2014. In 2014 only 8.3% of the population declared that they had never attended school. Similar results can be found in terms of the percentage of the population that is attending primary, secondary and higher education, for in 2014 the figures indicate that the population attending basic education increased by 3.3 percentage points, as well as the population to attend secondary and higher education, with increases of 7.6 and 3.7 percentage points from 2010 to 2014, respectively. Pre-school enrollment declined from 4.6% in 2010 to 3.4% in 2014.

Cabo Verde is an island country with few natural and financial resources, with a high external energy dependence, both for energy production and transportation, since it needs to import the most used fuels, namely petroleum products and their derivatives.
Cabo Verde does not possess primary fossil resources and on the other hand it does not register secondary energy exports.

Biomass consumption is mainly focused on firewood in rural areas and outskirts of cities for food preparation. Renewable energy, namely wind and solar, which essentially for electricity generation, given that thermal solar power does not have an expression in the Cabo Verde energy matrix, according to the National Directorate of Energy, Industry and Commerce, in 2016 accounted for near 20% of the energy injected into the national electricity grid. With respect to electrical energy, the vast majority are produced from thermal power plants using diesel and fuel oil (fuel 180 and 380).

From the energy point of view, the islands of Cabo Verde are linked by independent systems, characterized by their small size and the distance from the centers of supply. Moreover, the lack of conventional energy resources causes a strong dependence on energy from abroad.

Electricity (domestic consumption) and fuel (aircraft, water desalination) are energy products that are increasingly important for the socio-economic development of the country.

The energy sector in Cabo Verde is characterized by the consumption of fossil fuel (derived from petroleum), biomass (firewood) and the use of renewable energy, namely wind energy. Fossil fuel consumption consists of petroleum derivatives, namely: gasoline, diesel, fuel oil, jet al, butane gas and lubricants.
By 2010, the use of solar energy was practically insignificant, practically limiting to water pumping. Cabo Verde re-exports a portion of imported fossil fuels (Jet A1 for aviation and diesel for maritime transport), but a large portion for domestic consumption, mainly for transport and electricity generation and desalinated water.

Regular supply of electricity on the islands was provided only from late 2012, with the start-up of solar and wind farms on the islands of stronger economic power (Santiago, Boavista, Sal and São Vicente). The electro-producing park in Cabo Verde is essentially characterized by the great installed thermal power.

- **GHG inventory**

Cabo Verde has already presented the first and second Inventories, based on 1995 and 2000 years, respectively. In this National Communication, the country presents its third inventory, as per Decision 17/CP.8 of Climate Change Convention and IPCC methodological guidelines for the Preparation of National Communications of Countries Not Listed in Annex I to the, namely those of 2006, and in the Energy sector and in some IPPU categories 1996 guidelines for non-CO_2 gases were used.

Total GHG emissions and anthropogenic GHG removals in the country in 2005 were estimated at 297.40 Gg CO_2, 4.50 Gg CH_4, 0.19 Gg N_2O and 0.59 t HFC-134a. In 2010, total CO_2 emissions totaled 292.84 Gg, corresponding to a decrease of 1.54% against 2005. Total emissions of CH_4 and N_2O increased by 26.76% (5.71 Gg) and 17.18 % (0.23 Gg), respectively. HFC-134a had an increase of 225,45% in 2010 compared to 2005 and was estimated at 1.90 t HFC-134a.

In 2005 total emissions were estimated at 452,54 Gg CO_{2eq} and in 2010 emissions totaled 485,26 Gg $CO_{2eq.}$ In 2005, each inhabitant in Cabo Verde produced approximately 0,98 t CO_{2eq}/inhabitant, increasing by 1.02% in 2010, to 0.99 t 0,99 t CO_{2eq}/inhabitant.

Indirect greenhouse gas emissions were calculated as well. In 2005, they were estimated at 4.09 Gg NOx, 36.66 Gg CO and 3.68 Gg NMVOC. For the year 2010, NOx and CO emissions decreased by 11.41% and 11.16% respectively compared to 2005, and were estimated to be 3.6 Gg NOx and 32.57 Gg CO. Emissions due to NMVOC in 2010 increased by 9.46% compared to 2005, estimated at 3,6 Gg NOx and 32,57 Gg CO. Emissions due to NMVOC in 2010 increased by 9.46% compared to 2005, with 4.03 Gg. The NOx and CO gases were estimated in the AFOLU sector mainly due to the burning of agricultural waste and also in the energy sector, in addition to the NMVOC, by the burning of fossil fuels. In the IPPU sector, the NMVOC were also estimated.

Regarding the evolution of GHG emissions and removals in Cabo Verde between 1995 and 2010 by sectors listed, the Energy sector has contributed most to total emissions, reaching 548.60 Gg of CO_2 eq in 2005, the highest value of the series listed. In 2010, emissions decreased by 1.17% compared to 2005.

In terms of CO_2 emissions and removals, the Energy sector in 2005 and 2010 accounted for 533.87 Gg CO_2 and 528.35 Gg CO_2 respectively, of total gross CO_2 emissions in Cabo Verde. The AFOLU sector, more specifically Forestry, in 2005 and 2010 contributed to the net removal of CO_2, being in 2005 -237.29 Gg CO_2 and in 2010 -236.69 Gg CO_2, corresponding to a decrease of 0, 25% in 2010 relative to 2005.

In 2005, the transport subsector accounted for 55.19% of total CO_2 emissions in the energy sector, followed by the Energy Industries subsector with 32.97%. In 2010, the Sub-Sector Energy Industries accounted for 44.98% of total CO_2 emissions in the energy sector and transport accounted for 40.80% of total CO_2 emissions in this sector. The transport sub-sector decreased by 26.83% of total CO_2 emissions compared to 2005, due mainly to the reduction in the number of domestic flights in Cabo Verde.

- **Ability to reduce GHG emissions**

Cabo Verde has a great potential for Renewable Energy (RE), and in 2010 focus was heavily put on the production of electricity using renewable sources, namely solar and wind energy, currently (2017) with a contribution of around 20% penetration of RE in the electricity network.

As such, renewable energy is the opportunity for Cabo Verde to solve, in a structural way, energy sector related problems, reducing energy costs and prices, minimizing uncertainty and exposure to international fuel prices. The lower costs will allow the implementation of a set of active policies to reduce losses, ensuring that the cost of energy is shared by all who benefit from it, while safeguarding those with the weakest economic conditions.

With the constant technology innovation, there are numerous new ways of producing clean and renewable energy. Some of these new forms are already used in Cabo Verde. Due to limitations in economic, financial and endogenous resources, it almost obliges the country to invest in solar and wind technologies.

The proposed mitigation strategies are intended to contribute to efforts made by the international community to combat climate change in a context of sustainable development.

The methodology used focused on preliminary research on benefits, on the definition of projections, identification of the various partners relevant to the viability of the projects identified and on the approach taken to evaluate mitigation measures.

In general, for the energy production sector, according to the Strategic Plan for Renewable Energy Sector (PESER), Resolution No. 7/2012, of February 3, 2012, near 500 MW were identified for priority projects as part of the national mitigation action plan and were the subject of preliminary studies to evaluate emissions avoided, estimate the investment required.

As the main guidelines of the energy sector for mitigation Cabo Verde should implement a proactive energy strategy that promotes the country's transition to renewable energy and creates energy efficiency through the main energy-consuming sectors in the economy (residential, transportation, industry and tourism). In order to support this energy strategy, financial mechanisms should be created to stimulate private sector involvement and facilitate the establishment of public private partnerships.

The commitment of the government and the public institutions (AER, ECREEE, CERMI, IEFP and Technical and Professional Schools of the country) and private institutions that were created to support the energetic vision of Cabo Verde, is to stimulate the development of projects in the priority areas of energy, economically feasible and technically possible, in accordance with the Program of the Government of the IX Legislature.

- **Climate change vulnerability, adaptation and impacts**

Cabo Verde is located in a region where the variability of the Azores subtropical acts as regulatory factor of the anomalies of rainfall, by controlling the seasonal oscillation characteristics of the trade winds of maritime and continental features during the dry months (November to June). In the rainy season (July to October), there is the oscillatory movement of the ITCZ, characterized by southeast winds and disturbances from the east. Between December and February, the islands are affected by air masses from extra-tropical latitudes.

Cabo Verde archipelago are conditioned by the location and intensity of the action centers, most of them located in the Atlantic, namely four systems considered, such as the subtropical anticyclone of the Azores, low equatorial pressures, the Canarian sea current and thermal depression on the African continent during the summer. The region of the sub-tropical anticyclones is characterized by high pressures, divergence and subsidence in the air circulation. Its orientation and location influence and characterize the air masses that penetrate the Cabo Verde region throughout the year.

At altitude, the circulation is dominated by the East flow, with maximum intensity values conditioned by the location of East African (JAL) and East Tropical (JET) jets, according to Hall etal (2006). Located at the 600 hPa level, with maximum velocities of 10 m/s between 10° N and 15° N, JAL is the result of heat sinking by thermal depression, while JET, which is located at 200 hPa south-lagged to the equator, is fed by deep convection (Mohr and Thorncroft, 2006). This dynamics of seasonal circulation on the West African coast with the consequent southern movement of the ITCZ marks the rhythm of the pluviometry regime on the west coast of Africa and, consequently, on the Cabo Verde region.

The analysis of the archipelago climate variability was based on more complete chronological series of meteorological observations, with the concern of trying to detect any trend of pushing away significantly from the climatological normal. The series of the Mindelo, Sal and Praia stations were used, corresponding to the air temperature and amount of precipitation for the period from 1960 to 2015. We also analyzed the way the series behave over time. Assessments of other parameters such as wind, relative humidity and cloudiness were also made.

The variation of the extreme temperatures (maximum and minimum) has the same behavior as the average temperature, with an increasing trend since 1995. Although the variation of the minimum temperature is less pronounced than the maximum temperature, in the last five years this growth has slowed down.

This increase trend also occurs in seasonal variation with more evidence in the hot seasons, during the months of June, July and August (JJA) and September, October and November (SON), while in the colder seasons, this increase is less pronounced.

The lowest variability occurs in the JAS and OND periods. Given that the JAS quarter is warmer, it does not suffer the influence of cold air masses and there is an increase of rainfall, which acts as a thermal regulator factor. The positive anomalies observed since 1995 indicate that the average monthly temperature during the last years reached an average value of 0.4ºC above the 1960-1990 climatological normal.

The accumulated rainfall during this period reaches average values between 150-300 mm in wet years. In drier years the rainfall usually does not exceed 100 mm. In general, this precipitation is concentrated in the month of September. The less humid period, from November to February, sometimes shows weak precipitation, with greater expression for the islands of Barlavento, reaching sporadically values of up to 50 mm.

The impacts of climate variability can occur on agricultural productivity, which has shown significant sensitivity to the interannual change in rainfall, including the start and end dates of the rainy season. Thus, yields can be significantly affected by the negative, dry anomalies, which will have serious implications on the country's economy. On the other hand, the reverse happens with positive rainfall anomalies. Pest outbreaks and movement may be conditioned by temperature and precipitation variability. The same can be said for the health sector, with the spread of diseases related to regional climate variability. In this case the problem has to be addressed regionally.

Adaptation assessment is considered to be the assessment of the ability of particular systems and groups to adapt to specific constraints.
In view of the relatively recent timeframe of the more critical advent of this issue, an evaluation has not been carried out in this document, but rather an analysis of a set of measures implemented (torrential correction works, conservation of soil and water, afforestation, among others) to cope with adverse weather and climatic conditions.

Thus, over the years and particularly in the post-independence period, in the face of the adverse effects of climate variability, the adaptation measures implemented by the populations and successive governments aimed above all at creating conditions to ensure the minimum existence in terms of availability in water and food security, in the face of years with weak agricultural production.

Although an extensive impact assessment of all implemented measures has not yet been made, its positive effects are seen both from the point of view of environmental and landscape changes and from the socio-economic point of view.

Overall, the National Adaptation Strategy for Climate Change aims to increase resilience and create the necessary national resilience in the face of climate change and variability and in order to achieve the development goals set under the different programs and strategic sector plans with a view to introducing actions that, in the long term, aim to reduce GHG emissions.

After the vulnerability assessment related to different parameter behavior and their respective impacts conducted through sector vulnerability and adaptation studies and shared with stakeholders, a set of adaptation measures were proposed to all the sectors that have been subject to vulnerability analysis - Water Resources, Agriculture, Forestry and Grazing Livestock, Coastal Areas/Tourism, Biodiversity, Fisheries, Energy/Industry and Health and main characteristics of which are highlighted below.

- **Country organization on climate change issues**

The Government Program for the IX Legislature (2016-2021) and the Strategic Plan for Sustainable Development (2017-2021) have chosen climate change as the center of internal concern, involving regional entities and United Nations specialized agencies.

To better follow up on the process, the country defined cross-cutting strategies and presented plans of significant relevance, which are materialized in the following documents aimed at adapting the socioeconomic development sectors and mitigation of GHG emissions:
As a Contracting Party to the UNFCCC, Cabo Verde, as Small Island Developing State (SIDS), participates in the preparatory meetings and conferences of Parties held under the UNFCCC. Although with a small delegation it has accompanied the negotiations with participation in meetings of the groups: AOSIS (Alliance of Small Island States), African and G77 + China.
Also for technical-scientific issues the country has participated in the sessions of the Intergovernmental Panel on Climate Change (IPCC) and events held both nationally and internationally.

CHAPTER I – NATIONAL CIRCUMSTANCES

1.1 Caracterization of the country

1.1.1 Government structure

Cabo Verde is a sovereign, unitary and democratic republic, governed by the Constitution, which both guarantees the respect for human dignity and acknowledges the inviolability and inalienability of Human Rights as the foundation of the entire human community, peace and justice. In the organization of the political power, it acknowledges and respects the unitary nature of the state, pluralist democracy, separation and interdependence of powers, independence of the courts, existence and autonomy of local government and decentralization of public administration. The political setting is led by the Movement for Democracy (MpD), currently in power, by the African Party for the Independence of Cabo Verde (PAICV), the largest opposition party, and the Cabo Verdean Independent and Democratic Union (UCID) a minority party.

The head of state is the President of the Republic, the National Assembly is led by its President and the government executive is headed by a Prime Minister. The government of Cabo Verde is structured in Ministries, General Directorates, Institutes and Services that support the execution of policies in the different sectors of economic activity.

Cabo Verde is known for its good governance, with transparent electoral processes, strong democratic institutions, free press and respect for human rights. The country remains committed to strengthening citizen participation in democratic processes, in particular women and youth, and the efficiency and effectiveness of its public administration, including reforms to improve streamlining and transparency of the public finance management system

The Government of Cabo Verde is investing in more efficient and effective mobilization of internal revenues and strengthening decentralization to reduce regional disparities. Violence linked to organized crime and drug trafficking in recent years, particularly in urban centers, in addition to the incidence of gender-based violence and sexual violence against women and girls, and the persistence of sexual abuse and exploitation of children, require a constant commitment from the country to enhancing security, rule of law and judicial system as well as reducing the use of drugs and other substances

Civil Society Organizations (CSOs) remained involved in the country´s development process, particularly in social, economic, cultural and environmental areas. However, some challenges are still faced regarding leadership, resource availability and capability limitations to meet the current challenges.

Stable democracy, transparent institutions and strong civil society are some of Cabo Verde's key achievements. According to the Democracy Index of the Economist Intelligence Unit, the country ranked 32nd globally in 2015. However, there remains the challenge of involving all

citizens in democratic processes, including the political involvement of young people and women.
In the Ibrahim Index (an indicator that the Mo Ibrahim Foundation uses to analyze the quality of governance in Africa), Cabo Verde dropped to the fourth position, from 73 points in 2016 to 72.2 in 2017, having entered the group of countries with "warning signs". At the top of the list are the islands of Mauritius, Seychelles and Botswana in a total of 54 African countries listed in 2017.

Under the Minister of Agriculture and Environment, among other institutions, is the National Institute of Meteorology and Geophysics (INMG), as well the Directorate General for Environment (DGA), the current National Directorate for Environment (DNA), which is responsible for designing, implementing and coordinating environment and meteorology related policies. The DGA was the first agency responsible for coordinating the implementation of the UN Framework Convention on Climate Change (UNFCCC) in Cabo Verde. In an attempt to find new ways of working, the government decided that the DGA/DNA should maintain its central role in the process, but it should promote the participation of national institutions, including the INMG for implementation, involving the civil society and private sector. Thus, the INMG in coordination with DGA/DNA took over the leading role in processes related to the development of the National Program of Action for Adaptation to Climate Change (NAPA) and the Second and Third National s on Climate Change in Cabo Verde. Annex I includes International Legal and Environmental Tools Ratified by Cabo Verde.

1.1.2 Geographic and climate profile

1.1.2.1 Description of the territory

Cabo Verde archipelago is located between the Equator and the Tropic of Cancer, between parallels 17º 12' and 14º 48' North latitude and meridians and 22º 44' and 25° 22' west longitude (Figure 1 The country consists of 10 islands, nine of which are inhabited, and several uninhabited islets, divided into two groups by their location relative to the prevailing winds:

- The Barlavento (windward) group to the north, consisting from west to east of the islands of Santo Antao, Sao Vicente, Santa Luzia (uninhabited), São Nicolau, Sal and Boa Vista. Also belong to that group the islets of Branco and Raso located between Santa Luzia and São Nicolau, the islet of Pássaros off the bay opposite to the city of Mindelo, Sao Vicente, the islet of Rabo de Junco off the coast of the island of Sal, and the islets of Sal Rei and Baluarte off the coast of the island of Boa Vista;

- The Sotavento (leeward) group to the south, consisting from the east to the west of the islands of Maio, Santiago, Fogo and Brava. Also belong to the group the islet of Santa Maria located opposite to Praia, capital of Cabo Verde on the island of Santiago, the islet Grande, Rombo, Baixo, de Cima, Rei Luis Carneiro and Sapado located approximately 8 km from the island of Brava, and the islet of Areia along the coast of that island.

The nation´s capital is Praia, located on the Santiago Island, where is the Seat of the Government, of the executive, legislative and judiciary powers. The larger islands are Santiago located southeast the archipelago, and Santo Antao, located farthest northwest. The country´s extreme points are: Ponta do Sol, Santo Antao Island, north (17 ° 11 'N - 25 ° 05' W), Ponta Nho Martinho island of Brava, south (14° 49' N - 24° 42' W), Ilhéu do Roque, island of Boa Vista on the east (16° 05' N - 22° 40' W) and Ponta Chão Morgado, island of Santo Antão, west (17° 03' N - 25° 21' W).

All together these islands occupy a total land area of 4.033 km^2 and 734.000km^2 of Exclusive Economic Area (EEZ). The coast line is relatively large with around 1.020 km of white and black sand beaches which are alternated with cliffs. This natural arrangement represents a vulnerability shared by most small island states, with a coastal area that requires special attention in the face of potential negative impacts resulting from global climate change. Indeed, any rise in sea level will dramatically affect coastal areas and the population, considering that approximately 80% live in these areas, as well as the loss of habitat, biodiversity and industrial activities linked to small-scale fisheries and tourism.

For an island country that is making efforts to develop tourism as its main income, reducing the coastline due to a possible rise in sea level and extreme events are likely to be huge constraints to development.

Figure 1: Geographic location of Cabo Verde

1.1.2.2 Climate characterization

The climate in the Cabo Verde Archipelago is considered mild and strongly influenced, in terms of temperature, by the cold Canarian current. The archipelago is, throughout the year, under the influence of the Azores anticyclone. In the summer, Cabo Verde is particularly affected by convective systems associated with eastward undulating disturbances, which provide moisture penetration, especially between the months of July and October, when precipitation usually occurs over the islands. Cabo Verde is located in a region where the variability of the Azores subtropical acts as regulatory factor of the anomalies of rainfall, by controlling the seasonal oscillation characteristics of the trade winds of maritime and continental features during the dry months (November to June). In the rainy season (July to October), there is the oscillatory movement of the ITCZ, characterized by southeast winds and disturbances from the east. Between December and February, the islands are affected by air masses from extra-tropical latitudes. The climate is classified as dry sub-tropical.

1.1.2.2.1 Atmospheric dynamics

This region is under the influence of various atmospheric systems, including the convective activity band of the ITCZ, disturbances and east waves, depressions and tropical cyclones, the sub-tropical anticyclonic circulations and the low equatorial pressures (Thorncroft, CD, and Haile, M., 1997) characterizing the region under study. From the analysis of existing data, the time and climate of the Cabo Verde archipelago are conditioned by the location and intensity of the action centers, most of them located in the Atlantic, namely four systems considered, such as (i) the subtropical anticyclone of the Azores, (ii) low equatorial pressures; (iii) the Canarian sea current; and (iv) thermal depression on the African continent during the summer (Leroux, 2001). According to the author, the region of the sub-tropical anticyclones is characterized by high pressures, divergence and subsidence in the air circulation. Its orientation and location influence and characterize the air masses that penetrate the Cabo Verde region throughout the year.

Considered a center of action in the atmosphere, the Azores anticyclone is a very stable system that dominates the tropical and subtropical regions of the North Atlantic, originating flows between north (N), northeast (NE) and east (E), often very intense NE, referred to as "northeast trade". When they blow directly from the continent, they make the air masses continental with reduced humidity. When the winds blow parallel to the west coast of North Africa, they allow maritime influence to be decisive. In the period considered as "rainy season", this region is often affected by disturbances and winds of south and southeast.

Cabo Verde region is affected by the predominance of a subsidence movement called "the trade wind inversion”, which acts as a strong opponent of the vertical development of clouds (Riehl, H. 1979). This is accentuated by a cold stream from the Canary Islands. Inversions occur almost throughout the year, with an estimated 90% frequency (Carvalho, 1973). According to data from surveys carried out by the National Institute of Meteorology and Geophysics of Cabo Verde, the average baseline height of the inversion is between 380 and 850 meters and the climax rarely exceeds 1,420 meters.

The cold sea current from the Canary Islands, with temperatures below 21ºC, moves with the Northeast flow along the west coast of Africa towards the islands, contributing to reduce the temperatures in the region and eventually to define the precipitation variability. The annual average sea surface temperature is 24ºC, and it varies from 22ºC to 24ºC and from 21ºC to 23ºC, between the months of July to November and from December to June, respectively.

At altitude, the circulation is dominated by the East flow, with maximum intensity values conditioned by the location of East African (JAL) and East Tropical (JET) jets, according to Hall etal (2006). Located at the 600 hPa level, with maximum velocities of 10 m/s between 10° N and 15° N, JAL is the result of heat sinking by thermal depression, while JET, which is located at 200 hPa south-lagged to the equator, is fed by deep convection (Mohr and Thorncroft, 2006). This dynamics of seasonal circulation on the West African coast with the consequent southern movement of the ITCZ marks the rhythm of the pluviometry regime on the west coast of Africa and, consequently, on the Cabo Verde region. As a consequence, the variability of Northeast trade winds ends up conditioning the convection on the islands. In the rainy years, the zonal flow is less intense in the region and the northern meridional component is of less intensity than the southern component

Regarding the sea surface temperature, the results obtained by determining the dominant patterns of the field variance have identified a spatial pattern to the north with opposite signal action centers, suggesting a relationship still not very sure with the Oscillation of the North Atlantic, and another on the equator, which may correspond to the heat transfer through the equator (Soares, E., 2004). The stronger variability is associated with the oscillations of the temperatures under the influence of the Canarian current.

According to Leroux (2001), the pluviometry regime in the Cabo Verde region is of the maritime trade wind type (Type I), with a dry period between March and June, and a moist period, from July to October. There is, however, a transition period, less humid and shorter than the previous one, which runs from November to February, characterized by cold air from middle latitudes, known as "wintering" (Soares, 2004). These seasons do not have a specific date for beginning or end and are often so faint as to be confused. In recent years, there has been a marked trend towards the disappearance of the transition season, since the characteristics of the dry season prevail. The existence of these distinct periods is related to factors that condition the climate in Cabo Verde and has a direct dependence on the intensity, location and interaction between the centers of action in the region.

The period from July to October is mainly determined by waves from the east, which depending on the intensity and location, may or may not be accompanied by precipitation on the islands. These waves are synoptic systems that form on the African continent, south of the East African jet in the lower troposphere, and propagate westward between latitudes 5° N and 17.5° N. Under favorable conditions, the east waves intensify in the region of the West African coast and, frequently, they become tropical storms when crossing the archipelago. In general, they are accompanied by the formation of well-organized convective clouds, with storms and strong downpours. This period coincides with the intensification and approximation of the ITCZ, located to the south of Cabo Verde, contributing considerably to the amount of precipitation that occurs at this time of year.

In the period from December to February (DJF) the occurrence of precipitation is associated with the formation of jet streams at levels above 700 hPa, originated when, in the northeast of

the Canaries, a depression valley forms in altitude that extends to the southwest of the Cabo Verde region, facilitates the penetration of polar air and causes "wintering".
Figure 2 below shows the distribution and variability of annual average rainfall, in some stations in the country, for two different periods: (1961-1990) and (1991-2015).

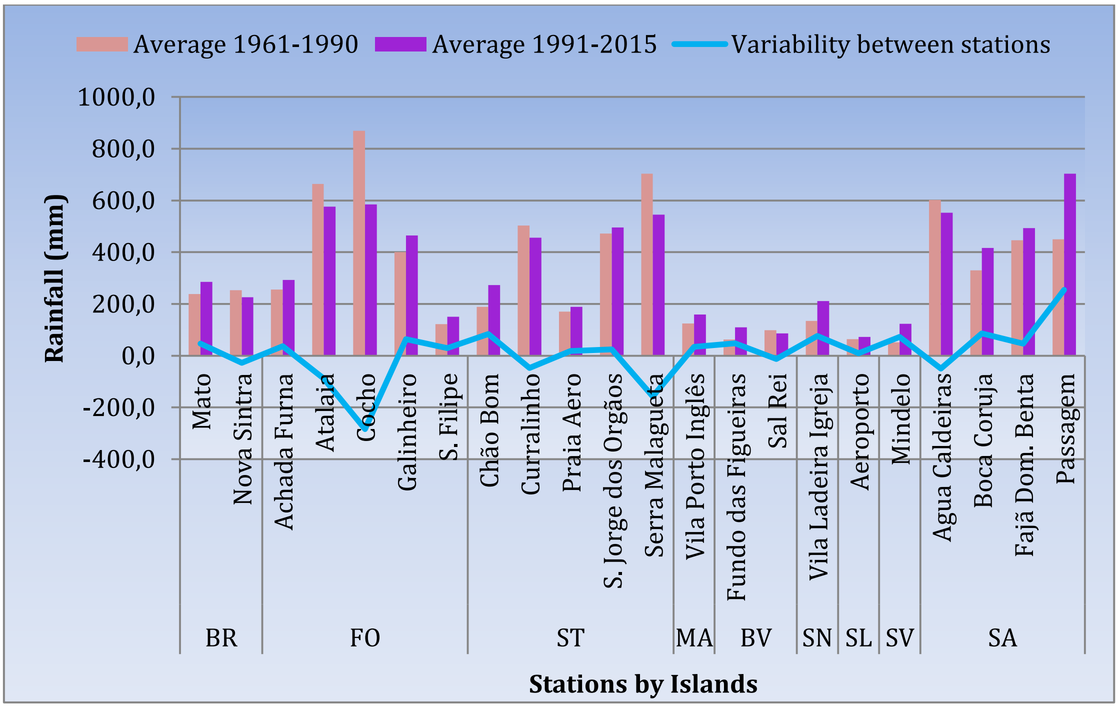

Figure 2: Distribution and variability of annual average rainfall in Cabo Verde

Source: INMG, 2017

Figure 2 shows that the rainfall distribution is made according to the south/north orientation, with the islands of Fogo, Santiago and Santo Antão showing higher rainfall rates in relation to the remaining islands. Regarding rainfall variability, the Atalaia, Cocho (Fogo), Curralinho, Serra Malagueta (Santiago) and Água das Caldeiras (Santo Antão) stations present indexes in the period (1961-1990) higher than the other stations compared to the most recent period (1991-2015). It should be noted that in the recent period, the stations of Mato (Brava), Achada Furna, Galinheiro (Fogo), Chão Bom, S. Jorge dos Orgãos (Santiago), Boca da Coruja, Fajã Domingas Benta and Passagem (Santo Antão) register figures above 200 mm, especially for the Passagem Station with a more expressive value, above 600 mm.

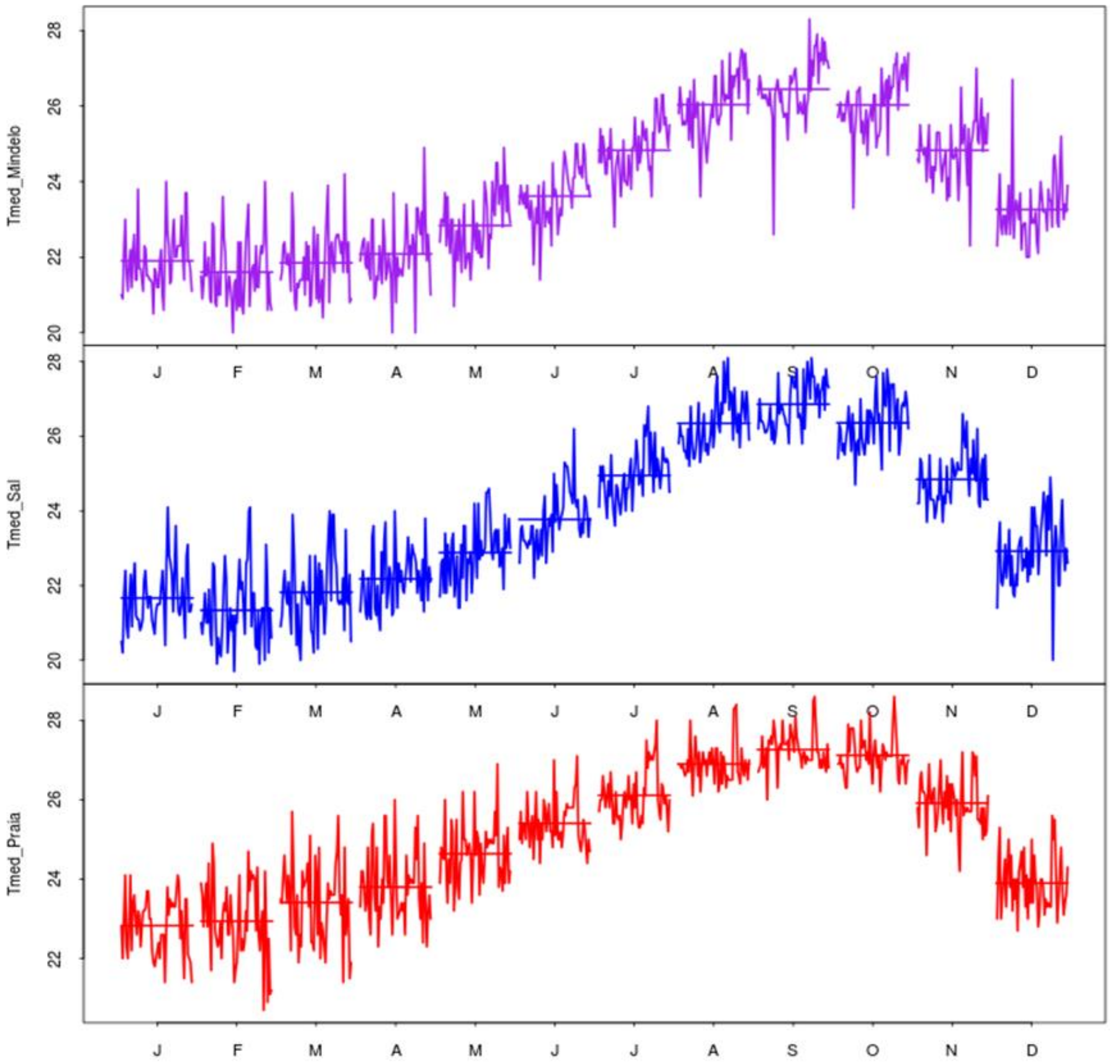

Figure 3: Variation of the average annual temperature

Source: INMG, 2017

Annual temperatures indicate low temperature range. The average annual temperature is around 25ºC for coastal areas, reaching 19ºC in areas with 1,000 meter altitudes. The minimum values between 20ºC and 21º C, correspond to January to April, and the maximum values of 26ºC to 28ºC are recorded in August-September. The monthly lowest temperature is usually recorded between December and February and differs from one island to another.

Based on Figure 3 it can be stated that in Cabo Verde the trend is for increased temperature extremes. According to forecasts, there is a propensity for a sharper rise in the coming years, which will impact on other climate parameters such as evapotranspiration.

Regarding Sea Surface Temperature (SST), the results obtained by determining the dominant patterns of the field variance have identified a spatial pattern to the north with contrary signal action centers, suggesting a weak association with the North Atlantic Oscillation and another over the equator, which may eventually correspond to trans-equatorial transfer of heat. The largest variability is associated with temperature fluctuations related to the Canarian current.

1.1.2.3 Topography

Of volcanic origin, the islands generally have quite uneven topography, with steep, deep and ramified valleys. However, the eastern islands (Sal, Boavista and Maio) have similar topographies, with predominantly flat areas from where isolated erosive volcanic cones raise.

The land is generally hilly, especially in the most recent islands, including the islands of Fogo, Santiago, Santo Antão and S. Nicolau, and relatively flat in the older islands namely Sal, Boavista and Maio, culminating in very high altitudes (Fogo 2,829m, S. Antão 1,979m, Santiago 1,395m, São Nicolau 1,340 m.

Dimensions and configurations of the topography are different from one island to another resulting in their wide-ranging landscapes. These settings highlight the following features: vast flat and wavy areas, slopes, valleys, mountains on high altitude islands and mountains and hills (typical volcanic cones).

The highest point in Cabo Verde is located on the Fogo Island (2,829m), at the top of the Fogo Volcano. The volcano is still active and it last erupted from 11/23/ 2014 to 02/08/2015.

1.2 Natural resources

1.2.1 Soils and land management

Of 4,033 km^2 making up the country, approximately 41,000 hectares is arable land; currently 36,000 ha is cultivated (V Agriculture Census, 2015), indicating a 1.9% reduction in cultivated land compared to 2004 (MAA, 2017). Therefore, soil resources are extremely limited.

Of arable land, more than 90% is dedicated to rainfed or dryland, while a little more than 5% is used for irrigated agriculture. About 23% of the country's surface is reforested. It should be noted that the highest proportion of arable soils is located in semi-arid and arid areas (MDR, 2013).
Soils are mostly of volcanic origin, developed on basaltic substrate of coarse to medium texture, hilly, rich in mineral elements, but poor in organic matter (< 2%) and shallow, showing significant signs of degradation. Although they are naturally fertile due to their volcanic origin, fertility has been decreasing over time due to water erosion, weak vegetation soil and continuous use without proper replenishment of nutrients extracted by crops.

It should also be noted that most of the crop residues are used as fodder and fuel. Deeper soil with higher organic matter content can be found in less marked slope lands. In the bottom of the valleys or streams predominate the alluvial soils that are used for irrigated agriculture.

Poor plant coverage, low organic matter, steep slopes and heavy rains make soil prone to water erosion and susceptible to degradation. Erosion and runoff have contributed to significant annual losses of arable land, leading to loss of soil fertility and endangering agricultural sustainability and food security.

In order to combat degradation and guarantee agricultural production, successive governments have implemented a vast program of soil and water conservation with the construction of mechanical and biological structures for soil conservation and water harvesting. Some examples include landfills, vegetable hedges, large dams for surface water retention, dams, terraces, among others.

Despite the positive impacts of the country's efforts to combat desertification and land degradation, land degradation and loss of soil quality prevail throughout the country, occurring in different forms and proportions.

Studies on the island of Santiago, the country's largest agricultural island, point to a strong to very strong erosion risk of more than 90% in more than 50% of soils (Tavares et al, 2015).

This marked degradation of soils and lands has conditioned the performance of soil ecosystem services, leading to loss of productive capacity, hydrological disturbances and loss of biological diversity (vegetation and terrestrial fauna), and water retention capacity and greenhouse gases.

Under healthy soil conditions, these function as important carbon pools, preventing their release into the atmosphere, which has contributed to the reduction of greenhouse gas emissions.

Hence, degraded soils with low organic matter content and hence organic carbon need to be restored and/or rehabilitated through sustainable management so that they can contribute to climate change mitigation.

1.2.2 Water resources

In Cabo Verde, water is one of the resources by which the population will recognize the effects of climate change, considering the likely changes in rainfall models and the consequent water availability. There is a well-marked seasonality with dry and rainy seasons in the country, so that at the end of the dry period caudal, underground and surface water can be observed well below the average and even absence of water in some sources.

Groundwater is among the most important natural resources. The increasing use of groundwater, the reduction of potable water and the consequent demand, salt water intrusion and contamination of coastal aquifers have become one of the most disturbing problems in the management of groundwater resources, since they are considered strategic reservoirs.

Climate change is taking place at an accelerating pace, with increasing social, environmental, economic and political vulnerability. Uncertainty and risk continue to persist as preponderant systemic variables that condition decision-making processes and make sustainable management of water resources the focus of the entities.

Cabo Verde, in general, has a reduced supply of water and this natural resource is distributed in a heterogeneous way in the national territory and has different origins.

Among freshwater sources, ground water and surface water resources stand out. Other sources of water may also be evaluated, such as the desalination of brackish or sea waters and the reuse of wastewater in some municipalities for irrigation.

In order to determine the volume of water needed to meet growing consumption demand, the National Strategic Plan for Water and Sanitation (PLENAS) was intended to supply 40l/inhab/day with fountain and 90l/hab/day in home connections to the public network.
The evaluation of the water availability, as shown in this paper, is fundamental for the establishment of Water Resources Plans, which will allow to make compatible the consumptive and non-consumptive uses, licensed or not, for the different islands.

On the islands of Santiago, Santo Antão, Fogo and São Nicolau, agricultural activity is practiced on a larger scale, which restrains groundwater availability.

Table 1:Water availability and demand in some Cabo Verde islands

Island	**Water recharge (hm^3/year)**	**Population IMC 2016**	**Área Km^2**	**Population density (hab/km^2)**
Santiago	30,5	297.904	991	300,6
S. Antão	36,8	39.922	779	51,2
Fogo	24,5	35.636	476	74,8
S.Nicolau	-	12.341	357	34,6

Source: ANAS

Based on United Nations baseline values (1997), it is verified that on the island of Santiago the per capita water availability is 278 m^3/inhabitant/year, a level considered as scarcity, while the islands of S. Antão and Fogo present availability of water resources at levels considered as stress (500 to 1000 m^3/inhabitant/year (Contingency Plan - ANAS, 2017).

According to the same source, the situation in terms of water availability for the country is considered to be of water scarcity (water availability less than 500 m^3/hab/day), but the remaining islands (Sal, Maio, Boavista, S. Vicente) have a rainfall of less than 100 mm, indicating the need to implement their respective water resources management plans, the need for intensive management activities and large investments in response to sustainability indicators for water resources, according to the UN:

- ✓ Water use represents less than 5% of total availability implies that little management activity is needed;
- ✓ Between 5% to 10% there might be the need for management to solve localized problems;
- ✓ Between 10% to 20% management activity becomes needed;

- ✓ Above 20% means that intense management activities and investment are needed.

Water on the planet acts as a development factor, since it is used for many uses directly related to the regional, national and international economy. In Cabo Verde, the most common and frequent uses of water resources are: water for domestic use, irrigation, and industrial use. The decline in agricultural production in areas that depend exclusively on rainwater would lead to a worsening food security problem.

Decay in production would affect not only the consumption and nutrition of the population dependent on agriculture, but would also lead to a consequent reduction in income levels, limiting the purchasing power of this population, which would lead to poverty increase level in the country.

The volumes explored on the four most rainy islands, taking into account the water points invoiced, during 2016 were as follows:

- Santiago – 5, 961,175,15 m^3
- Fogo – 1,012,782,69 m^3
- Santo Antão – 976,364,00 m^3
- São Nicolau – 351,846,00 m^3

Of these volumes, 49% was used in agriculture, 43% in water supply and 6% for industrial purposes and 2% for desalination, as per the following Figure.

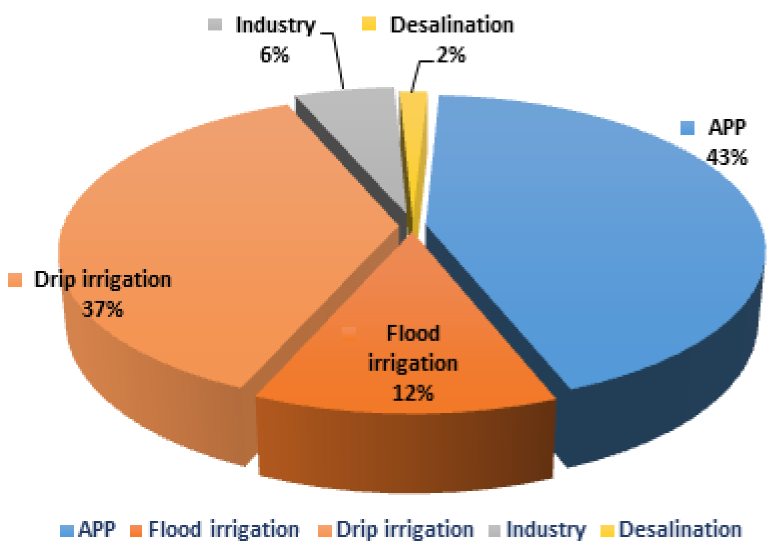

Figure 4: Percentage of water use in Cabo Verde - 2016

Access to adequate water services is an extremely important determinant for improving the living conditions of the population. Goal 6.1 (ODS 06) proposes to increase universal and equitable access to safe drinking water at an affordable price for all.

According to data from IMC-2016, 64.1% of the Cabo Verdean population is supplied through the public supply network, 8.1% through neighbors, 13.2% through fountain, 5.5% through water tanks and 9% from other sources.
Figure 5 shows the water supply situation in urban and rural areas. The urban environment presents better coverage of water in terms of public network with 69.2%, however the rural area presents an acceptable value with 53.8%.

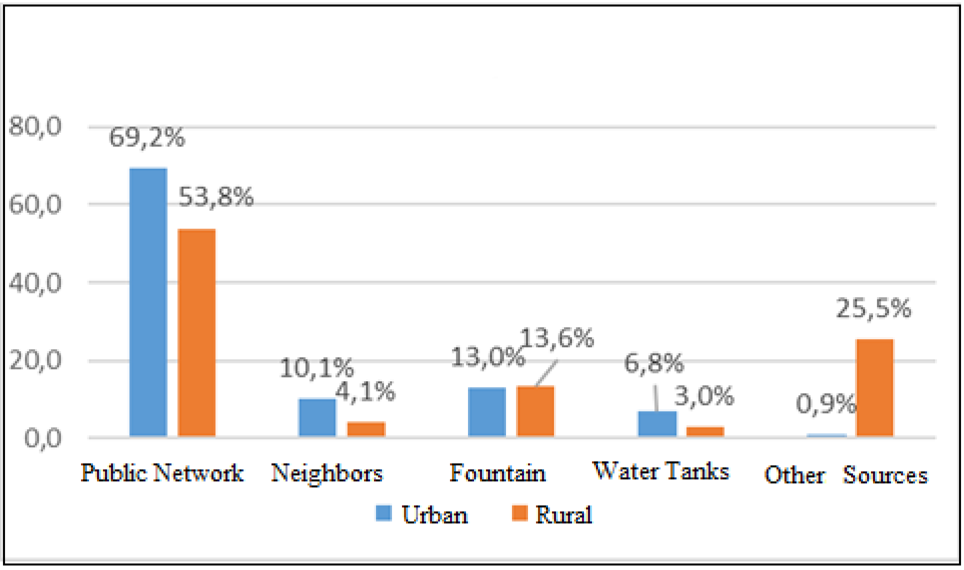

Figure 5: Source of water supply in urban and rural areas

1.2.3 Biodiversity – Current situation in Cabo Verde

Despite being a small island state, with poor and ecologically fragile natural resources, Cabo Verde hosts a wide range of ecosystems, according to topographic and climatic diversity. Natural vegetation is rare, especially in arid and low regions. However, during the rainy season, the atmosphere changes completely with the appearance of herbaceous plants that cover altitude areas. These characteristics have determined the modes of occupation and the actual use of space by local communities, making the archipelago to face economic, social and environmental vulnerabilities, posing critical challenges to the country and population.

Cabo Verde has a relatively rich biodiversity, with more than 5000 species identified in both terrestrial and marine environments (Arechavaleta, et al, 2005), typical of tropical regions, usually characterized by very diverse populations but of relatively low abundance.

The natural characteristics of the archipelago make its biodiversity important in all its aspects - genetic, specific, taxonomic, ecological and functional. In addition to the ecological importance, biodiversity represents the support of all economic activity, with emphasis on (i) agriculture, forestry and livestock; (ii) fishing; (iii) beach and beach tourism; (iv) water sports, recreation and leisure, and (v) ecotourism / nature tourism (MAHOT, 2014).

1.2.3.1 Terrestrial biodiversity

Over 3300 species are currently listed in the archipelago, distributed by 2097 genera and 634 families, including fungi (62), plants (1170 - lichens, bryophytes, pteridophytes, spermatophytes) and animals (2024 - mollusks, arthropods and chordates) (Arechavaleta, et al., 2005; Gomes et al., 2013, INIDA, 2016).
About 503 Land taxa are included in the national red list, classified as threatened or extinct. The animals include the highest number, with 85% of the species followed by the 15% plants. Fungi do not have species included in the red list (Leyens & Lobin, 1996).

In terrestrial flora are identified about 908 species of 515 genera, 151 families and 73 orders, being Briofitas 4%, Pteridofitas 17% and Spermatófitas 79%. Approximately 10% of these species are endemic to Cabo Verde (Gomes et al, 2013) and 17.5% involve some degree of threat in the national red list (Leyens & Lobin, 1996). Romeiras et al. 2016 ranked 78% of endemic plants as threatened globally following the IUCN criteria, of which 29% are in critical danger and 7.6% as vulnerable.

In relation to terrestrial fauna, the list currently includes more than 2000 species identified, distributed in 3 Filos (Molluscs - 2%, Arthropods - 95% and Chordates - 3%), 10 Classes, 54 Orders, 380 Families and 1349 Genres (Arechavaleta et. al., 2005, INIDA, 2016). Approximately 25% of these species are endemic to the country (Gomes et al, 2013) and 21% are listed on the national red list with some degree of threat (Leyens & Lobin, 1996).

Among the terrestrial taxonomic groups that have been targeted for list updates are reptiles and birds.

Vasconcelos (2013) updated the list of reptiles and identified 34 taxa (22 species and 9 native subspecies and 3 introduced) distributed in 3 genera Hemidatylus (5), Tarentola (14) and Chioninia (12) and 3 families (Arnold et al. , 2008, Miralles et al, 2010, Vasconselos, 2010, Vasconcelos et al, 2013). About 88% of the natives are considered endemic, being the most specific of each island. Almost all native species are endangered and two taxa are currently extinct in the group, Atlantic Geochelone and the giant lizard Chioninia (Macroscincus) coctei (Leyens & Lobin, 1996; Lopez-Jurado, Mateo & Garcia, 1998Vasconcelos et al, 2013).

In the group of birds, a total of 255 species have been identified in the archipelago, including native (41 species) (Tosco, 2005) and migratory species (214 species) (Hazevoet, 1995,1996, 1997, 1999, 2010, 2012; 2014, Fernandes, 2007, INIDA, 2016) that are observed locally only during a few months, which coincide with the winter periods in the north. Among the native species 13 taxa are considered endemic (5 species and 8 subspecies) (Tosco, 2005) more than 50% are listed on the red list with some degree of threat (Leyens & Lobin, 1996).
In annex I, table - The terrestrial biodiversity situation in Cabo Verde.

1.2.3.2 Marine biodiversity

More than 2000 marine species are currently identified in the Exclusive Economic Zone of Cabo Verde, distributed in flora (Cyanophytes, Chlorophytes, Rhodophytes and Feofites) and fauna (Poriferas, Cnidarians, Molluscs, Arthropods, Echinoderms and Cordados) (Rolan, 2005; Wirtz, In this paper, we present the results of a study by Wirtz, et al, 2013, Fernandez, 2013, Almeida et al, 2014, Reiner, 2014, Freitas, 2014, Peters et al., 2016, FAO, 2017, González, et al, 2017).

In marine flora the red algae belonging to Rhodophyta dominate with 220 species identified, including 16 endemic species, followed by the brown algae of the phylum Phaeophyta with 53 species and two endemisms, green algae of the Chlorophyta phylum with 57 species being 2 endemic and blue algae, Cyanophyta with 9 species (Prud'homme, et al., 2005). There are also two species of marine grasses, Halodule wrightii (Creed et al., 2016), Ruppia maritime (Martínez-Garrido et al 2017).

In fauna the following groups can be highlighted:

Cnidarians include corals with about 24 registered species (1 belonging to the hydrozoa class and 23 from the entozoan class, divided into 3 orders and 13 families) that constitute the Cabo Verdean coral community (Almeida et al, 2014).
Among Crustaceans are listed Decapod with 125 species, grouped in 83 genera and 40 marine families (Gonzalez et al, 2017).

Some 184 species of mollusk (Groh 1983, Rolano, 2005, Lopes, 2010, Tenorio et al 2014, Afonso, & Tenorio, 2014; Cossignani, & Fiadeiro, 2014) are identified, where gastropods of the genus Conus , with 56 species, of which 53 are endemic (Peters et al., 2016). In an evaluation of the endemic Conus group following the IUCN Red List of endangered species lists, Peters et al. (2016) found that 45.3% of the 53 species evaluated in Cabo Verde are threatened, a rather high rate compared to 7.4% of 579 species in the rest of the world.

Of the echinoderms in Cabo Verde a total of 97 species are recognized, with 37 species belonging to Asteroidea (5 orders, 12 families, 26 genera), 27 in Ophiuroidea (4 orders, 10 families, 16 genera), 18 in the class Echinoidea 8 orders, 10 families) and 15 in the Holothuroidea (4 orders, 8 families, 9 genera) (Entrambasaguas, 2008).

According to data published by the FAO on the Fishbase (2017), there is a list that includes 667 species of fish identified in the archipelago, of which 607 are considered as native, with 17 endemisms. It is noteworthy that 36% of the 58 species of cartilaginous fish of the archipelago are considered as threatened at global level (Wirtz et all, 2013; Reiner, 2014; Freitas, 2014; Fishbase, 2017).

In relation to marine reptiles, it is possible to find the presence of 5 species of sea turtles: Caretta caretta, Lepidochelys olivácea, Chelonia mydas Eretmochelys imbricata, and Dermochelys coriacea (López-Jurado et al., 2000, DNA, 2015, 2016), of which the first three with nesting record. All included in the list of endangered species in Cabo Verde (Leyens & Lobin, 1996).

It is also worth noting that the archipelago is the third largest spawning site in the world and the second in the Atlantic for C. caretta (Abella, 2010).

The list of marine mammals that occur in Cabo Verde currently includes 23 species of which 17 are considered as native (Hazevoet & Wenzel 2000, Hazevoet et al, 2010, Hazevoet et al., 2011, López-Suárez et al, (2008), Wenzel & López-Suárez 2012, Ryan et al 2013, Van Waerebeek, 2013, Ryan et al 2014) and 3 considered to be globally threatened by international IUCN (Reilly et al 2008, Taylor et al., 2008, 2011, 2012, 2013). In annex I, Table - Current status of marine biodiversity in Cabo Verde.

1.3 Population profile

According to data from the National Institute of Statistics (INE) on demographic projections from 2010 to 2030, the population of Cabo Verde, in the period 2012-2016, grew at a rate of 1.23%. In 2016, 531,239 residents were estimated, with an increase of 6,406 inhabitants, compared to 2015.

The analysis by municipality indicates that Praia and São Vicente present a higher concentration of the population, representing, in 2015, 28.9% and 15.4% of the total, respectively. The lowest concentrations of the population were registered in the Municipalities of Tarrafal de S. Nicolau (1%) and Santa Catarina do Fogo (1.1%) (Table 5), Resident Population in Cabo Verde by Municipality (2012-2016). Statistical Yearbook, 2016 (AECV.2016).

Table 2: Resident population by Municipality (2012-2016)

	2012	2013	2014	2015	2016
Cabo Verde	**505 983**	**512 173**	**518 467**	**524 833**	**531 239**
Ribeira Grande	18 129	17 748	17 375	17 017	16 674
Paul	6 616	6 433	6 261	6 099	5 940
Porto Novo	17 807	17 681	17 556	17 431	17 308
S. Vicente	78 325	79 241	80 140	81 014	81 863
Ribeira Brava	7 431	7 347	7 262	7 182	7 108
Tarrafal de S. Nicolau	5 256	5 254	5 249	5 242	5 233
Sal	29 096	30 655	32 208	33 747	35 268
Boa Vista	11 262	12 313	13 376	14 451	15 534
Maio	6 934	6 932	6 947	6 980	7 034
Tarrafal	18 488	18 424	18 367	18 314	18 264
Santa Catarina	44 052	44 387	44 745	45 123	45 516
Santa Cruz	26 579	26 509	26 436	26 360	26 277
Praia	139 993	143 787	147 607	151 436	155 252
S. Domingos	13 936	13 970	14 004	14 037	14 070
São Miguel	15 271	15 067	14 867	14 671	14 482

	2012	2013	2014	2015	2016
S. Salvador do Mundo	8 680	8 670	8 661	8 652	8 642
S. Lourenço dos Órgãos	7 288	7 233	7 179	7 127	7 079
Ribeira Grande de Santiago	8 372	8 385	8 399	8 415	8 437
Mosteiros	9 468	9 428	9 394	9 364	9 336
S. Filipe	21 806	21 587	21 384	21 194	21 018
Santa Catarina do Fogo	5 307	5 299	5 290	5 279	5 267
Brava	5 887	5 823	5 760	5 698	5 638

Source: INE, Demographic projections, 2010-2030 /Statistical Yearbook,/ AECV – 2016.

The natural growth rate declined from 1.5% in 2012 to 1.3% in 2016. As regards the annual average growth rate (TCMA), it maintained the same value (1.2%) registered in 2015.
In 2016, the average life expectancy for men was 71.8 years, while for women it was 80.0 years, pointing to an average age difference of 8.2 years.

According to the 2016 Statistical Yearbook, the average age of the Cabo Verdean population has been around 27 years, from 2012 to 2014, reaching the average value of 28 years in 2015 and a slight increase (28.3) in 2016. At municipality level, it was noted that, in 2016, the municipality of Santa Cruz appears with the lowest average age (26.2 years), while Ribeira Grande de Santo Antão presents the highest (32.9 years).

The Total Dependency Ratio has been steadily declining from 2012 to 2016, mainly due to the significant number of working-age men and women, compared to the population of children and the elderly. In 2012, this indicator was 57.7% and dropped to 52.6% in 2016.

Particularly on the reality of Cabo Verde, statistical data point to a country where the population is expanding, with the resident population going from 531,239 inhabitants in 2016 to 621,141 inhabitants in 2030, a scenario that presents opportunities and challenges. (AE, INE 2017) For the Youth and the Elderly Dependency Ratio, the observed behavior has been similar to the Total Dependency Ratio, that is, both have been decreasing in the period under analysis (AECV 2016).

1.4 Economic and social development

Cabo Verde is a poor country and vulnerable to climate change and external factors, as near 90% of its consumption needs is imported. The Gini index for Cabo Verde increased from 52.5 points in 2001 to 47.19 in 2017.

Despite this progress, challenges remain in terms of significant regional disparities and disparities between islands for poverty as well as constant levels of inequality.
Cabo Verde's characteristics as a small island developing state (SIDS), with its dry and unpredictable climate, limitation and access to water and geomorphology of many of the inhabited islands also pose significant risks to the primary sector, agriculture.

Territorial dispersion also hampers the unification of the internal market and has implications for the transport, distribution and storage systems as well as other essential services which are important for boosting the primary sector, bearing in mind that they entail high transaction costs. The tertiary sector (services) accounted for near two-thirds of the economy in 2014 and generates almost half of all national employment, making Cabo Verde a particularly dependent country, with particular emphasis on tourism.

Cabo Verde faces a particularly important challenge related to the full participation of women and young people in the labor market, where the greatest inequalities occur. Unemployment mainly affects young people in urban areas and continues to be higher among women (17.4% for men and 12.9% for women). In 2016, the highest unemployment rates were observed in young women living in urban areas (74.3% of women aged 15-19).

1.4.1 Unemployment rate

The unemployment rate dropped 1.8 percentage points, from 16.8% in 2012 to 15.0% in 2016. From 2015 to 2016, this rate increased by 2.6 percentage points. With regard to youth unemployment (15-24 years), this rate continues to grow from 28.6% in 2015 to 41.0% in 2016, representing an increase of 12.4 percentage points. AE, INE 2017.

Regarding the unemployment rate, by sex, it is found that it is lower in men than in women. In 2016, unemployment was 17.4% for women and 12.9% for men.

In rural areas, the unemployment rate was 10.3% and in urban areas 16.9%. However, when analyzed by municipality, it is observed that Ribeira Grande de Santo Antão (4.5%), São Lourenço dos Órgãos (4.5%) and Brava (4.6%) are the municipalities presenting the lowest unemployment rate in 2016, while the municipality of Praia had the highest rate (22.1%). AE, INE 2017.

1.4.2 Indicators of absolute poverty

In 2015, Cabo Verde had a global absolute poverty rate of near 35%, which means that 179,909 people are considered poor. That is, they live with an average annual consumption per person, below the urban poverty threshold, of 95,461 escudos (262 escudos per day) and, in the rural area, 81,710 escudos (224 escudos per day), a value estimated as the minimum to guarantee the basic food needs and non-food goods and service needs.

Geographically, it has been observed that poverty is more pronounced in rural areas, where a decrease of the population, as a consequence of the exodus to the urban environment, is evident over the years. Currently, the rural population accounts for 35.7% of the total population and almost half of its resident population (88,524) is considered to be poor, equivalent to a poverty incidence of 49%. The rural poor represent 49.2% of the total of the poor at the national level.

In urban areas, the incidence of poverty stands at 27.8% and reaches 91,384 people.

Extreme absolute poverty was set at 10.6%, and it was more significant in rural areas with 20.3% (in urban areas, it was 5.3%). (AECV.2016).

1.4.3 Inequality and concentration of expenditure

The Gini Index allows to assess the degree of concentration of expenditure. It is noted that inequalities or concentration of expenditure have been declining over the years. The Gini Index fell from 0.53 in 2001-2002 to 0.42 in 2015.

However, the 20% of the richest families (5th quintile), with an annual average expenditure of 404,999 escudos, concentrated 48.7% of the total expenditures made in 2015, with particular emphasis on urban households with 56,7%. In rural areas, the distribution of consumer spending is more equitable and translates to a Gini index of 0. 37. AECV.2016.

1.4.4 Education profile

According to the Cabo Verde 2016 Statistical Yearbook, the percentage of the population that never attended school dropped by 4.6 percentage points between 2010 and 2014. In 2014 only 8.3% of the population declared that they had never attended school. school. Similar results can be found in terms of the percentage of the population that is attending primary, secondary and higher education, for in 2014 the figures indicate that the population attending basic education increased by 3.3 percentage points, as well as the population to attend secondary and higher education, with increases of 7.6 and 3.7 percentage points from 2010 to 2014, respectively. Pre-school enrollment declined, from 4.6% in 2010 to 3.4% in 2014.

The data show that differences persist in terms of the population's gender and means of residence. In terms of gender, the proportion of the population that has never attended an educational establishment, women are disadvantaged compared to men, as the rate of women in these conditions is more than double that of men. By means of residence, 12.3% is located in rural areas and 6.2% in urban areas.

These differences are not so evident in relation to the percentage of the population enrolled in primary and secondary education, however, it is noted that the rural population presents higher rates for the population that attends preschool and basic education. The municipality of Ribeira Grande stands out for having a greater percentage (14.6%) of the population that never attended school.

Access to basic and secondary education is possible in all municipalities in the country. At the upper level, however, such access remains selective, limited by the existence of supply almost exclusively on the islands of Santiago and São Vicente. The quality of education continues to be the main challenge at all levels of education, urgently requiring reforms. In the particular case of higher education, courses offered by universities often are not aligned with the needs of the market.

1.4.5 Health profile

According to the AECV.2016, the continuous improvement of sanitary indicators reflects the importance the health sector occupies in the country´s overall development from very beginning of its existence.

In fact, the evolution of the main health indicators, namely infant and under-five mortality, maternal and general mortality, changes in the vaccination coverage levels of children under 1 year of age, as well as the improvement of health care provided to women, children and adolescents, among others, were determinants for Cabo Verde´s elevation to Average Income Country.

Health indicators presented in this document depict the epidemiological transition phase in which the country remains, due to the relatively significant coexistence of communicable diseases, together with an increasing prevalence of chronic noncommunicable diseases, which are clearly reflected in the main causes of mortality in the general population in recent years, leading to circulatory system related conditions, followed by malignant tumors.

With regard to communicable diseases, Malaria, Tuberculosis and HIV/AIDS, which are considered as priorities in the 2012-2016 National Health Development Plan, there has been an evolution from the incidence and prevalence point of view in 2015, compared to 2013.

1.4.5.1 Health Service Resources and Infrastructure

The health infrastructure network consists of two central hospitals (municipalities of Praia and São Vicente) and four regional hospitals (Ribeira Grande, Sal, Santa Catarina and São Filipe). As for the Health Centers, there was an increase of three infrastructure, distributed in the municipalities of Sal, Praia and São Filipe. The Basic Health Units, although having decreased by one unit, compared to the year 2013, are installed in all municipalities, being essential infrastructure in the implementation of the health policy in the country.

It should be noted that the analysis showed that at municipality level, compared to 2013, the ratio of doctors and nurses per 10 thousand inhabitants evolved both in São Vicente (12.12 in relation to doctors per 10 thousand inhabitants and 19.37 nurses per 10,000 inhabitants) and in Praia (12.22 physicians per 10 thousand inhabitants and 14.99 nurses per 10 thousand inhabitants). However, the regional differences remain, which have to do with the type of existing infrastructure and care provided in the less populated municipalities.

With regard to the number of hospital beds in sanitary facilities, a reduction in the number of beds was observed, from 561 in 2011 to 525 in 2015, which represents an average decrease of 1.6%/year. By 2015, regional hospitals totaled 239 beds and health centers (with hospitalization) 304 beds.

1.4.5.2 Birth rates and Fertility levels

Birth and Fertility Indicators, in 2016 - Fertility Index (ISF), Gross Birth Rate (TBN), Gross Reproduction Rate (TBR) and Net Reproduction Rate (TLR) -, data analyzed in the

AECV.2016, show a slight decrease when compared to the last five years of this time series. At municipality level, São Vicente is the municipality with the lowest value, both in the ISF (1.95%), in the TBR (0.95%) and TLR (0.93%).

Regarding TNB, Ribeira Grande was the municipality registering the lowest value, remaining at 14.35%. At the other extreme is the municipality of Santa Catarina do Fogo with the highest value for ISF (2.94%), TBR (1.43%) and TLR (1.40%), and the island of Sal with the highest value in the TBN (24.08%), according to the demographic projections made by INE covering 2010 to 2030.

1.4.5.3 Vaccination coverage

By 2015, the proportion of children under one year of age (<1 year) who were completely vaccinated was 90.2%. For BCG vaccine, since it is applied at birth (soon after birth), rates above 100% were recorded in the structure/municipality where the childbirth occurred. For example, at the Paul Health Center, there are no deliveries. At the other extreme, Santa Catarina registers a rate of 152.8% of BCG vaccines, since the vast majority of pregnant women in the health area of Santiago Norte give birth at the hospital that covers the region.

Considering the other vaccines (Polio 3, Pentavalent 3 and Measles), coverage rates above 90% were recorded in 2015. AECV.2016 Data.

1.4.5.4 Mortality

From the AECV – 2016 data review, it is noted that the mortality rate rose from 5.1% in 2011 to 5.2% in 2015, registering 4.9% in 2013. These data clearly show an increase in the mortality rate in the period under review. However, it should be noted that in some periods, this rate remains practically at the same levels.

Regarding the maternal mortality rate, in the period under review, there was a marked oscillation, being considered a volatile indicator, taking into account the number of maternal deaths underneath it, it was verified that in 2012, the rate of 9.6/100,000 live births resulted in 1 maternal death, while in 2015, the rate of 47/100,000 live births represents the occurrence of 5 maternal deaths.

The infant mortality rate declined sharply in the period under review from 23.0 in 2011 to 15.3 in 2015 per 1,000 live births (in 2013 it was 21.4), early neonatal component that declined from 14.1 to 8.1 (in 2013 was 13.4) per 1,000 live births. This was essentially due to the improvements implemented in childbirth care. Consequently, the under-five mortality rate also declined significantly, from 26.2 to 17.5 per 1,000 live births (23.6 in 2013).

According to AECV.2016, analyzing the number of deaths, it is verified that, in 2015, there were 2,744 deaths resulting in an increase of 217 deaths (8.6%), when compared to 2011. Observing the sex-disaggregated data, in the same period, there is an increase in the number of male deaths (from 1,486 to 1,517) as in female deaths (from 1,041 to 1,227).

1.5 Economic profile

According to the AECV.2016, for the economic sector, data and indicators on economy and finance allow to characterize and identify the structural changes that have occurred in the country in the last five years, with more emphasis for 2016.

1.5.1 National accounts

5.1.1.1 Annual national accounts

Quarterly national estimates available show that in 2016, GDP grew by 3.0% in nominal terms (current) and 3.8% in real terms (by volume), compared to 2015.

This growth is mainly due to the positive evolution in Transformation Industry (9.7%), Financial Services (9.4%), Business Services (8.9%), Public Administration (8.3%) and Agriculture (7.7%).

The assessment of total Gross Value Added (GVA) indicates an increase of 2.4% in value and 4.0% in volume, while net taxes on products fixed at 6.6% and 2% 5%, in value and volume, respectively.
The sector that contributed most to this evolution was services that, with a share of near 61% in the GDP structure, grew 3.8% in value and 4.2% in volume.
From these data assessment, it can be seen that, in terms of contribution to nominal GDP, it was noted that in 2016 the tertiary sector contributed with 61%, while the primary and secondary sectors contributed with 8.8% and 17.1%, respectively

Under Good Governance of the Mo Ibrahim Foundation Cabo Verde dropped from the second to third position (from 78 to 73 points in 100 possible), following the Mauritius and Botswana, out of 54 African countries assessed in 2016. Although there has been a 2.3-point setback in the score, the evolution has been considered positive since 2006, as the country maintains a position in the top three of the best positioned, remaining the best Portuguese Speaking Country.

The United Nations indicated that the country kept its 122nd position in the Human Development Index in 2016, although it has improved its score from 0,646 to 0,648 points. All these positions reflect the socio-economic situation of the country, considered from 2009 as a Middle Income Country with an average annual income per inhabitant of 1976,46 USD in 2004. In 2016, this increased to 2997,75 USD.

Concluding, analysts identify the following critical success factors for Cabo Verde's development: a) human resources with a relatively satisfactory level of training, b) an Exclusive Economic Zone of approximately 734,000 km² which represents some economic potential, c) a privileged geographic location in the middle of the Atlantic and allowing excellent links between the North Atlantic/South Atlantic regions and finally d) privileged location with preferential access to the main world markets.

Despite this, the country still faces serious constraints that hamper its development process, since it is located far from the main markets and therefore exposed to high costs of communications with the outside, it faces difficulties in terms of economies of scale, particularly with regard to the implementation of infrastructure due to geographical dispersion, it has a weak agricultural production base due to the lack of water and very limited arable land (10%). and finally, poor industrial performance.

Given this scenario and the country's vulnerability to external shocks, its development is strongly conditioned by the global economy evolution. In the 2015/2016 period, Cabo Verde's GDP grew by near 2.9%.

The successive reforms implemented in early 1990s, based on the private-based commercial liberalization of the economy, with the consequent reduction of the state presence in the economy, the reform of the banking system, reform of the state enterprise sector, and the 1998Agreement, provided years of robust economic growth. On the other hand, in 1997 the international financial crisis had an impact, and the authorities resumed restrictive measures. From 2000, the economy resumed its GDP growth course.

In July 2008, Cabo Verde joined the World Trade Organization (WTO), becoming the 153rd member of this multilateral international organization and benefiting from this accession, namely recognition of the country's ability to follow the international trade rules, as defined by the GATT agreement.

In 2017, Cabo Verde signed a Special Partnership Agreement with the European Union, with the country enjoying significant advantages in its relationship with the European Union, namely funds meant for the outermost regions of the European Union.

At the subregional level, Cabo Verde is a member of the African Union and the Economic Community of West African States (ECOWAS). In 2002 the country subscribed to the NEPAD initiative.

The entry of Cabo Verde into the WTO concludes a set of strategic and economic options initiated with the exchange agreement with Portugal, the political-military approach to NATO, the special partnership agreement with the European Union supporting its the entry into the Group of Middle Income Countries, but also provides Macaronesia with a wider range of trade relations, placing the country as one of the main entry and exit points in relations between the European Union and Africa and a platform between it and the American continent. All these international engagements are reflected in the different national strategic frameworks, grouped within the Strategic Plan for Sustainable Development (PEDS), adopted in 2017.

1.6 Industrial Profile

Cabo Verde´s industrial performance is poor for production and exports and its stagnant industrial structure is poorly organized to take advantage of new the technological environment. Without a new competitive structure the risk of industrial marginalization is substantial. The country´s development over the recent years did not allow the industry sector to occupy a more significant place, with a growth rate below the national average. The economy of Cabo Verde is today more service-oriented.

According to the AECV.2016, companies in the industry sector increased by 24.1%, from 2011 to 2015, reaching 974 companies in 2015 (+189 companies). Of the 974 companies in 2015, 24% worked in the manufacture of furniture and mattresses, 18.7% in the food industry and 12.3% in the manufacture of metal products, except machinery and equipment.

From 2011 to 2015, the most significant increase in the number of staff employed was registered in the food industry (+ 388 employees). Note that in the clothing industry, the number of staff employed has doubled between 2011 and 2015 (+ 250 employees). In 2015, food industry employed approximately 36% of staff working in the industry sector.

Data show that the Food Industry has been consolidating its share, regarding the turnover in the industry sector. Between 2011 and 2015, this subsector increased by 63.5% of total turnover (4,767,788 escudos). AECV.2016.

Food and beverage industry in 2015 contributed by 51.4% and 16.8%, respectively, in the total turnover of the industrial activity. Together, these companies represent more than two-thirds (68.2%) of the turnover of this activity, as shown in the following figure:

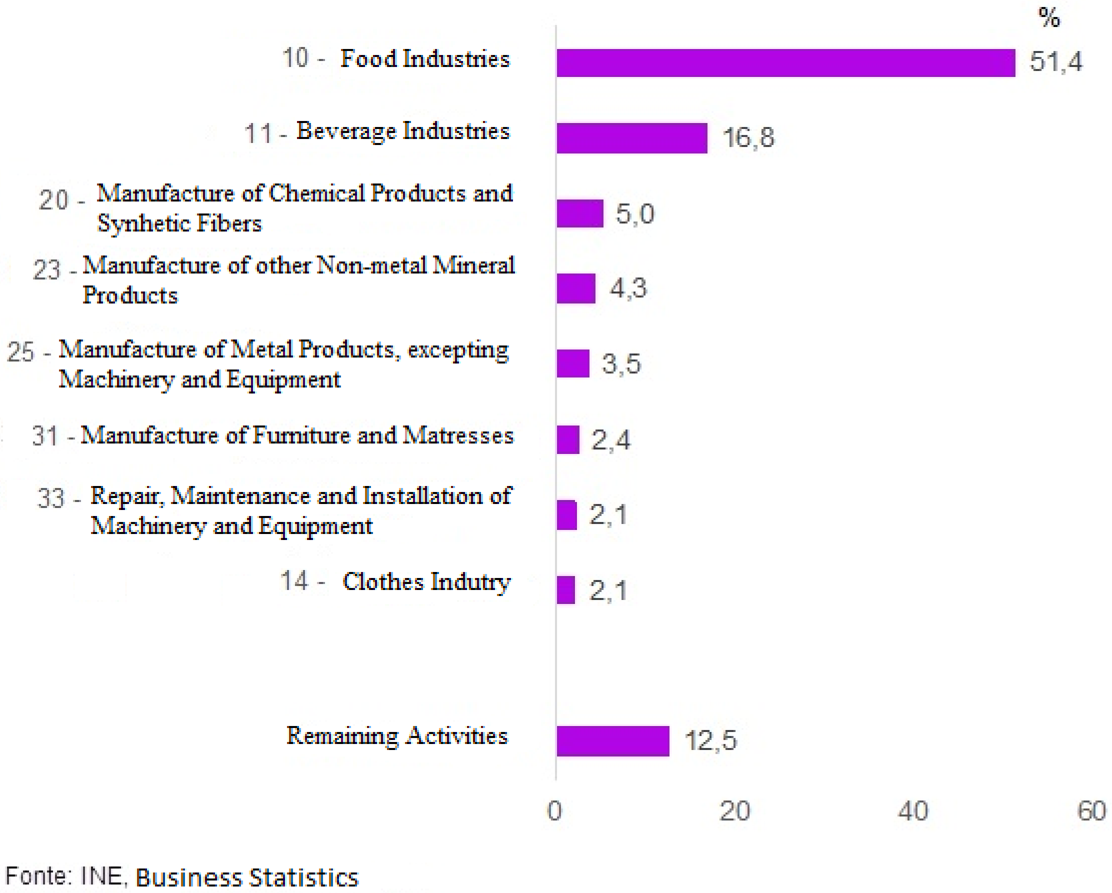

Figure 6: Turnover in industry Sector (2015), according to the main CAE CV distribution– Rev.1. Source: AECV – 2016

Exports are concentrated on certain customers and are channeled mainly to European destinations, given that exports to the African continent or intra-community (ECOWAS) is irrelevant. The products that Cabo Verde most exported in the 2000/2016 period are mainly fresh and frozen fish (37%), canned fish (32%), clothes (16%) footwear and parts of footwear (12%).

1.6.1 Indicators of access and use of information and communication technologies (ICT)

1.6.1.1 Households and access to ICTs

The proportion of households with access to land line telephone service indicates that, from 2012 to 2016, there was a decrease of 16.2 percentage points, from 40.6% to 24.4%. In 2016, the lowest percentage of households with access the land line service was in the municipality of Santa Cruz (8.7%) and the highest in Ribeira Brava (53.8%). AECV – 2016.

1.6.1.2 Population and use of ICTs

In 2016, the proportion of the 10-year-old or older population that used computers (laptop, desktop, Ipad or tablet) in the last three months was 32.5% overall. However, in urban areas, this percentage amounts to 39% and, in rural areas, 19.6%.

In the municipality of Ribeira Grande de Santiago, where 17.3% of the population aged 10 years or more used computers in the last three months, the lowest percentage was found, contrasting with Sal, where this percentage reached the highest value (42, 8%).

In 2016, the percentage of the population aged 10 years or more who have used the Internet in the last three months was 57.4% and the discrepancy is noticeable in both rural and urban areas and from one municipality to another. It was also observed that 31.2% of the population of São Lourenço dos Órgãos aged 10 years or more had access to the internet in the last three months, while on Sal Island this percentage reached 70.6%.

1.6.2 Imports

1.6.2.1 Of goods

Overall, imports increased by 1% from 2012 to 2016 in terms of value and decreased by 10.7% over the same period in terms of volume.
In 2016, imports of goods totaled 66,384 million Cabo Verdean escudos, corresponding to an increase of 10.5% compared to 2015. This variation represents an acceleration compared to the variations recorded in previous years.

Taking into account the Classification by Broad Economic Categories (CBEC), it was observed that, in 2016, imports of consumer goods accounted for 45.3% of the total imported value and the Intermediate Goods (33.4%). These categories accounted for near 79% of the total value of goods imports in 2016.
By 2015, Cabo Verde had 829 import companies, corresponding to a 10% increase over 2011, when there were 754 importing companies. Between 2014 and 2015, there was a 12.2% increase in import companies.

Analyzing the data by island, in relation to the number of importing companies, it was verified that the largest increase occurred on the island of Boa Vista, from 8 to 41 importing companies from 2011 to 2015, representing an absolute growth of 33 companies, in the four-year period. In 2015 most of companies (89.5%) were concentrated on the islands of Santiago (48.2%), São Vicente (25.9%) and Sal (15.4%).

In 2016, the European continent was the main supplier of Cabo Verde, with 79.0% of the total imported value and 79.5% of the total imported share. The African continent is the economic zone with the lowest contribution (3.2%) in the total value of imports. (AECV.2016).

1.6.2.2 Of services

Imports of services have fluctuated considerably over the last five years. The 9.8% decrease in 2013 can be mainly explained by the decrease in imports of transport services (-18.3%), insurance (-26.2%), IT and information (-17.3% %).

In 2015, there was a further reduction (-1.3%) due to a decrease in imports of communication services (-67.5%) and financial services (-48.6%).

In turn, in 2016, there were increases, reflecting the growth of imports in transport services (14.8%), financial services (63.1%) and other business services (64.0%).

The main services imported in the country in recent years were: transportation, travel and other business services. (AECV.2016).

1.6.3 Exports

1.6.3.1 Exports of goods

In the 2012-2016 period, exports of goods increased by 23.3% in value and 69.1% in volume. (AECV.2016).

In 2016, exports of goods to foreign markets reached 5,966 million escudos, a 10.2% decrease compared to 2015 (- 678 million escudos).
Cabo Verde's exports are concentrated in Consumer Goods, with a 99.1% share of the value exported, and in Intermediate Goods (0.9% share). These categories together represented the goods categories exported in 2016.

Exports of goods are concentrated in consumer goods, representing, in 2016, 99.1% of the total value and 97.6% of the total imported volume.

The European continent continues to be Cabo Verde's main customer, with 97.4% of the total value exported and 72.2% in terms of total exported volume. The African continent, like imports, is the economic zone with the least share in the exports structure.

In 2016, the main external destinations of national goods continued to be Spain and Portugal, and together they concentrated 91.6% of exports.

Spain strengthened its position as the main customer (72.4% share). Exports to Portugal increased by 21.9% (+206 million escudos, with the highest increase globally).

1.6.4 Mineral resources

Although natural resources have drastically declined, their importance in the new global industry context should never be overlooked. With near 20% of the GDP in 2016, industry represents a modest share in the Cabo Verde´s economy. Despite this situation, the country produces a certain amount of minerals used in the preparation of construction materials: clay on the islands of Boavista, Sal and Sao Vicente, plaster on Maio; limestone on Boa Vista, Sal and Santo Antao, pozzolan in S. Antão, and finally, salt on the islands of Maio and Sal.

1.7 Energy

The islands of Cabo Verde, from energy point of view, are composed of independent systems, characterized by their small size and distance from supply centers. Furthermore, the lack of conventional energy resources causes a critical dependence on foreign energy. Electricity (domestic consumption) and fuel (aircraft, water desalination) are energy products increasingly vital for the current socio-economic system.

Biomass consumption is mainly focused on firewood use in rural areas and city outskirts for food cooking. in 2016 and according to the National Directorate for Energy, Industry and Commerce renewable energy, namely wind and solar power, accounted for near 20% of the energy injected into the national electricity grid. With respect to electrical energy, the vast majority are produced from thermal power plants using diesel and fuel oil (fuel 180 and 380).

From energy point of view, the islands of Cabo Verde are linked by independent systems, characterized by their small size and the distance from the centers of supply. Moreover, the lack of conventional energy resources causes a strong dependence on energy from abroad.

The energy sector in Cabo Verde is characterized by fossil fuel consumption (derived from petroleum), biomass (firewood) and the use of renewable energy, namely wind energy. Fossil fuel consumption consists of petroleum derivatives, namely: gasoline, diesel, fuel oil, Jet Al, butane gas and lubricants.

By 2010, the use of solar energy was practically insignificant, practically limited to water pumping. Cabo Verde re-exports a portion of imported fossil fuels (Jet A1 for aviation and diesel for maritime transport), but a large portion is for domestic consumption, mainly for transport and electricity generation and desalinated water.

1.7.1 Electricity generation capacity

Although government programs have privileged the energy sector, regular electricity supply has only started in late 2012, with the start-up of solar and wind farms on the islands of higher economic power (Santiago, Boavista, Sal and São Vicente). The electro-producing park of Cabo Verde is essentially characterized by the thermal installed power.
The figure below shows the evolution of installed capacity in the country between 2000 and 2010.

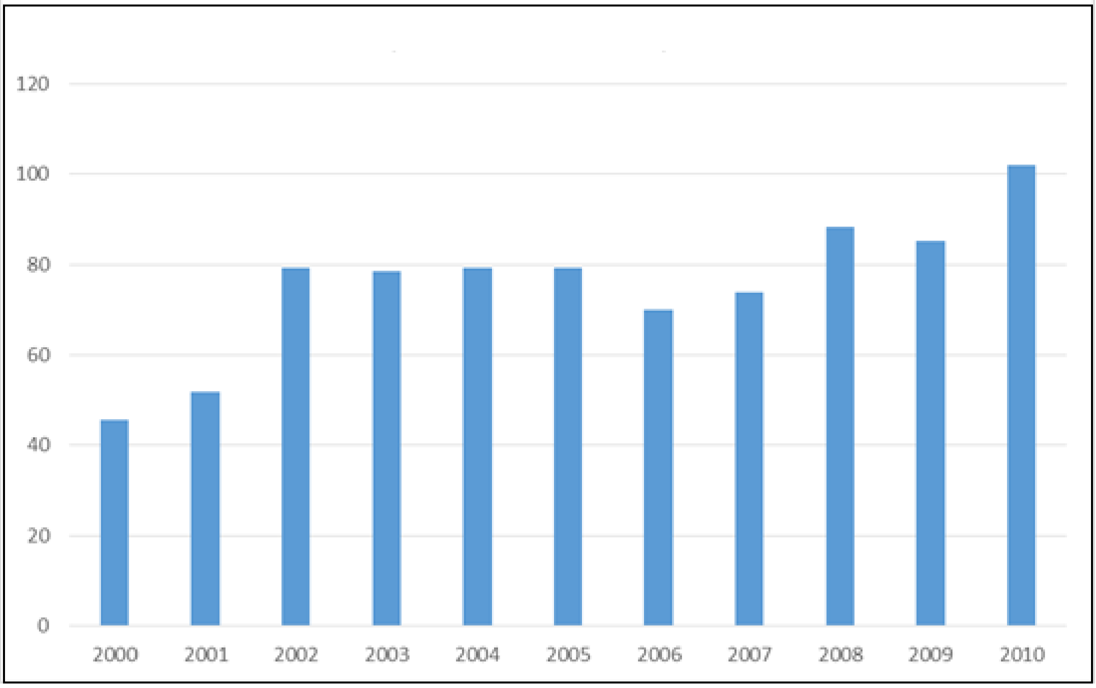

Figure 7: Evolution of Installed Capacity (MW)

Source: Electra Annual Account Reports

As figure 7 above shows, installed capacity in Cabo Verde has grown in recent years. According to Electra's Annual Report for 2006, the national electricity company had an installed capacity of 79.2 MW in 2005, in a set of 21 diesel power stations of different sizes and a thermal power plant (0.77MW) and 4 wind farms, with a 2.4 MW installed capacity, spread over the nine inhabited islands of Cabo Verde. However, it should be noted that 2010 is when the solar power plants of Praia and Sal started operations.

Next, Table 3 presents electricity generation, by source. Due to the lack of data and their reliability, electricity generation by family generators and small commercial establishments is not included, which is estimated to be irrelevant and presented in the energy consumptions by sector, in table 4, below.

Table 3: Electricity generation per source, 2000-2012

Year	Solar (GWh)	Wind (GWh)	Thermal (GWh)	Total (GWh)
2000	-	8,0	130,0	138
2001	-	6,0	149,0	155
2002	-	6,0	165,0	171
2003	-	5,0	182,0	187
2004	-	6,0	200,0	206
2005	-	6,4	229,6	236,0
2006	-	7,4	252,2	259,6
2007	0	6,9	275,5	282,4
2008	0	5,5	293,8	285
2009	0	4,7	304,3	295
2010	2.1	2,0	342,1	346
2011	9,0	15,6	340,3	361
2012	7,5	61,4	302,0	391

Source: Up to 2005 - *International Energy Statistics;* DNEIC/DSE - 2005-2012

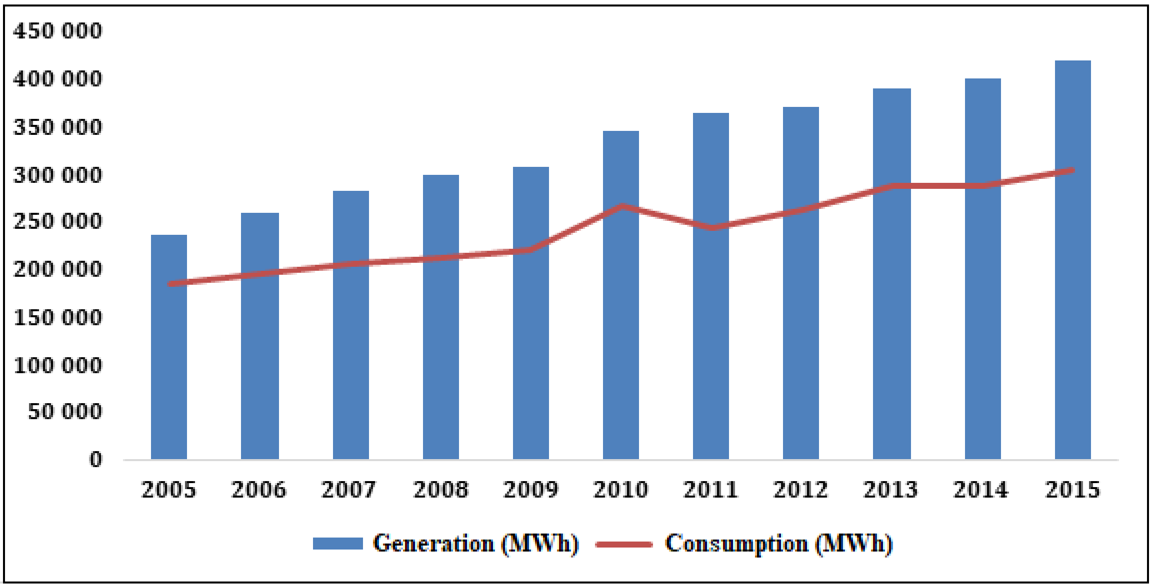

Figure 8: Evolution of electricity generation and consumption (MWh), 2005-2015

Source: DNEIC/DSE

According to figure 8, the progress of electricity generation and consumption has accompanied the country´s growth indicators.

1.7.2 Access to Electricity

Table 4: Evolution of electricity access rate in Cabo Verde, 2000- 2015

Years	2000	2010	2012	2013	2014	2015
Access to Electricity (%)	50	80	87	87	85	86

Source. INE

Cabo Verde increased its access rate to electricity to 86% in 2015, corresponding to a 36% growth rate, between 2000 and 2015.

1.7.2.1 Energy consumption per sector

The model includes an estimate of energy use by type and by sector. Having identified existing installed electricity generation capacities, effective production, transport losses, and imports of other energy resources, it is equally important and necessary to assess the energy use by economic sector. It is in this information that the use of other endogenous energies of the country, other than domestic electricity, becomes perceptible.

The calculation of the final energy use in Cabo Verde is based on sector calculation of this energy. In this sense, the following sectors were considered, with the respective energy consumption, presented below in table 5.

Table 5: Final energy consumption, per sector and type, 2013

Sector	Firewood (tep)	Coal (tep)	Buthane gas (tep)	Eletrictricity (tep)	JET A1 (tep)	Gasoline (tep)	Diesel (tep)	Total/sector (tep)
Household	**31081,72**	**0,00**	**6813,72**	**10900,33**	**0,00**	**0,00**	**48908,44**	**97704**
Agriculture	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0**
Industry	**816,11**	**442,63**	**3762,38**	**11511,65**	**0,00**	**0,00**	**0,00**	**16533**
Water	0,00	0,00	0,00	1642,30	0,00	0,00	0,00	1642
Other	816,11	442,63	3762,38	9869,34	0,00	0,00	0,00	14890
Services	**198,51**	**107,67**	**915,17**	**2400,65**	**0,00**	**0,00**	**0,00**	**3622**
Transports	**0,00**	**0,00**	**0,00**	**0,00**	**17936,37**	**7231,30**	**55098,88**	**80267**
Road	0,00	0,00	0,00	0,00	0,00	7231,30	49742,05	56973
Maritime	0,00	0,00	0,00	0,00	0,00	0,00	5356,84	5357
Air	0,00	0,00	0,00	0,00	17936,37	0,00	0,00	17936
Total per energy	**32096,34**	**550,30**	**11491,28**	**24812,62**	**17936,37**	**7231,30**	**104007,33**	**198125,54**

Source: Domestic information (factual document) – DG Energy CV

In late 2015 and according to INE Cabo Verde presented a national electrification rate above 95% and with an electricity access rate of 86%, as a result of an ambitious investment plan in production capacity and networks to improve the quality and safety of electricity supply to populations.

By 2016, 89.6% of households had electricity as the main source of energy for lighting, also with more expression in urban environment (93.0%) than in rural areas (83.1%). Gas is the main source of energy used by the vast majority of families (76.0%) in urban areas, while in rural areas only 42 out of 100 use gas, and wood is the most important source (55.2%). This poses a real threat to terrestrial biodiversity.

According to the National Plan for Renewable Energy (PNAER), in 2013 the fuel with largest share in domestic consumption is diesel, accounting for near 34.9%, followed by firewood and fuel with 26,7% and 16.2%, respectively. Production of desalinated water is directly linked to electricity generation and it consumes approximately 10% of the electricity produced in Cabo Verde.

In domestic energy, according to INE, in 2016, the most consumed fuel in urban areas is gas, around 76.0% of households, mainly in urban areas (91.1%), followed by firewood with 20, 6%, particularly in rural areas (55.2%).
The municipalities of Santiago, with the exception of Praia, register the highest consumption of firewood as a source of energy for cooking.
By islands, the largest demand for firewood is concentrated on the island of Santiago, representing about 50% of the national demand. About 39.5% of households use wood as the main energy source for cooking. The vast majority (85%) of the wood used is collected mainly by women and only 13.3% is purchased.

The successive increases in gas prices in recent years have led to an increase in firewood consumption for domestic use, particularly in rural areas, where most of the poor are concentrated.

Cabo Verde is not a country with tradition in charcoal production and use. Production is limited to the islands of Maio, Boavista and São Vicente, mainly for sale in Praia.

According to the Strategic Energy Plan, energy efficiency and technological innovation are considered as an alternative resource in the field of renewable energy.
The country is heavily dependent on energy from abroad, taking into account it imports near 99% of fossil fuels. However, a number of renewable energy projects are underway which, once implemented, will represent a nearly 30% reduction (20000 tons/year) in imports of petroleum products.
Electricity from the public grid continues to be the main energy source used by Cabo Verdean households for lighting, accounting for 58%, followed by the use of candles (18.7%) and petroleum (15.4%).

According to the National Plan for Domestic Energy (PNED), the use of electricity is strongly linked to higher income families, with the lowest income households mainly using candles and petroleum. Illegal connections to the electricity grid account for approximately 5.5 %.

The most used lamps by households are incandescent (73.3%), with only 7.8% of households using fluorescent lamps. Approximately 61.4% of households do not use low-energy bulbs. Although renewable energy sources´ capacity to contribute to energy production nationally is 3.2%, it does not even represent a percentage point. This is because the technologies used are not fully operational due to malfunctions and there are not sufficient technical personnel to perform maintenance and the equipment repairs.

1.8 Transport Infrastructure

In 2013, the country had near 1,046.4 km of road network, of which 37% was on the island of Santiago and 20.4% on Santo Antão. It is noted that the distribution of the road network has a certain proportionality to the size of the surface on each island.
Legal measures have been adopted to reduce accident rates, among which are the legal compulsory use of seat belts and prohibition of mobile phone use by the driver. Limits on the maximum level of alcohol intake were also legally defined.

The obligation to make periodic inspection of vehicles was instituted and the conditions to assign periodic inspection service of vehicles to private entities were legally defined. The public intercity and urban transport service is fully provided by the private sector.

Currently the country has four international airports, located in the islands of Santiago, Boa Vista, Sal and São Vicente. All of the islands, except for Brava, Santo Antão and Santa Luzia have an airfield for domestic flights. Also, it should be noted that all the islands, with the exception of Santa Luzia (which is not inhabited) is endowed with port infrastructure.

1.8.1 Road transport

The road transport fleet grew between 2007 and 2016 at an average annual rate of 14%. This growth reflects a rapid renewal of the fleet.

According to the AECV 2016, in the 2012-2015 period, there was a general 12.4% increase in the total number of vehicles registered. In 2015, near 70% were light vehicles, 20% motorcycles/quadricycles and heavy vehicles accounted for10.4%.

From 2012 to 2015, the most significant increase, in absolute terms, of the vehicles inspected, was registered in the island of Santiago (+ 4,270 vehicles inspected). The islands of Santiago and São Vicente represented, cumulatively, 75.1% of the total number of vehicles inspected in 2015.

1.8.2 Maritime Port System

1.8.2.1 Port Network and infrastructure

The territory´s island characteristics give great importance to maritime transport, aiming at internal mobility. In addition to the existence of three ports that receive international traffic (Praia, Mindelo and Palmeira), all the islands have port infrastructure capable of ensuring

maritime accessibility. Cabo Verde presents conditions to become a turning regional and international platform of passengers and cargo.
Passenger movement in national ports increased by 5.1% from 773,869 in 2012 to 813,687 in 2016. In the same period, there were increases in passengers, both on departures (4.6%) and arrivals (5.7%).

In relation to the goods movement, it was verified that, in 2016, most of the goods handled in ports were associated with arrivals (78.6%), a value consistent with the structure of the national economy, heavily dependent on imports of goods.
Overall, the movement of goods increased by 14.1%, from 2012 to 2016, with a highlight to the shipment movement, which increased by 17.6% and arrivals of passengers by 13% over the same period. AECV 2016.

1.8.3 Air sector

1.8.3.1 The airport system

Cabo Verde´s airport system consists of 4 international airports and 3 airfields: Amílcar Cabral Airport on Sal Island, Nelson Mandela Airport in Praia, Santiago, Cesária Évora Airport in São Vicente, Rabil Airport on Boavista and the Aerodromes in Preguiça- São Nicolau, São Felipe- Fogo, and Maio on the island with the same name. All the airport infrastructure are managed by the public company of Airports and Air Safety, ASA.

1.8.3.2 Air transports

National air transport is currently provided by Binter CV and the international services by the national airline, TACV Cabo Verde Airlines, TAP, Iceland AIR and other private companies. While the international lines are balanced, the inter-island lines are mostly loss-making. There are other foreign airlines operating regularly at the international airports of Cabo Verde, ensuring regular connections with the main international partners, and tourist charters to Sal, Santiago and Boavista airports. Some airlines use the island of Sal for technical stops.

Passenger flows increased by 12.5% from 2012 to 2016.
However, in this same period, the flows in domestic flights decreased by 8.2%, increasing by 27.6% in international flights. AECV 2016.
Regarding the aircraft movement, from 2012 to 2016, there was a general 14% decrease. In the same period, there were decreases of aircraft in domestic flights (-30.9%) and increases in international flights (16.5%).
With regard to cargo movement, there was a 14.9% decrease from 2012 to 2016.
During the same period, there were decreases in domestic flights (-30.2%) and increase in international flights (7.7%).
In relation to the postal movement, from 2012 to 2016, there was a 19% increase. In the same period, there were positive changes in postal movements, both domestic (16.8%) and international (21%).

The table 6 below summarizes the data of the main sectoral components of GDP related to the national circumstances of the country.

Table 6: Cabo Verde National Circumstances

Criteria	Unity	Absolute value (2000)	Absolute value (2004)	Absolute value (2016)	Source
Population	Nº	440.000	469.456	539.560	INE
Area	Km^2	4.033	4.033	4.033	REQA-2008
GPD	Esc	105.362	135.730	142.028	INE
GDP per capita	Esc	1.238,38	1.976,46	2.997,75	INE-CV (National Accounts)
Share of informal sector in GDP	%	35%	40%	40	Several (estimates)
Share of agriculture in GDP	%	7,7%	6.11%	10%	INE
Share of Fisheries in GDP	%	0,71	0,52	1,2%	INE
Share of Industry in GDP	%	26,1	26,7	20%	INE
Share of water and electricity in GDP	%	4,1	5,0	3,3%	INE
Share of construction sector in GDP	%	14,7	16,05	7,9%	INE
Share of trade in GDP	%	14,7	16,07	10,2%	INE
Share of hotels and restaurants in GDP	%	3,2	4,1	4,6%	INE
Share of transports sector in GDP	%	12,61	10,3	9,6%	INE
Share of communications sector in GDP	%	5,9	6,2	3,7%	INE
Share of Banks in GDP	%	2,4	2,7	3,9%	INE
Share of government services in GDP	%	11,3	12,5	15,9%	INE
Share of other services in GDP	%	1,4	1,4	0,9%	INE
Share of imports duties and taxes in GDP	%	6,3	6,0	12,6%	INE

Source: INE - Cabo Verde, Contas Nacionais (National Accounts), BCV.

1.9 Special circumstances

This item will address the special circumstances related to the specific needs and concerns arising from the negative climate change effects and/or impact resulting from response measure implementation, in accordance with article 4, paragraph 8 of the UN Framework Convention on Climate Change.

Some studies have been produced on specific sector vulnerabilities against possible negative impacts that may result from Climate Change effects. Although studies have covered the main areas of economic development, regarding the selection criteria Water Resources, Tourism and Agro-sylvopastoral / Coastal Zones were considered as priority sectors, needing immediate adaptation measures to minimize negative impacts. Other sectors such as Health and Biodiversity were also analyzed for vulnerability.

1.9.1 Coastal Areas

Cabo Verde has a 2,000 km coastline with urban and industrial areas, areas of intensive tourism as well natural, rural and fishing areas. The Exclusive Economic Zone (EEZ) of Cabo Verde comprises an area of approximately 734,000 km^2. The coastal area is a dynamic area with biological, chemical, physical and geological features in constant change, including relevant and highly productive biodiversity ecosystems, that offer habitat for many marine species, which are particularly vulnerable to climate change in the perspective of a possible rise in sea level resulting from global warming. Note that the geomorphological characteristics of the islands define a set of landscapes, where lowlands in the coast stand out (Table 7) that, nationally, are significantly vulnerable to a possible rise in sea level associated with extreme and adverse climate events, as are cases of storms with high winds, heavy rains and tidal waves.

Table 7: Vulnerable islands abs coastal areas

Islands	Vulnerable areas
Sal	Baía de Palmeira, Baía de Santa Maria, Buracona, Baía da Murdeira, Ponta de Sino and Costa de Fragata
Boavista	Baía do Sal Rei
Maio	Ribeira da Lagoa
Santiago	Porto da Praia, Zona Costeira da Praia Baixo, Porto da Calheta de São Miguel - Porto Formoso; Baía da Cidade Velha, Caniço, Porto de Praia Baixo and Baía do Tarrafal
Santo Antão	Cidade do Porto Novo, Vila das Pombas – Porto do Paúl, Baía de Janela, Baía de Monte Trigo, Ponta de Sol and Cruzinha
S. Vicente	Baía de S. Pedro, zonas balneares da Baía das Gatas and do Calhau
S. Nicolau	Baías do Tarrafal, Preguiça and Carriçal
Brava	Baía da Furna

1.9.2 General consequences of a possible sea level rise on coastal areas

Law No. 44 / VI / 2004, of July 12, published in the B.O. Nr. 20, Series I, establishes that the 80-meter-wide strip of land from the coastline belongs to the State of Cabo Verde. Private use is permitted by specific regulations and authorization from the Government. For turtle spawning beaches, a protection range of 150 meters was established through an executive order from the National Directorate for the Environment, as a protection measure. Although the majority of the Cabo Verdean population and consequently economic activities are concentrated in the coastal area (near 90%), the population per unit of coastline length (PLC) is not yet known, a parameter considered important to assess and quantify the direct impacts of a possible sea level rise on the population. For policy and management purposes related to the best response to sea level rise, the PLC parameter should be used in conjunction with other information, such as coastal geomorphology, land use types and economic activities, as well as historical data.

In Cabo Verde, the main effects of possible sea level rise would include increased coastal erosion, partial tidal flooding, increased salinity of wells and boreholes located in the inner parts of the islands, abandonment of some tourist infrastructure located in the areas affected by the tides. In some coastal areas, the negative effects caused by strong human pressure, combined with the poor management of coastal resources and aggravated by the incidence of natural factors (wind, runoff, rainfall, tides, etc.) are already evident, with the consequent degradation of structures, erosion and destruction of beaches. In order to restore and recover some of the potential of the coastal areas, pilot adaptation projects were developed in some coastal areas/islands.

Cabo Verde's ports play an important role in inter-island shipping (both cargo and passenger transport) in national and international trade and would be directly affected by climate change, with negative impacts on port structures and operations. Cabo Verdean coastal areas are generally vulnerable due to the geomorphological characteristics that define the different coastal configurations and topographic landscapes from one island to another.

Both mountainous and shallow islands have vulnerable coastal areas due to the occurrence of Climate Change related extreme climatic events. However, to minimize local impacts, existing legislation should be strictly enforced in order to reduce human pressure along the coastline to avoid the total degradation of the natural coastal protection that serves as the land/sea interface.

CHAPTER II GREENHOUSE GAS INVENTORY

As a signatory to the UNFCCC or Climate Convention, Cabo Verde has as one of its main obligations the development of National Communications and the subsequent periodic updating of the National Inventory of Anthropogenic GHG Emissions and Removals not controlled by the Montreal Protocol.

Cabo Verde has already presented the first and second Inventories, based on 1995 and 2000 years, respectively. It now presents the third inventory, following the Guidelines for the Preparation of National Communications of Countries Not Listed in Annex I to the Convention (developing countries) (Convention Decision 17/CP.8) and the IPCC methodological guidelines, namely those of 2006, and in the Energy sector and in some IPPU categories the 1996 guidelines were used.

Although the most relevant GHGs - CO_2, CH4 and N_2O occur naturally in the atmosphere, human activities have increased atmospheric GHG concentrations since the pre-industrial era. In addition to these natural GHGs, other substances that are produced exclusively by industrial activities also have the capacity to heat the atmosphere and include substances leading to the ozone layer depletion (CFCs, HCFCs and halons covered by the Montreal Protocol) and some other halogenated substances which contain fluorine - hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6) and nitrogen trifluoride (NF3) that do not deplete the stratospheric ozone layer but are potent GHGs.

There are also several gases that have no direct effect on global warming, but which affect the formation or destruction of other greenhouse gases.

This Inventory identifies the country profile for GHG emissions and removals generated by socio-economic activities for the baseline year 2005 and timeline 2005-2010.

2.1 Summary of GHG Emissions and Removals

Total GHG emissions and anthropogenic GHG removals in the country in 2005 were estimated at 297.40 Gg CO_2, 4.50 Gg CH_4, 0.19 Gg N_2O and 0.59 t HFC-134a.
In 2010, total CO_2 emissions were 292.84 Gg, corresponding to a decrease of 1.54% against 2005. Total emissions of CH_4 and N_2O increased by 26.76% (5.71 Gg) and 17.18 % (0.23 Gg), respectively. HFC-134a had an increase of 225,45% in 2010 compared to 2005 and was estimated at 1.90 t HFC-134a.

In 2005 total emissions were estimated at 452.54 Gg CO_2eq and in 2010 emissions totaled 485.26 Gg CO_2eq.
In 2005, each inhabitant in Cabo Verde produced approximately 0.98 t CO_2eq/inhabitant, increasing by 1.02% in 2010, to 0.99 t CO_2eq/inhabitant.

Indirect greenhouse gas emissions were calculated as well.
In 2005, they were estimated at 4.09 Gg NOx, 36.66 Gg CO and 3.68 Gg NMVOC. For the year 2010, NOx and CO emissions decreased by 11.41% and 11.16% respectively compared to 2005, and were estimated to be 3.6 Gg NOx and 32.57 Gg CO.
Emissions due to NMVOC in 2010 grew by 9.46% compared to 2005, with 4.03 Gg. NOx and CO gases were estimated in the AFOLU sector (Agriculture, Forests and Other Land Uses) mainly due to the burning of agricultural waste and also in the energy sector, in addition to the NMVOC, by the burning of fossil fuels In the IPPU sector, NMVOC are also estimated.

Table 8 and Figure 9 describe the evolution of GHG emissions and removals in Cabo Verde between 1995 and 2010 by sectors listed. The Energy sector has contributed most to total emissions in Cabo Verde, reaching 548.60 Gg of CO_2 eq in 2005, the highest value of the series listed. In 2010, emissions decreased by 1.17% compared to 2005.

Table 8: CO_{2eq} emissions and removals by sector, 1995-2010

Sectors	1995	2000	2005	2010	Variation %	
	Gg CO_2eq				2000-2005	2005-2010
Energy	233,74	300,29	548,60	542,16	82,69	-1,17
IPPU	0,35	0,51	1,35	3,37	168,21	148,48
AFOLU	- 96,27	- 123,47	- 129,77	- 117,81	5,11	-9,22
Waste	27,87	25,67	32,35	57,54	26,03	77,85
Total Emissions and Removals	**165,70**	**203,00**	**452,54**	**485,26**	**122,93**	**7,23**
Total Emissions and Removals without Forestry	**261,97**	**326,46**	**582,31**	**603,07**	**78,37**	**3,56**

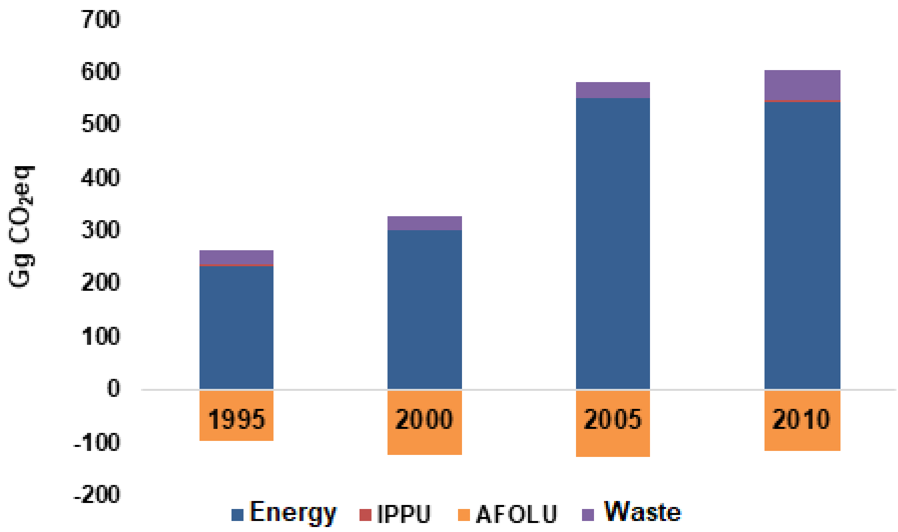

Figure 9: Evolution of CO_{2eq} Emissions and Removals by sector, 1995-2010

According to the 2006 IPCC guidelines, GHG emissions resulting from the export of fuels to international bunkers (aviation and marine) and biomass used as energy (firewood and coal) are not accounted for in the total emissions and removals of the country, but should be estimated and reported. The following table reports Cabo Verde's contributions to the *Memo Items*.

Table 9: Cabo Verde's contributions to the *Memo Items*, 1995-2010

Memo Items	**1995**	**2000**	**2005**	**2010**	**Variation %**	
	Gg CO2eq				**2000-2005**	**2005-2010**
Aviation	215,83	205,42	170,76	140,28	-16,87	-17,85
Marine	18,37	75,10	146,45	138,97	95,00	-5,11
Total International Bunkers	**234,20**	**280,52**	**317,21**	**279,24**	**13,08**	**-11,97**
Biomass	**177,97**	**145,41**	**151,33**	**147,49**	**4,07**	**- 2,54**

The country's contribution to CO2eq emissions in the International Bunkers decreased by 11.97% in 2010 compared to 2005, and the largest decrease was registered in aviation activity, which actually suffered a decrease in the number of flights in this period.

2.1.1 CO_2 Emissions and Removals

The Energy sector in 2005 and 2010 accounted for 533.87 Gg CO_2 and 528.35 Gg CO_2 respectively, of the total gross CO_2 emissions in Cabo Verde. The sector of AFOLU, more specifically Forestry, in 2005 and 2010 contributed to the net removal of CO_2, being in 2005 (-237.29 Gg CO_2) and in 2010 (-236.69 Gg CO_2), corresponding to a decrease of 0,25% in 2010 compared to 2005.

In 2005, the Transportation subsector accounted for 55.19% of total CO_2 emissions in the energy sector, followed by the Industry Energy subsector with 32.97%.

In 2010, the sub-sector Energy Industries accounted for 44.98% of total CO_2 emissions in the energy sector and Transports accounted for 40.80% of total CO_2 emissions in this sector. The total CO_2 emissions in the Transports sub-sector decreased by 26.83% compared to 2005, due mainly to the reduction in the number of domestic flights in Cabo Verde.

Table 10 e a figure 10 show CO_2 emissions in Cabo Verde by sector and subsectors.

Table 10: CO_2, emissions and removals by sector in 1995, 2000, 2005 and 2010

Sectors and Subsectors	1995	2000	2005	2010	Variation %	
	Gg CO_2				2000-2005	2005-2010
Energy	**219,75**	**287,88**	**533,87**	**528,35**	**85,45**	**-1,03**
Energy Industry	62,74	97,22	176,01	237,63	81,05	35,01
Industry	21,33	21,01	26,18	35,61	24,58	36,01
Transports	107,99	138,05	294,62	215,56	113,41	-26,83
Other sectors	27,68	31,60	37,06	39,56	17,31	6,73
IPPU	**0,35**	**0,38**	**0,59**	**0,89**	**56,98**	**49,88**
AFOLU	**- 196,77**	**- 229,84**	**- 37,29**	**-236,69**	**3,24**	**- 0,25**
Waste	**0,13**	**0,16**	**0,23**	**0,29**	**44,05**	**25,73**
Total Emissions and Removals	**23,46**	**58,57**	**297,40**	**292,84**	**407,75**	**-1,54**

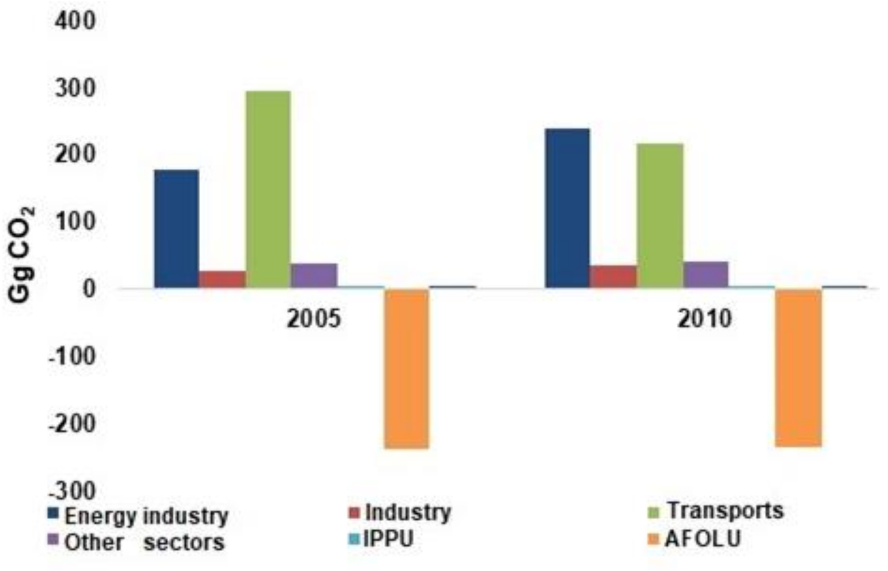

Figure 10: CO_2 emissions and removals by sector in 2005 and 2010

In 2005, the balance between emissions and removals in the AFOLU subsector, in absolute terms, presented an increased by 3.24% over 2000.

Figure 11 shows the evolution of CO_2 emissions by sector between 1995 and 2010.

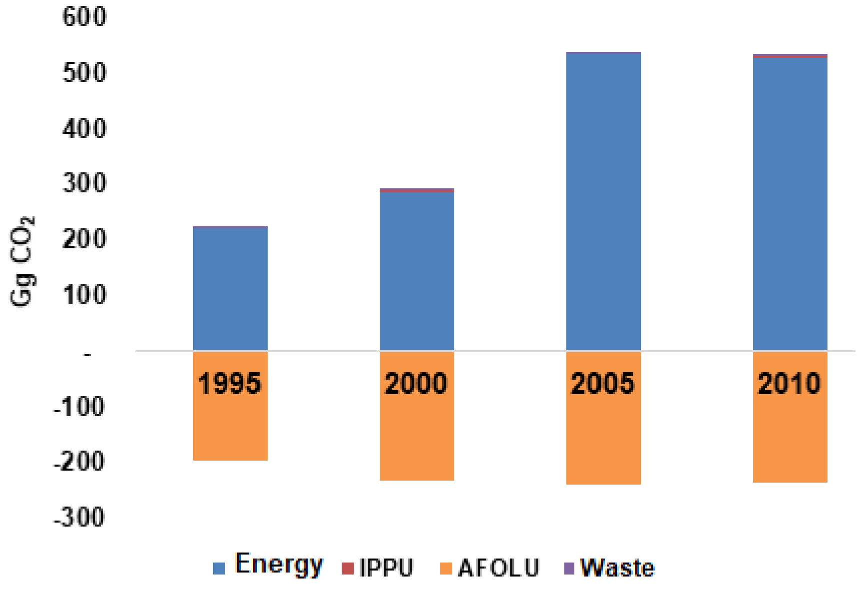

Figure 11: Evolution of CO_2 emissions and removals by sector, 1995-2010

2.1.2 CH_4 Emissions

CH_4 emissions in Cabo Verde grew by 26.78% between 2005 and 2010. The AFOLU sector, which also includes livestock activity, was the sector that most contributed to the total CH_4 emissions in Cabo Verde, with 63, 33% of total gas emissions. These emissions were due to the contribution of enteric fermentation, manure management and the burning of agricultural waste. In 2010, emissions in the AFOLU subsector were estimated at 2.90 Gg CH_4, representing an increase of 1.67% compared to 2005.

CH_4 emissions in the energy sector were estimated at 0.41 Gg CH_4 in 2005, falling by 2.25% in 2010. These emissions occur mainly due to the incomplete burning of fossil fuels.
CH_4 emissions in the waste sector occur due to disposal of solid waste in landfill, incineration and burning of waste and effluent treatment. In 2005 emissions in this sector accounted for 27.47% of total CH_4 emissions in the country, reaching 1.24 Gg CH_4 and in 2010 emissions increased by 94.38% to 2.40 Gg CH_4.

Of the total CH_4 emissions in 2010 in the waste sector the treatment of effluents was the activity that contributed the most to these emissions with 60.58%, followed by waste disposal with 34.99% of the total emissions.

Table 11 and figures 12 and 13 summarize CH_4 emissions by sector and subsector in Cabo Verde.

Table 11: CH_4 Emissions by sector and subsector, 1995-2010

Sector and Subsector	1995	2000	2005	2010	Variation %	
	Gg CH_4				2000-2005	2005-2010
Energy- Fuel burning	**0,49**	**0,41**	**0,41**	**0,40**	**0,99**	**-2,25**
AFOLU	**2,39**	**2,53**	**2,85**	**2,90**	**12,67**	**1,67**
Enteric fermentation	1,59	1,72	1,88	2,04	9,26	8,53
Manure management	0,14	0,15	0,16	0,17	7,69	4,33
Agriculture waste management	0,67	0,66	0,81	0,69	22,66	-14,74
Waste	**1,09**	**0,95**	**1,24**	**2,40**	**30,23**	**94,38**
Solid waste disposal	0,40	0,50	0,64	0,84	27,32	31,14
Effluent treatment	0,64	0,39	0,51	1,46	32,77	183,41
Incineration of waste	0,05	0,06	0,08	0,11	38,49	30,79
Total	**3,98**	**3,89**	**4,50**	**5,71**	**15,73**	**26,78**

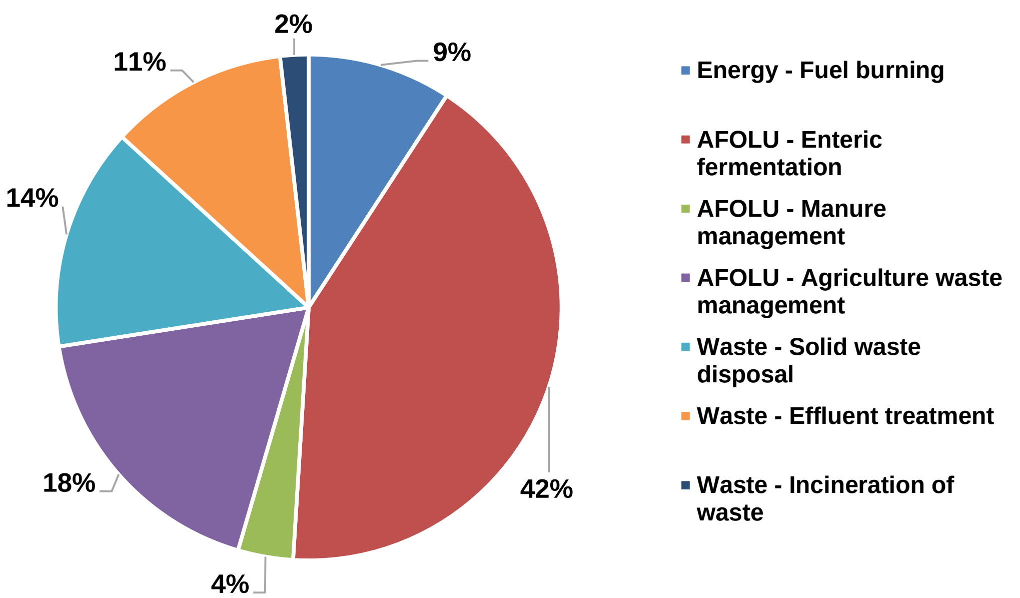

Figure 12: CH_4 emissions by sector and subsector in 2005

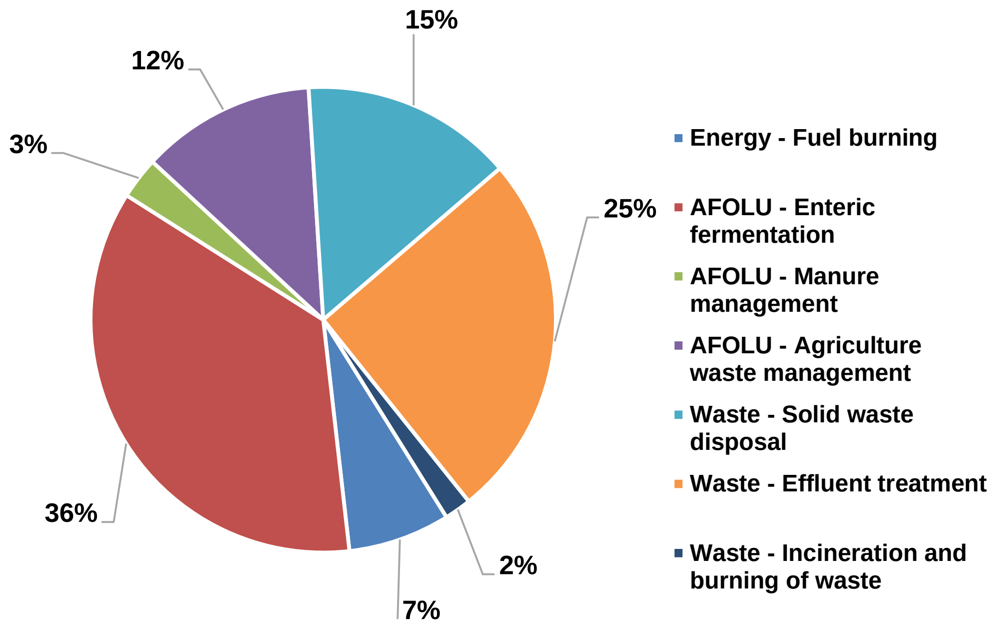

Figure 13: CH_4 emissions by sector and subsector in 2010

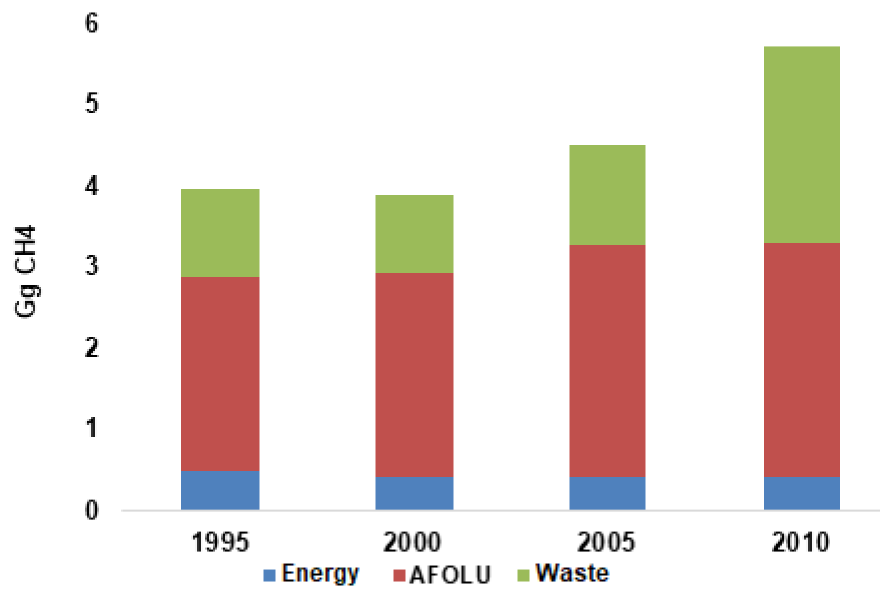

Figure 14: Evolution of CH_4 by sector, 1995-2010

2.1.3 N_2O Emissions

N_2O emissions in Cabo Verde increased by 17.2% between 2005 and 2010. These emissions occur mainly from the AFOLU sector due to indirect emissions in land management. In 2005 emissions in this subsector accounted for 79.63% of total N_2O emissions in Cabo Verde. Between 2005 and N_2O emissions in the AFOLU subsector grew by 21.88%, reaching in 2010 approximately 0.187 Gg.

In 2005, N_2O emissions in the energy sector were estimated at 0.019 Gg, representing 10.09% of total gas emissions.
In 2010 N_2O emissions in this sector decreased by 11.97% compared to 2005, and the sector accounted for 7.58% of total emissions in 2010.

The Waste sector in 2005 and 2010 accounted for 10.29% and 9.64%, respectively, of the total N_2O emissions in the country, most of which was due to incineration and open sky burning of waste.

Table 12 present national N_2O emissions by sector and subsector in 1995; 2000; 2005 and 2010.

Table 12: N_2O emissions by sector and subsector, 1995-2010

Sectors and Subsectors	1995	2000	2005	2010	Variation %	
	Gg N_2O				2000-2005	2005-2010
Energy- Fuel burning	**0,012**	**0,012**	**0,019**	**0,017**	**58,72**	**-11,97**
AFOLU	**0,162**	**0,172**	**0,153**	**0,187**	**-10,60**	**21,88**
Burning of agriculture waste	0,017	0,017	0,021	0,018	22,66	-14,74
Soils (direct emissions)	0,079	0,083	0,063	0,084	-24,46	34,67
Soils (indirect emissions)	0,065	0,072	0,070	0,085	-2,52	21,44
Waste	**0,016**	**0,018**	**0,020**	**0,022**	**10,47**	**9,92**
Total	**0,189**	**0,202**	**0,193**	**0,226**	**-4,52**	**17,24**

Below figures 15 and 16 show national N_2O emissions by sector and sub-sector in 2005 and 2010.

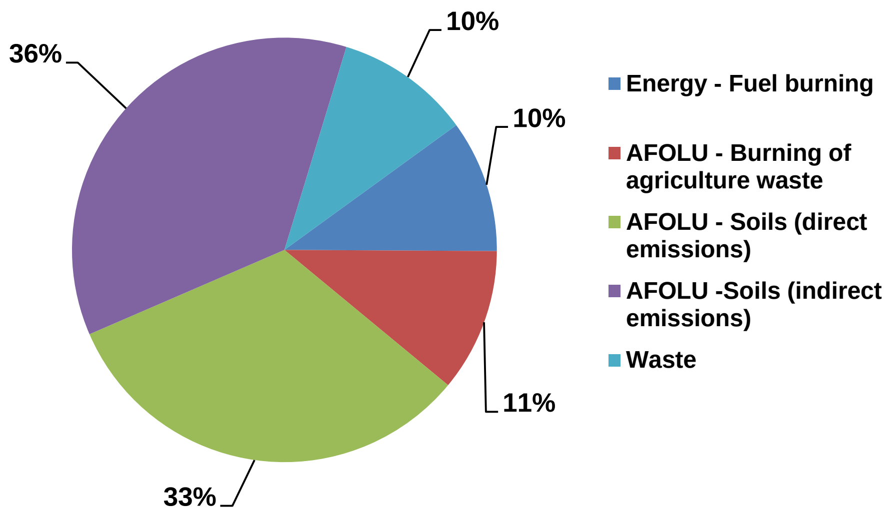

Figure 15: N_2O emissions by sector and subsector, 2005

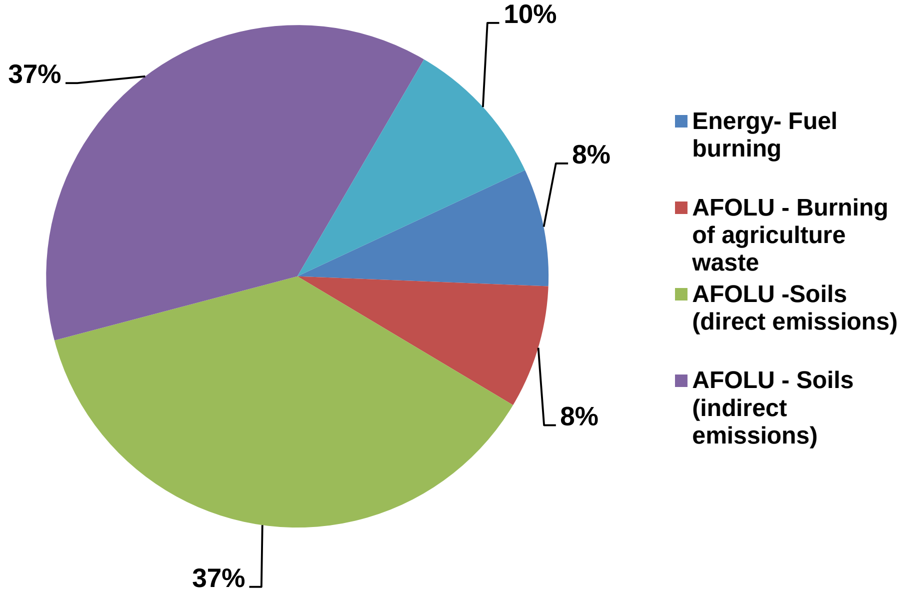

Figure 16: N_2O emissions by sector, 2010

Figure 17 presents N_2O emission evolution by sector, between 1995 and 2010.

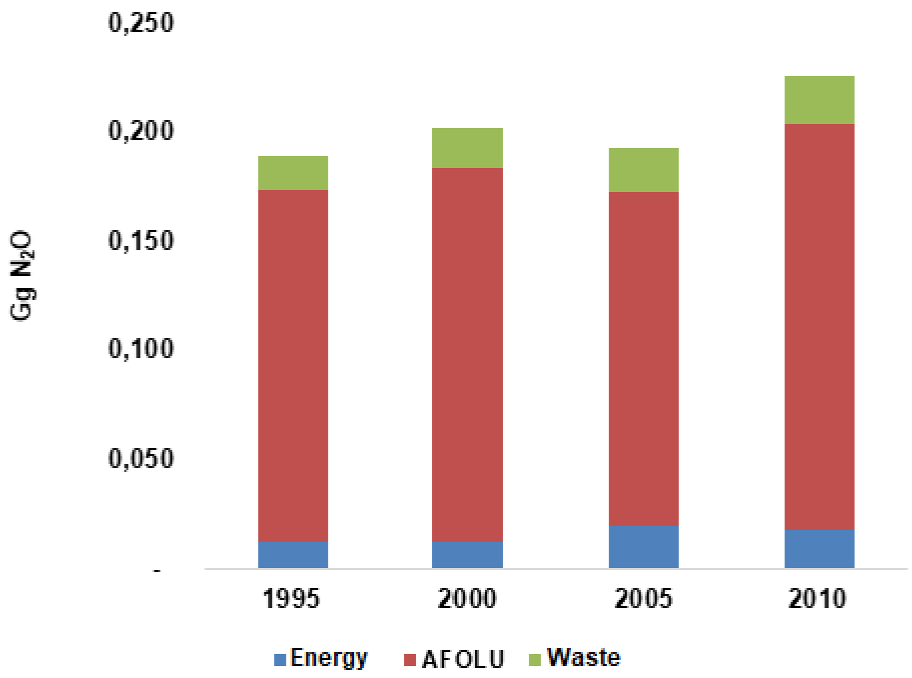

Figure 17: Evolution of N_2O emission by sector, 1995-2010

2.1.4 – Hydrofluorocarbon (HFCs) Emissions

Cabo Verde imports HFC-134a for use in refrigeration and air conditioning (fixed and mobile). HFC-134a Emissions were estimated in 2005 at 0.596 t HFC-134a, corresponding to an increase of 501% compared to 2000. In 2010, HFC-134a emissions grew by 225.94% compared to 2005.

Table 13: HFC-134a emissions in Cabo Verde, 1995-2010

Subsector	1995	2000	2005	2010	Variation %	
	t				2000-2005	2005-2010
Refrigeration and air conditioning	NE	0.098	0,585	1,905	501,03	225,94
Total	NE	0,098	0,585	1,905	501,03	**225,94**

2.1.5 Indirect GHG Emissions

Indirect GHG emissions were estimated in the energy sector, IPPU and AFOLU. In the energy sector, NOx, CO and NMVOC emissions were estimated due to the incomplete burning of fossil fuels. In the IPPU sector NMVOC emissions were estimated due to emissions in the food and beverage subsectors, foams and other solvents. In the AFOLU sector, NOx and CO emissions occur due to the burning of agricultural waste.

Total NOx emissions decreased from 4.09 Gg to 3.62 Gg between 2005 and 2010, corresponding to a decrease of 11.40%.
The energy sector is the main responsible for NOx emissions in the country, reaching 81.62% of total gas emissions in 2005 and in 2010 this represented 82.31% of total emissions.

The Transports subsector is the one that has contributed most to the emissions since the type of gas, in 2005 it was responsible for 78.25% of the total NOx emissions in the energy sector.

The following table presents the NOx emissions contribution by sectors listed.

Table 14: NO_X emissions, in Gg, by sectors and subsectors

Sectors and Subsectors	1995	2000	2005	2010	Variation %	
	Gg NOX				2000-2005	2005-2010
Energy	**1,60**	**2,00**	**3,34**	**2,98**	**67,19**	**-10,64**
Energy Industry	0,17	0,26	0,47	0,63	79,62	33,83
Industry	0,06	0,06	0,07	0,10	19,37	35,76
Transports	1,17	1,50	2,61	2,07	74,42	-20,77
Other sectors	0,20	0,18	0,18	0,19	3,92	1,44
AFOLU	**0,62**	**0,61**	**0,75**	**0,64**	**22,66**	**-14,74**
Total Emissions	**2,22**	**2,61**	**4,09**	**3,62**	**56,74**	**-11,40**

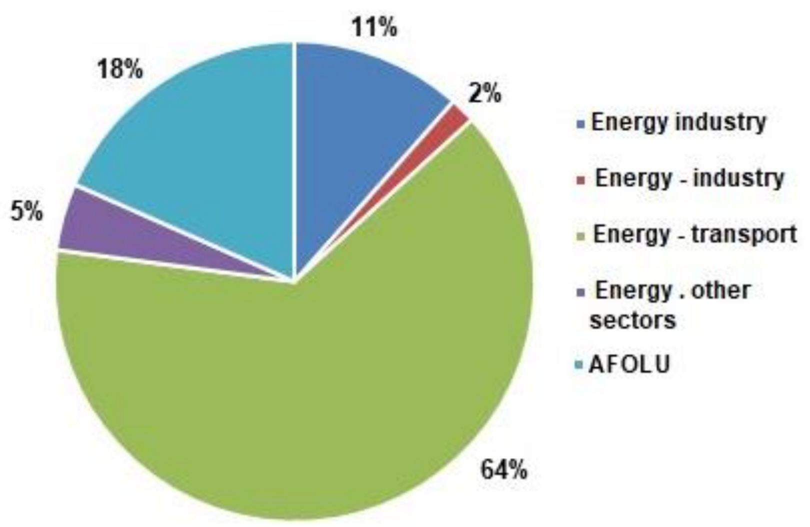

Figure 18: NO_X emissions by sector and subsector in 2005

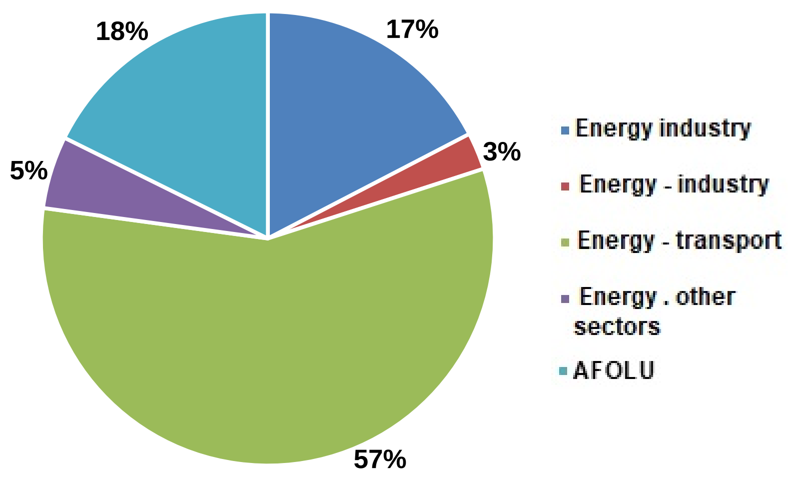

Figure 19: NO_X emissions by sector and subsector in 2010

Total CO emissions in 2005 reached 36.66 Gg and in 2010 32.57 Gg, corresponding to a 11.16% decrease in 2010 compared to 2005.

Table 15: CO Emissions in Gg, by sector and subsector 1995-2010

Sector and Subsector	1995	2000	2005	2010	Variation %	
	Gg CO				2000-2005	2005-2010
Energy	**11,12**	**10,36**	**11,40**	**11,05**	**9,97**	**-3,07**
Energy Industry	0,02	0,03	0,11	0,13	280,06	12,38
Industry	0,12	0,10	0,004	0,005	-96,55	35,76
Transports	3,10	3,80	4,86	4,53	27,94	-6,82
Other sectors	7,86	6,43	6,42	6,38	-0,21	-0,52
AFOLU	**20,88**	**20,58**	**25,27**	**21,52**	**22,76**	**-14,81**
Total Emissions	**32,00**	**30,94**	**36,66**	**32,57**	**18,48**	**-11,16**

The AFOLU sector namely the burning of agricultural waste, is largely responsible for CO emissions in Cabo Verde, contributing in 2005 with 25.27 Gg corresponding to 68.92% of total CO emissions, the energy sector in 2005 contributes with 31.08% of total emissions.

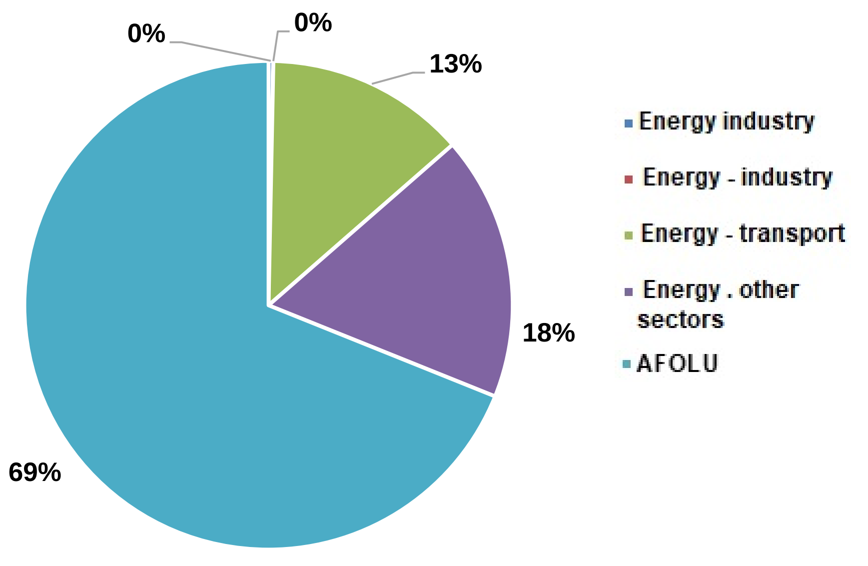

Figure 20: CO Emissions by sector and subsector in 2005

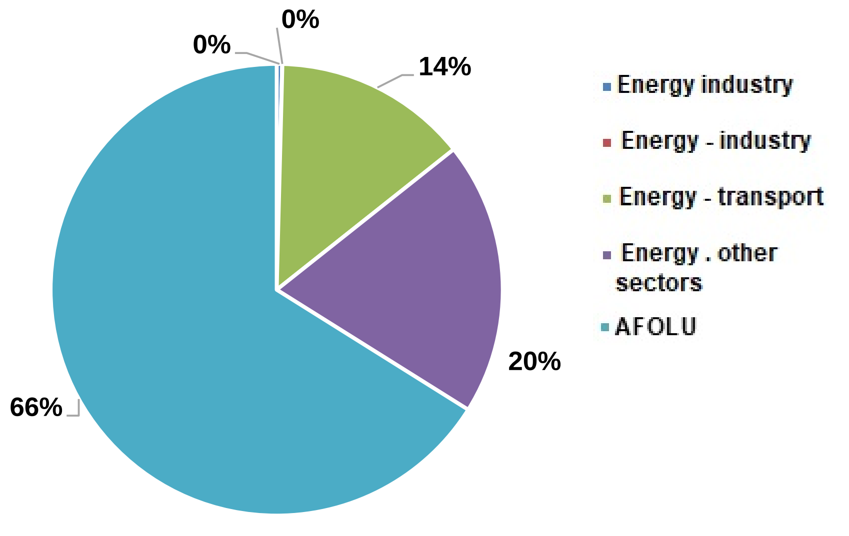

Figure 21: CO emissions by sector and subsector in 2010

Table 16: NMVOC emissions, in Gg, by sector and subsectors in 1995 -2010

Sector and Subsector	1995	2000	2005	2010	Variation %	
	Gg NMVOC				2000-2005	2005-2010
Energy	**1,555**	**1,521**	**1,761**	**1,671**	**15,76**	**-5,08**
Energy Industry	0,005	0,007	0,015	0,020	120,06	26,35
Industry	0,004	0,004	0,002	0,002	-54,27	35,76
Transports	0,602	0,738	0,986	0,896	33,52	-9,12
Other sectors	0,944	0,772	0,758	0,753	-1,83	-0,56
IPPU	**1,041**	**1,18**	**1,92**	**2,36**	**63,09**	**22,79**
Chemical industry	NE	NE	0,0008	0,0008	-	1,84
Solvent use	0,009	0,010	0,5498	0,648	5666,90	17,88
Other productions	1,032	1,167	1,369	1,708	17,25	24,78
Total Emissions	**2,60**	**2,70**	**3,68**	**4,03**	**36,41**	**9,46**

NMVOC emissions in 2010 increased by 9.46% compared to 2005, reaching a total of 4.03 Gg of NMVOC. In 2005 the emissions of NMVOC were estimated at 3.68 Gg, corresponding to an increase of 36.41% in relation to 2000.

The IPPU sector was the sector that contributed most to total emissions in 2005, with a total of 1.92 Gg of NMVOC, which corresponds to an increase of 22.79% in 2010 compared to 2005.

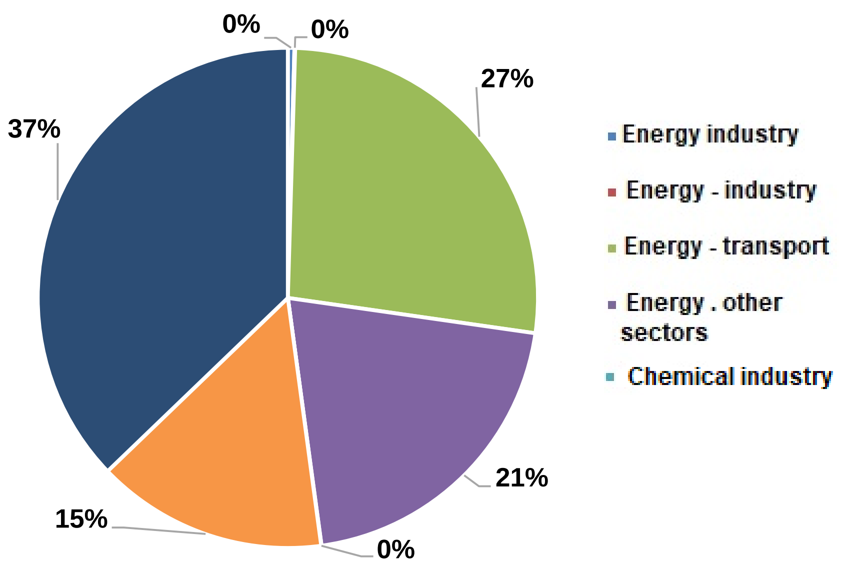

Figure 22: NMVOC emissions by sector and subsector in 2005

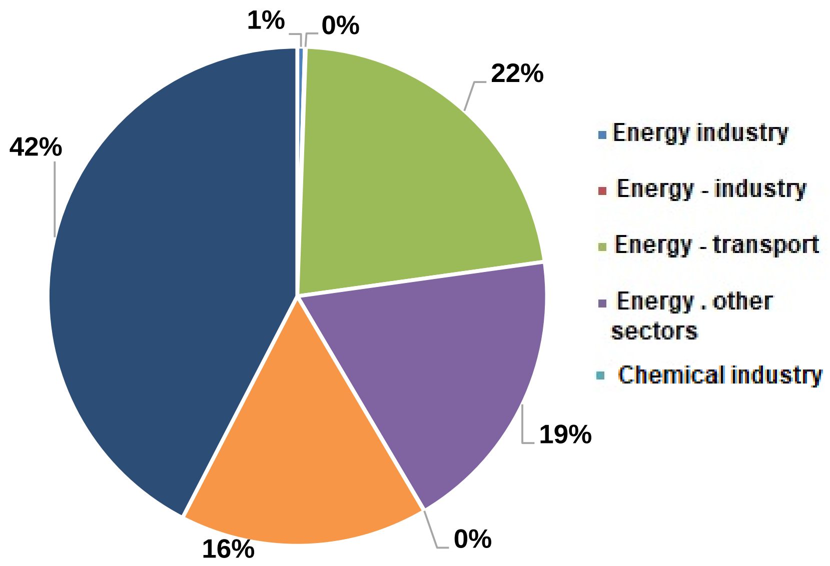

Figure 23: NMVOC emissions by sector and subsector in 2010

2.2 GHG Emissions and Removals by Sector

This inventory has been prepared in accordance with the 1996 and 2006 IPCC guidelines for conducting national GHG inventories. GHG emissions and emissions were listed in the following sectors: Energy, IPPU, AFOLU and Waste.

2.2.1 Energy sector

The Energy sector contributes to GHG emissions through the transmission and distribution of fuels and burning of fuels in fixed and mobile sources. Fugitive emissions occur in the country, mainly in the transformation, distribution and final use of fuels. These emissions have not been estimated in this inventory since there are no available data and/or measurements in Cabo Verde.

According to IPCC 2006 guidelines, international bunker emissions should be estimated by each country, but not included in total national GHG emissions and removal estimates, and reported in the memo items category. Also in the case of biomass fuels (firewood and coal) CO_2 emissions are assigned to a separate category of total national GHG emissions, but CH_4 and N_2O emissions for the use of firewood and coal are considered in total emissions of this sector.

As mentioned above, emissions from fixed sources of CO_2 were considered in this sector due to the burning of fossil fuels. During the combustion process the carbon and hydrogen of the fuels are converted mainly into CO_2 and water (H_2O). CH_4 and N_2O, gases resulting from the combustion process, were also accounted for in GHG emissions from the sector.

There are also other gases that can be released during the combustion process due to the incomplete burning of fuels, namely CO, NO_X and NMVOC. These were also estimated in this sector using the 1996 IPCC guidelines.

Table 17: Methodological Level and Guidelines used in the Energy Sector

Category	Methodological Level	Guidelines
1 - Energy	1	IPCC 2006
1.A.1 – Energy Industry	1	IPCC 2006
1.A.2 – Industry and construction	1	IPCC 2006
1.A.3 - Transports	1	IPCC 2006
1.A.4 – Other sectors	1	IPCC 2006
1.A.5 – Non specified (Biomass)	1	IPCC 2006
1.B - Fugitive Emissions	NE	NE

GHG emissions due to the use of fuels for non-energy purposes, due mainly to the use of lubricants, were considered in the IPPU sector.

2.2.1.1 Emissions due to Fuel Burning

2.2.1.1.2 CO_2 emissions due to fuel burning

CO_2 emissions due to the burning of fossil fuels were estimated according to the methodology specified in the IPCC 2006 guidelines, using the available inventory software. The baseline approach was used, which considers that CO_2 emissions are calculated from the energy supply in the country, more precisely from the energy balance.

For CO_2 emission estimates, methodological level 1 was used based on the amount of fuel burned and the standard emission factors. Methodological level 1 (Tier 1) was used because the country's national emission factors are not yet available.

For emissions estimates, data were collected, both from state and private institutions, of energy production and consumption by type of source. These data allowed the preparation of the energy balance for the baseline years of the inventory, 2005 and 2010.

Due to insufficient annual data on firewood and coal production, the production data contained in the baseline report for Cabo Verde, prepared in 2014, were considered for the energy balance. In that report, it was considered that the overall efficiency of the process of coal production is around 33.3%. Annual consumption of firewood and coal was estimated taking into account the same distribution of end use considered in the baseline report for Cabo Verde.

Based on the energy balance data produced, the application of the IPCC 2006 methodology was followed through the software respecting the following steps:

1. Introduction of production data, in tep, (in the case of firewood), consumption and export (international bunkers) - See 2005 and 2010 balance sheets in Annex II;
2. For conversion of the data introduced the single conversion factor from tep to TJ was used, considering 1 tep = 0,041861TJ;
3. Introduction of emission factors, in kg/TJ, by type of fuel and by subsectors of the activities listed, default values of the IPCC - see values in Annex II;

Carbon oxidation factors were not considered for the calculation of GHG emissions, considering that these are already included in the emissions factors set out in the 2006 IPCC guidelines.

2.2.1.1.3 CH_4 and N_2O emissions due to fuel burning

These gases were estimated for all types of fuels, including for biomass derivatives, using methodological level 1, since no information was available on the use and characteristics of the burning equipment. The IPCC 2006 software was also used to estimate these gases. In this software were introduced data on production, consumption and export of fuels, the single conversion factor of data from tep into TJ and the default emission factors of the IPCC, for each type of fuel and by subsector.

Table 18: CO_2 eq emissions in Energy subsectors, 1995, 2000, 2005 and 2010

Subsectors	1995	2000	2005	2010	Variation %	
	Gg CO_2eq				2000-2005	2005-2010
Energy Industry	62,97	97,56	176,73	238,55	81,15	34,98
Industry	21,44	21,11	26,27	35,73	24,43	36,01
Transports	109,73	140,26	298,89	218,94	113,09	-26,75
Other sectors	39,60	41,35	46,71	48,94	12,96	4,78
Total	**233,74**	**300,29**	**548,60**	**542,16**	**82,69**	**-1,17**

CO_2eq emissions in the energy sector decreased by 1.17% between 2005 and 2010. This decrease stems mainly from the decrease in emissions in the Transports subsector, due to the decrease in the number of domestic flights.
In 2005 CO_2eq emissions in this subsector accounted for 54.48% of total CO_2eq emissions in the Energy sector, followed by emissions from the energy industries sub-sector with 32.22%. In 2010 the subsector energy industries were responsible for 44.00% of total CO_2eq emissions from the energy sector, surpassing the Transports subsector.
CO_2eq emissions in the subsector industries increased by 36.01% between 2005 and 2010, thus demonstrating the changing energy consumption pattern in the industry.

Figures 24 and 25 show CO_2eq emissions in the Energy sector by activity sub-sector.

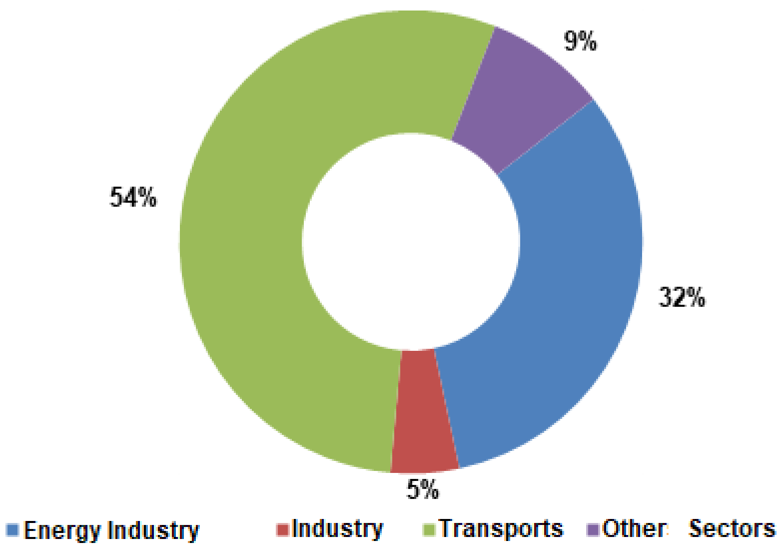

Figure 24: CO_2eq emissions in Gg, in Energy Sector by subsector in 2005

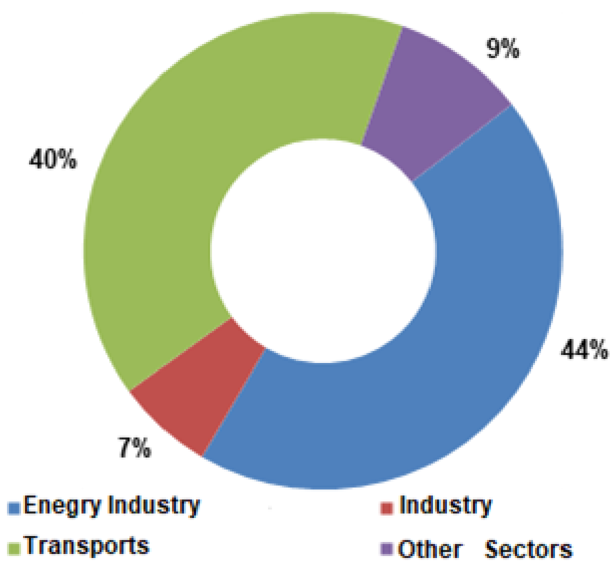

Figure 25: CO_2 eq emissions in Gg in Energy Sector by subsector in 2010

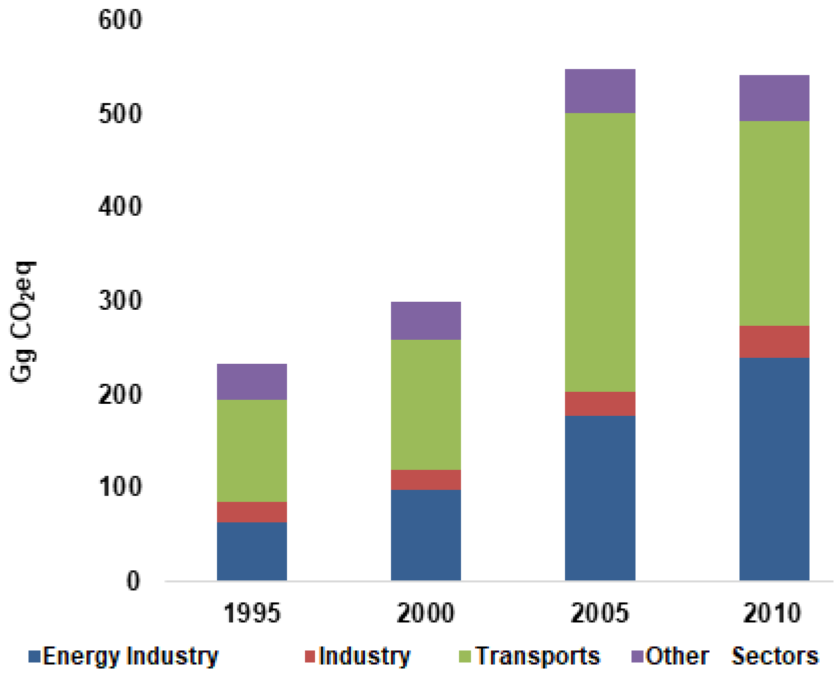

Figure 26: CO_2eq emissions in Energy Sector and subsectors, 1995-2010

2.2.2 Industrial Processes and Product Use (IPPU)

The IPPU sector allows, like the others, to know the country's profile regarding GHG emissions and other gases. In this sector, the gases listed were HFCs, carbon dioxide CO_2 and NMVOC. However, gases such as PFCs, SF_6, CO and NOx were not estimated since there is no activity data allowing for any estimation in Cabo Verde. The NF_3 and N_2O gases are used in the country in insignificant quantities and were therefore not considered.

Estimates for the IPPU sector were made according to the following subsectors:

- Chemical industry: Production of Vinyl chloride – PVC, Polystyrene, Polyethylene HDPE, Polyethylene PEBD, Polyethylene PELBD;
- Non-energy products from fuel and solvent use - Essentially by the use of lubricants in the industry;
- Refrigeration sub-sector: HFC emissions due to the use of this gas in fixed and mobile air conditioners;
- Solvent use and other products: emissions, including the use of paints, dry cleaning, foam processing, printing industry; and
- Other products: food and beverage production activities.

Activity data and emission factors survey was performed with the subsectors described above. Default emission factors of the IPCC guidelines were used since there were no national data published, respecting the principles of transparency, consistency and accuracy recommended by the IPCC. The following table specifies the methodological level and the guidelines used to estimate GHG emissions in this sector.

Table 19: Methodological level and IPPU Sector Guidelines

Categories	Methodological level	Guidelines
2 – Industrial processes and product use		
2.B - Chemical industry	1	IPCC 1996
2.C – Metal industry		
2.D – Non-energy products and Solvent use	1	IPCC 2006
2.D.1 – Use of lubricants		
2.F – Use of products as substitutes for ozone depleting substances	1	IPCC 2006
2.H – Other		
2.H.2 – Food and Beverage Industry	1	Corinair 1966
2.H.3 - Other (paints)		

In Cabo Verde some industrial processes and product use that are referenced in IPPC 2006, were not listed, because they do not exist in the country so far, i.e.:

- Mineral Industry;
- Chemical industry, excepting those above mentioned;
- Metal industry;
- Electronic industry (including the use of NF_3) and
- Other productions, more precisely paper industry (including the use of NF_3, SF_6 and PFCs).

2.2.2.1 Chemical industry

Emissions from the chemical subsector in Cabo Verde are associated to the production of PVC, Polystyrene, polyethylene HDPE, polyethylene PEBD, Polyethylene PELBD, which produce indirect NMVOC emissions according to the IPCC 1996. For chemicals, indirect greenhouse gas emissions were calculated with emission factors listed in the Table below.

Table 20: Emission factors for chemical emission

Chemical product	kg NMVOC/t chemical
PVC	1,5
Polyethylene PEAD	6,4
Polyethylene PEBD	3
Polyethylene PELBD	2

Table 21: Chemical production, in t, for 2005 and 2010

Year	Chemical production (t)			
	PVC	Polyethylene PEAD	Polyethylene PEBD	Polyethylene PELBD
2005	7,72	77,20	80,00	28,00
2010	8,27	77,50	81,40	31,90

2.2.2.2 Non-energy products from fuel and solvent use

CO_2 emissions in this sub-sector were estimated according to the methodology specified in the IPCC 2006 guidelines, using the available inventory software and methodological level 1, which is based on the amount of lubricants used in industry and Transports and on standard emission factors. The methodological level 1 was used because in the country the national emission factors associated with the use of lubricants in the industry and Transports are not yet available.

In this inventory, no emissions were estimated due to the use of bitumen, although they exist in the country. The quantities of bitumen used mainly in road asphalt were insignificant in 2005 and 2010 and therefore were not taken into account when calculating the emission estimates for this subsector.

For emission estimates, data were collected on the consumption of lubricants from the companies selling this type of fuel. As the data on the consumption of lubricants per year are in Gg and the lower calorific value in TJ/Gg, conversion of consumptions is made into TJ, followed by the introduction of lubricant consumption, content and fraction of carbon oxidation in the IPCC 2006 software. Default values for the content and fraction of carbon oxidation defined in the IPCC 2006 guidelines were applied.

Table 22: Estimate of lubricant sale, in tons

Lubricants (t)	1995	2000	2005	2010
Use in road Transports	533	570	895	734
Use in Industry	186	199	313	1077

The Table below shows the default emission actors that allow estimating emissions from fuel use.

Table 23: Emission factors to estimate emissions due to use of lubricants

Lubricants	Lower Calorific Value (TJ/Gg)	Carbon contents (t C/TJ)	Oxidation fraction
	33,5	20	0,2

2.2.2.3 - Use of products as substitutes for ozone depleting substances

In this subsector, only HFCs (R134a) emissions were identified, for refrigeration and fixed air-conditioning and air-conditioning for vehicles.
Other subsectors such as fire extinguishers and explosion protection, aerosols, solvents and foams were not estimated because there is no domestic production and no devices with these substances are imported.
The emissions were estimated for the 2005 to 2010 period using the IPPC 2006 guidelines for this subsector. IPCC 2006 software was used for the operation. A loss of 15% of the installed base, a 10-year equipment life, and a 25% destruction of the remainder at the end of its useful life were considered.

Imports of HFCs were obtained from the information provided by the Customs information analysis system and data from the National Ozone Program of the National Directorate for the Environment, presented in the following Table.

Table 24: Evolution of HFC 134a imports, in kg

Year	HFC 134a imports (kg)
2000	653
2001	691
2002	767
2003	976
2004	1068
2005	1170

Year	HFC 134a imports (kg)
2006	1206
2007	1432
2008	2134
2009	3211
2010	2979

2.2.2.4 Solvent use and other products

NMVOC solvent related use emissions were estimated. The calculations were carried out by type of use building on the guidelines recommended by CORINAIR 1996. Following the methodology approach, the following activities were highlighted: paint application, dry cleaning, polyurethane foam processing, printing industry and domestic use. The estimates are explained below.

Paint application

This activity is broken down in two sub-activities: construction and buildings, and domestic use:

a) **Construction and buildings**: to estimate emissions NMVOC in this subactivity, the average per capita emission factor of 0.99 kg/capita/year (average emission factors observed by the national paint manufacturers) was used, associated to the evolution of the economically active population in the 1995/2010 period. Thus, table 25 presents NMVOC emissions estimation for the 1995/2010 period in this subsector.

Table 25: NMVOC (t) emission estimates related to Construction and Buildings

Year	PEA	NMVOC Emissions (t)
1995	132 618	131,29
2000	150 000	148,50
2005	266 826	264,16
2010	314 615	311,47

b) **Domestic use**: similarly, to item (a), this was also evaluated based on the average per capita emission factor, which is 0.73 kg/ capita/ year (average emission factors observed by the national paint manufacturers), in association with EAP evolution in the 1995-2010 period

Table 26: NMVOC (t) emissions related to domestic use

Year	PEA	NMVOC Emissions (t)
1995	132 618	96,81
2000	150 000	109,50
2005	266 826	194,78
2010	314 615	229,67

Dry cleaning

The main solvent used in dry cleaning is tetrachloroethane (also called tetrachlorethylene or perchlorethylene, also an NMVOC).

In order to quantify the use of this solvent for this specific activity, 100% of solvent used was considered because there was no local production of this substance. Thus Table 31 shows the evolution of total PER consumption in laundries (dry cleaning).

Table 27: NMVOC (t) Production and Emission due to dry cleaning

Year	Production (t)	NMVOC* Emissons (t)
2005	0,88	0,88
2010	1,73	1,73

Polystyrene foam processing

Foam production occurs through the action of a blowing agent, pentane in the case of polystyrene foam (water is used as a blowing agent in flexible foams). According to CORINAIR 1996, emissions occur from the production of expandable polystyrene foam (EPS), which incorporates 6% of the agent, before expansion.
Thus, for the quantification of NMVOC emissions in these activities, the series related to the production of EPS foams is needed, directly available in the sources consulted.

Table 28: Evolution of EPS production and related NMVOC emissions

Year	Production (t)	NMVOC Emissions (t)
1995	140,49	8,43
2000	158,90	9,53
2005	165,77	9,95

Year	Production (t)	NMVOC Emissions (t)
2010	181,51	10,89

Printing industry

The simple proposed methodology for the quantification of NMVOC emissions in this activity requires knowledge of the historical series of paint consumption verified in press, publishing/publishing, packaging (probably the most significant) and others.
Therefore, given the absence of consolidated statistics in these sectors, and in order to provide an estimate, albeit preliminary and similarly to what was made in other sectors, the average of the emission factors per capita observed in other countries, associating them with the EAP was applied.

In this inventory we used the same factor value of the emissions that was used in the Second National Communication, 0.3 kg/person/year.

Table 29: NMVOC emissions (t) occurred in printing industry

Year	PEA	NMVOC emissions (t)
1995	132 618	39,79
2000	150 000	45,00
2005	266 826	80,05
2010	314 615	94,38

2.2.2.5 Other productions

In food and beverage subsector, productive process related emissions are NMVOC. These emissions were estimated based on the emission factors suggested by the IPCC 1996 since the 2006 IPCC does not include new values, recommending the use of other guidelines.
During the use of cereals and fruits in the fermentation processes emission of NMVOC occurs.
To know these emissions, the activity rate, that is, the total annual production, is multiplied by emission factors. For this estimate the Excel tool was used.

Food production

Table 30: Food production and related Emission Factors

Food	Production (kg)				Emission Factor kg/NMVOC/t
	1995	2000	2005	2010	
Meat, fish, poultry	5208,00	5890,60	5632,50	4254,00	0,30
Bread	12 109,27	13.696,40	17 268,35	19 628,21	8,00
Animal Food	8665,45	9801,20	10 552,32	12 759,48	1,00
Coffee roasting	77 295,15	87 426,00	111 215,01	72 032,12	0,55

Table 31: NMVOC Emissions related to food production

Food	NMVOC Emissions (t)			
	1995	2000	2005	2010
Meat, fish, poultry	1,56	1,77	1,69	1,28
Bread	96,87	109,57	138,15	157,03
Animal Food	8,67	9,80	10,55	12,76
Coffee roasting	42,51	48,08	61,17	39,62
Total	**149,61**	**169,22**	**211,56**	**210,68**

Beverage production

Table 32: Beverage production and related emission factors

Beverage	Production (hL)				Emission factor kg/hL
	1995	2000	2005	2010 2015	
Wine	102,38	115,80	122,14	127,05	0,08
Beer	13 735,70	15 536,00	18 830,36	22 730,05	0,04
Destilled	58 786,97	66 492,00	77 083,65	99 738,00	15,00

Table 33: NMVOC Emission (t) due to beverage production

Beverage	NMVOC Emissions (t)			
	1995	2000	2005	2010
Wine	0,01	0,01	0,01	0,01
Beer	1,10	0,54	0,66	0,80
Distilled (cane brandy)	881,80	997,38	1156,25	1496,07
Total	**882,91**	**997,93**	**1156,92**	**1496,88**

The Table below summarizes total NMVOC emissions and emissions from subsectors contributing to theses emissions, in tons.

Table 34: Total NMVOC emissions by subsectors in t, 1995 - 2010

Subsectors	1995	2000	2005	2010
Chemical industry	**NE**	**NE**	**0,80**	**0,82**
PVC Production	NE	NE	0,01	0,01
PEAD Production	NE	NE	0,49	0,50
PEBD Production	NE	NE	0,24	0,24
PELBD Production	NE	NE	0,06	0,06
Solvent use	**8,97**	**9,53**	**549,82**	**648,14**
Paint use	NE	NE	458,94	541,14
Foam processing	8,97	9,53	9,95	10,89
Dry cleaning	NE	NE	0,88	1,73
Printing Industry	NE	NE	80,05	94,38
Others productions	**1031,91**	**1167,16**	**1368,48**	**1707,56**
Food production	149,61	169,22	211,56	210,68
Beverages production	882,29	997,93	1156,92	1496,88
Total	**1040,88**	**1176,69**	**1919,10**	**2356,51**

NMVOC's emissions increased by 22.79% in 2010, reaching 2356.51 t the subsector that contributed the most to this increase was Other productions, in particular beverage and food production, which accounted for 72.46% of the total NMVOC emissions in 2010.

In the Solvent use subsector, the paint use is the activity with the highest NMVOC emissions recorded both in 2005 and 2010, with 83.47% and 83.49%, respectively, of the total NMVOC emissions in the Solvent use subsector.

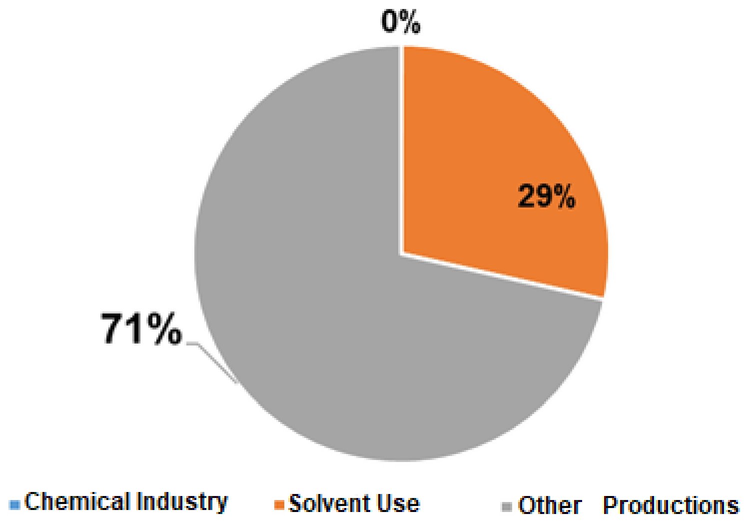

Figure 27: NMVOC Emissions by subsector, in t, 2005

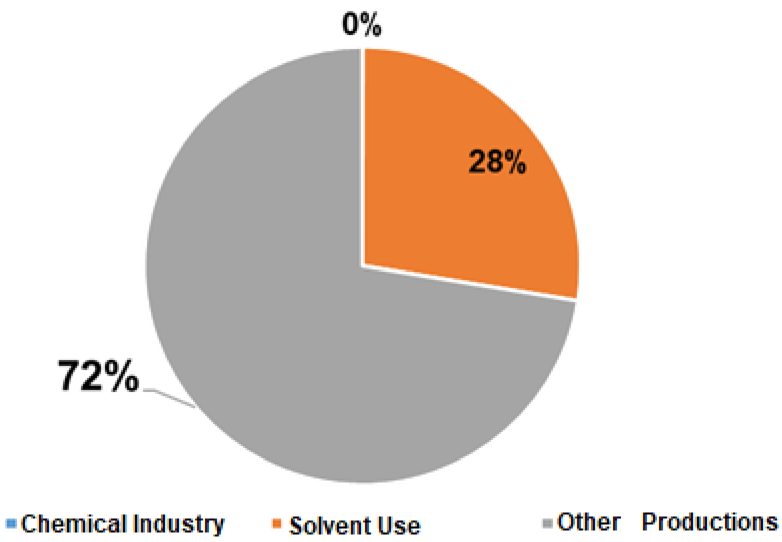

Figure 28: NMVOC Emissions by subsector, in t, 2010

2.2.3 Agriculture, Forestry and Other Land Use (AFOLU)

This sector encompasses emissions and removals from the livestock, forestry and other land uses and agriculture subsectors.

Livestock contributes to emissions due to enteric fermentation of livestock, which is one of the largest sources of CH_4 emissions in Cabo Verde. The emissions due to manure management and disposal and Daily Spread are considered in the subsector agriculture.

Emissions and removals under forestry and other land uses subsector result from the variation of the carbon stock present in forest areas. Due to the lack of data, only the emissions and removals related to the Variation of aerial biomass and emissions derived from the burning of forests were estimated. Carbon emissions and removals were not considered in this inventory. This inventory did not consider Variation of the carbon stock in the biomass below the soil, the organic matter in the soil of the areas with woody vegetation and debris and dead organic matter.

The agriculture subsector includes emissions related to burning of agricultural residues, urea application and soil management. The burning of agricultural waste is responsible for the emissions of CH_4, N_2O, NO_X and CO and the application of urea for CO_2 emission. Soils contribute with direct and indirect N_2O emissions, mainly due to the application of synthetic and organic fertilizers and the disposal of animal manure in pasture.

The following table presents the methodological level and the guidelines used to estimate emissions and GHG removals in the AFOLU sector.

Table 35: Methodological level and Guidelines for AFOLU

Category	Methodological level	Guidelines
3 - Agriculture, Forestry and Other Land Uses		
3.A – Livestock	1	IPCC 2006
3.A.1 – Enteric fermentation		
3.A.2 – Manure management	1	IPCC 2006
3.B – Land	1	IPCC 2006
3.B.1 – Forestry		
3.C – Agriculture		
3.C.1 - Emissions due to agriculture waste burning	1	IPCC 2006
3.C.3 – Urea application	1	IPCC 2006
3.C.4 - Direct N_2O emissions from soil management	1	IPCC 2006
3.C.5 –Indirect N_2O emissions from soil management	1	IPCC 2006

The Table below puts together emissions and removals (negative values) of CO_2eq in the AFOLU sector from 1995 to 2010. This sector and specifically the forestry subsector accounted for removal of $CO_{2,}$ in Cabo Verde.

Table 36: Emissions and removals of CO_2eq in AFOLU subsectors, Gg, 1995-2010

Subsectors	1995	2000	2005	2010	Variation %	
	Gg CO2 eq				2000-2005	2005-2010
Forestry	- 196,77	- 229,87	- 237,33	- 236,77	3,25	-0,23
Farming	**100,50**	**106,40**	**107,56**	**118,88**	**1,09**	**10,61**
Livestock	36,20	39,26	42,85	46,36	9,14	8,20
Agriculture	64,30	67,14	64,71	72,52	-3,62	12,20
Total AFOLU	**- 96,27**	**- 123,47**	**- 129,77**	**- 117,81**	**5,11**	**-9,22**

Total net CO_2 eq emissions in the AFOLU sector decreased by 9.22% between 2005 and 2010. This decrease stems mainly from the decrease in emissions in the forestry sub-sector, which decreased by 0.23% in the same period.

Between 2005 and 2010 CO_2eq emissions in the livestock and agriculture subsectors increased by 8.20% and 12.20%, respectively.

Figure 29: Emissions and removals of CO_2 eq in Gg in AFOLU, 1995-2010

2.2.3.1 Livestock

Enteric fermentation of ruminants is the main source of GHG emissions in this subsector. The emissions due to manure management and N_2O emission due to its disposal in pasture and Daily Spread were contemplated in the agriculture subsector.
Ruminants (mainly goats and sheep) ingest grass and other fibrous foods, which are degraded in the rumen, in the absence of air. For this reason, some of the carbon molecules contained in food are associated with hydrogen, forming methane, a product of the fermentation occurred during the microbial digestive process, and is expelled by the animals through the burp.

For GHG emissions estimation in this subsector, the methodology defined in the IPCC 2006 guidelines was followed using the inventory software. Calculations were estimated by applying methodological level 1, taking into account available national data.

Data on the effective number of animals used for the 2005 emission calculation were obtained from the 2004 IV General Agriculture Census. For 2010, data obtained by extrapolation were used based on 2012 data available in the Statistics and Information Management Services from the Ministry of Agriculture and the Environment.

Table 37: Projection of number livestock by species, 2004-2014

Species	Total Livestock by Species										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bovine	22306	22355	22404	22454	22503	22552	22602	22652	22701	22750	22799
Goat	148094	152476	156738	160885	165390	170021	174782	179676	184706	189875	195186
Sheep	10400	10527	10655	10785	10917	11050	11185	11321	11457	11593	11729
Equine	11302	11549	11796	12043	12290	12537	12784	13031	13278	13525	13772
Mules	6206	6453	6700	6947	7194	7441	7688	7935	8182	8429	8676
Swine	77316	78094	78872	79659	80455	81260	82072	82893	83723	84553	85392

Table 38: Emission factors to estimate emissions in livestock

Species	Emission factor of CH_4 emission (kg/animal/year)
Bovine	32
Goat	5
Sheep	5
Equine	18
Mules	10
Swine	1

Source: IPCC 2006

Data on the number of livestock per species and the default emission factors by species defined in the IPCC guidelines have been introduced in the IPCC inventory software, thus obtaining estimates of CH_4 emissions by species. The following table describes CH_4 emissions in this sector.

Table 39: CH4 Emissions, in Gg, due to enteric fermentation, by species

Species	1995	2000	2005	2010	Variation %	
	Gg CH_4				2000-2005	2005-2010
Bovine	0,70	0,71	0,72	0,72	1,41	0,00
Goat	0,05	0,05	0,05	0,06	0,00	20,00
Sheep	0,57	0,66	0,76	0,87	15,15	14,47
Equíne	0,16	1,80	0,21	0,23	-88,33	9,52
Mules	0,05	0,06	0,06	0,08	0,00	33,33
Swine	0,07	0,07	0,08	0,08	14,29	0,00
Total	**1,59**	**2,49**	**1,88**	**2,04**	**-24,50**	**8,51**

The species that contributed most to total CH_4 emissions in this enteric fermentation subsector in 2005 and 2010 was the goat species with 40.43% and 42.65%, respectively, of the total CH_4 emissions. The bovine cattle are the second species that contributes most to the total CH_4 emissions in 2005 and 2010 with 38.30% and 35.29% respectively.

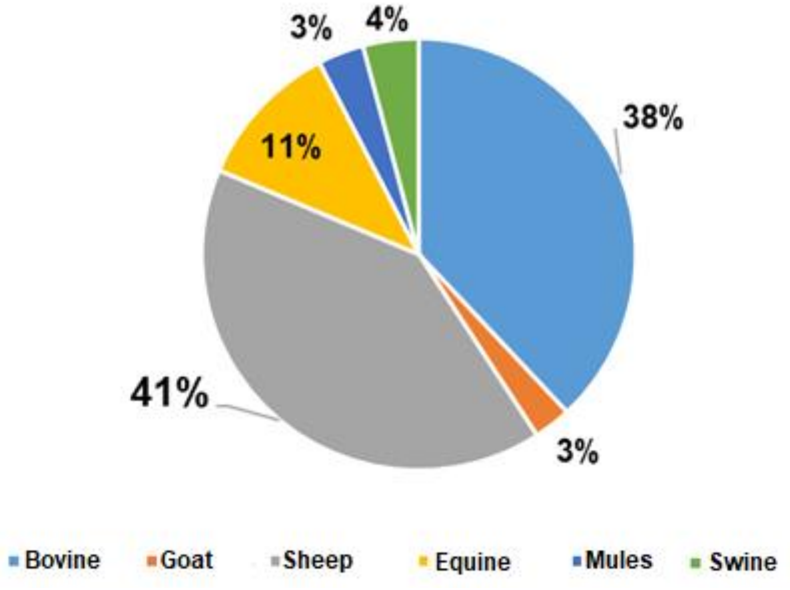

Figure 30: CH_4 emissions due to Enteric Fermentation by Species, 2005

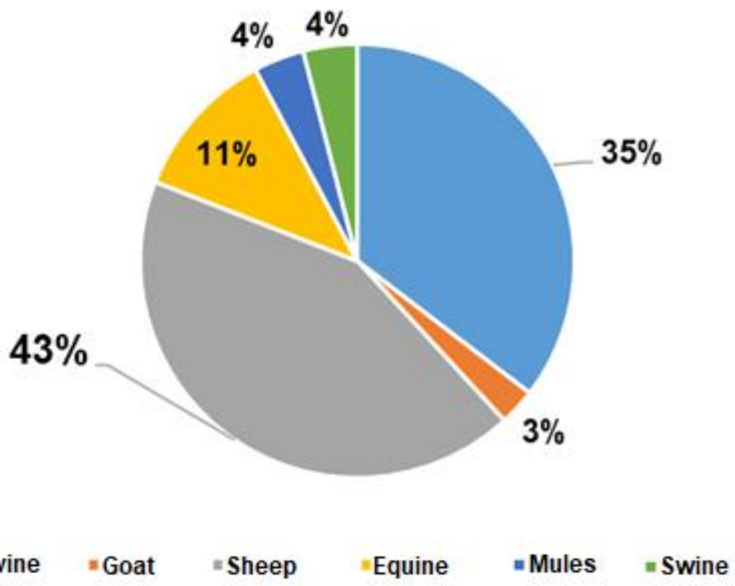

Figure 31: CH_4 Emissions due to Enteric Fermentation by Species, 2010

Table 40: CH_4 Emissions in Gg due to manure management

Species	1995	2000	2005	2010	Variation %	
	Gg CH_4				2000-2005	2005-2010
Bovine	0,022	0,022	0,022	0,023	1,12	1,10
Swine	0,070	0,074	0,079	0,082	6,62	4,02
Poultry	0,005	0,006	0,005	0,002	-14,78	-67,69
Total	**0,097**	**0,102**	**0,107**	**0,106**	**4,14**	**-0,14**

The bovine species contributed most to total CH_4 emissions due to manure management in 2005 and 2010, reaching 0.079 and 0.0082 Gg CH_4, respectively.

2.2.3.2 Forestry and Other Land Uses

Emissions and removals in this subsector result from the Variation of the carbon stock present in the forest areas. Due to the lack of data, only the emissions and removals related to the Variation of aerial biomass and emissions derived from forest burning were estimated.

The national forest inventory of 2013 and the FRA-FAO report were used to build the forest dynamics between 1990 and 2013. According to the forest inventory, between 2005 and 2013, there are data from forest areas converted into agricultural areas, settlements, in other uses, besides the burned areas. There are also data on areas planted for the same period.

From the FRA-FAO report, there are forest areas in 1990, 2000, 2005 and 2010, where it is reported that there are no primary forests, but only planted forests, according to the following Table:

Table 41: Forest areas (1000 ha) in 1990, 2000, 2005 and 2010

Categories of FRA 2010	Forest area(1000 ha)			
	1990	**2000**	**2005**	**2010**
Primary forest	0	0	0	0
Other naturally regenerated forests	0	0	0	0
…of which placed species	0	0	0	0
Planted forest	57,75	82,09	83,59	85,09
… of which placed species	57,75	82,09	83,59	85,09
Total	**57,75**	**82,09**	**83,59**	**85,09**

Source: FRA-FAO

The forestation rate from 1990 to 2000 was estimated at 2400 ha/year, being 300 ha/year from 2000.

Based on planted, chopped and burned areas from 2005 to 2013 of the national forest inventory, it was possible to estimate forest areas in 2005 and 2010 more accurately than indicated in the FAO-FRA. According to the following table the estimated annual average plantings are 2,430 kha/year from 1995 to 2000 which is compatible with that defined in the FAO-FRA. Likewise, the calculated areas relating to 2005 and 2010, reaching 86.75 and 89.06 kha respectively, are close to those 83.59 and 85.09 kha, respectively reported in the FAO FRA.

Table 42: Forest Areas in Cabo Verde, 1995 -2010 in kha

Areas	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Planted forests – beginning of the year (1000 ha)	69,92	72,35	74,79	77,22	79,66	82,09	83,02	83,96	84,89	85,82	86,75	87,37	87,85	88,09	88,07	89,06
Planted area (1000 ha)	2,434	2,434	2,434	2,434	2,434	2,434	0,933	0,933	0,933	0,933	0,648	0,517	0,297	-	0,984	0,452
Areas converted into agriculture areas (1000 ha)	A-	-	-	-	-	-	-	-	-	-	-	-	-	0,006	-	0,213
Areas converted into settlements (1000 ha)	-	-		-	-	-		-	--	-	-	-	-	-	-	0,111
Areas converted into other uses (1000 ha)	-	-	-	-	-	-	-	-	-		-	-	-	-	-	0,003
Areas cleared (1000 ha)	-	-	-	-	-		--	-	-	-	-	-	-	0,006	-	0,326
Burnt Areas (1000 ha)	-	-	-	-	-	-	-	-	-	-	0,030	0,037	0,058	0,010	-	-
Planted forests – end of the year (1000 ha)	**72,35**	**74,79**	**77,22**	**79,66**	**82,09**	**83,02**	**83,96**	**84,89**	**85,82**	**86,75**	**87,37**	**87,85**	**88,09**	**88,07**	**89,06**	**89,18**

To estimate emissions and removals in this subsector the simplified approach, tier 1, was used. Based on the 2013 national forest inventory, it is possible to estimate the amount of aerial biomass per island. The average value of Cabo Verde estimated was 11.13 t dry matter/ha (t ms/ha).

Table 43: Cabo Verde Aerial biomass estimates, in t ms/ha

Woody vegetation, per island	Africulture/Forest areas (ha)	Forest (ha)	Open forest formations (ha)	Bush areas (ha)	Woody vegetation area (ha)	Biomass area (t/ha)
Boa Vista	97	1.334	489	3566	5486	11,7
Brava	211	646	167	376	1400	22,9
Fogo	5216	1694	653	2366	9929	9,6
Maio	1240	4184	1263	490	7177	9,6
Sal	66	57	299	1292	1714	13,2
Santiago	5901	30000	7328	7303	50532	9,5
Santo Antão	106	2.009	169	3106	5390	25,4
São Nicolau	372	2080	384	2694	5530	12,8
São Vicente	252	1613	550	330	2745	10,7
Cabo Verde	**13462**	**43617**	**11302**	**21522**	**89903**	**11,13**

For the growth of forest biomass, data from Table 4.12 of IPCC 2006 were used, considering the ecological zone of the Dry tropical forest type. To estimate the value of vegetation biomass growth in planted forests, an adjusted factor of 18.54% was considered for Cabo Verde (ratio between biomass estimated area from forest inventory by biomass area defined in the IPCC guidelines) multiplying by net growth of vegetation biomass in planted forests established in the IPCC at 8.0 t ms/ha/year, thus obtaining a value of approximately 1.48 t ms/ha/year for dry matter growth.

The following table presents estimates of net growth of vegetation biomass in planted forests in Cabo Verde.

Table 44: Estimate of vegetation biomass growth in planted forests in Cabo Verde

Ecological area	Vegetation biomass in natural forests (t ms/ha)	Vegetation biomass in planted forests (t ms/ha)	Net growth of vegetation biomass in natural forests (t ms/ha/year)	Net growth of vegetation biomass in planted forests (t ms/ha/year)
Dry tropical forest	130	60	2,4	8,0
Cabo Verde, according the 2013 Inventory		11,13		
Biomass grow in planted forests t ms/ha/year (adjusted value) for Cabo Verde				1,48

With the value of dry matter growth per year, the total growth of the planted forest is estimated. And with the estimated biomass of planted forests, the amount of biomass lost per hectare due to clearing and forest fires is calculated.

For the estimation of forest emissions and removals, the oxidation factor for tertiary tropical forests (Table 2.6 of the IPCC) considered was 0.59; the carbon content in dry matter was 50% and the carbon ratio to CO_2 was 44/12. For gas emissions from forest fires, the factors listed in IPCC 2006 Table 2.6 were used: 1569 g CO_2/kg ms, 4.7 g CH_4/kg ms, 107 g CO/kg ms, 0.26 g N_2O/kg ms, 3 g NOx/kg ms.

The following table summarizes the results of the biomass calculation, emissions and removals of the forestry subsector between 1995 and 2010.

Table 45: Calculation of Forest Biomass, Emissions and Removals in Cabo Verde, 1995-2010

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Planted forest Total growth (t ms)	107 329	110 939	114 550	118 160	121 771	125 381	124 538	125 921	127 305	128 688	129 650	130 372	130 758	130 672	132 108	132 779
Biomass lost due to cleaning (t ms)	-	-	-	-	-	-	-	-	-	-	-	-	-	61,19	-	3 629,32
Biomass burnt (t ms)	-	-	-	-	-	-	-	-	-	-	334,98	411,64	645,27	111,25	-	-
Removal of planted forest (Gg CO_2)	**-196,77**	**-203,39**	**- 210,01**	**- 216,63**	**- 223,25**	**- 229,87**	**- 228,32**	**- 230,86**	**- 233,39**	**- 235,93**	**- 237,69**	**- 239,02**	**- 239,72**	**- 239,56**	**- 242,20**	**- 243,43**
CO_2 emissions due to cleaning (Gg)	-	-	-	-	-	-	-	-	-	-	-	-	-	0,11	-	6,65
CO_2 emissions due to burning (Gg)	-	-	-	-	-	-	-	-	-	-	0,31	0,38	0,60	0,10	-	-
CH_4 emissions due to burning (Gg)	-	-	-	-	-	-	-	-	-	-	0,0009	0,0011	0,0018	0,0003	-	-
CO emissions due to burning (Gg)	-	-	-	-	-	-	-	-	-	-	0,0211	0,0260	0,0407	0,0070	-	-
Emissions N_2O due to burning (Gg)	-	-	-	-	-	-	-	-	-	-	0,0001	0,0001	0,0001	0,0000	-	-
Emissions NO_x due to burning (Gg)	-	-	-	-	-	-	-	-	-	-	0,0006	0,0007	0,0011	0,0002	-	-
Gross Emissions (Gg CO_2)	-	-	-	-	-	-	-	-	-	-	0,31	0,38	0,60	0,22	-	6,65
Net Emissions (Gg CO_2)	**- 196,77**	**- 203,39**	**- 210,01**	**- 216,63**	**- 223,25**	**- 229,87**	**- 228,32**	**- 230,86**	**- 233,39**	**- 235,93**	**- 237,38**	**- 238,63**	**- 239,13**	**-239,35**	**- 242,20**	**- 236,77**

Table 46: Emissions and Removals in Forestry subsector in Gg, per type of gas, in 1995, 2000, 2005 and 2010

Emissions and removals by type of gas	1995	2000	2005	2010	Variações %	
	Gg				2000-2005	2005-2010
CO_2 Removals	-196,77	-229,87	-237,38	-236,77	3,27	- 0,26
CH_4Emissions	-	-	0,0009	-	-	-
CO Emissions	-	-	0,0211	-	-	-
N_2O Emissions	-	-	0,0001	-	-	-
NO_x Emissions	-	-	0,0006	-	-	-

2.2.3.3 Agriculture

GHG emissions in this subsector result from the burning of agricultural waste, application of urea, direct N_2O emissions by use of organic and synthetic fertilizers, and excretions and urine of grazing animals. Indirect N_2O emissions also occur due to the atmospheric deposition of NH_3 and NO_X as well as leaching and surface runoff.

2.2.3.3.1 Burning of agriculture waste

In this inventory it is considered that the burning of agricultural waste is due essentially to the burning of waste associated with maize and bean crops during land preparation for the agricultural season. Waste burning produces CH_4, N2O, NO_X and CO emissions.

The IPCC 2006 methodology for estimating GHG emissions (Tier 1) and the IPCC 2006 inventory software were used. In this software the area of agricultural waste burning in ha (estimated from the cultivated area) was introduced, the amount of waste available for burning in t/ha, the combustion factor and emission factors by type of gas, as defined in the IPCC 2006 guidelines. The following Tables show the values considered for emission calculations due to agricultural waste burning.

Table 47: Estimates of cultivated land, in ha, and corn production, in t

Data activities	2005	2006	2007	2008	2009	2010	2011	2012
Cultivated land	30053	29263	35716	32026	31983	32028	31318	30582
Corn production	9572	6378	4425	8039	7383	7047	5569	6001

Table 48: Emission factors to estimate emissions due to burning of agriculture waste

Quantity. Waste available for burning t/ha	Combustion factor	Emission factor (Gg gas GEE/kg mass burnt)	
10	0,8	CH_4	2,7
		CO	84
		N_2O	0,07
		NO_x	2,5

2.2.3.3.2 Urea application

GHG emission due to urea application was estimated following the methodology defined in the IPCC 2006 guidelines using the IPCC 2006 inventory software, which considers the annual amount of urea used in the soils and the default emission factor determined in the respective guidelines.
The annual amount of urea applied in tons per year was estimated considering that 30% of the total nitrogenous fertilizers used represent the amount of urea used in soils.

Table 49: Quantity of urea and emission factor

Year	Quantity urea t/year	Emission factor t C/t urea
2005	119,80	0,20
2010	112,40	0,20

2.2.3.3.3 Direct N_2O emissions

Direct N_2O emissions are due to the addition of organic and synthetic fertilizers and excretions and urine of grazing animals. For the N_2O emission estimates, considerations included the IPCC 2006 default factors for the nitrogen content in the wastes and the N_2O emission factor per amount of nitrogen deposited due to the use of synthetic fertilizers based on the methodology defined by the IPCC 2006 through inventory software.
The amount of N excreted was estimated taking into account the number of livestock kept in a closed system, namely the bovine, swine and poultry. For bovine cattle it was assumed that 20% of the total cattle are kept in closed system and the rest in free grazing. The remaining categories were also assumed, namely goats, equines and sheep are raised in an extensive system. The following Table establishes the number of livestock considered and the emission factor used.

Table 50: Total nr of livestock by species

Species	1995	2000		2005	
Bovine	21728	22108		22355	22602
Sheep	9010	9861		10527	11185
Caprine	112997	131287		152476	174782
Equine	8954	9963		11549	12784
Mules	5003	5567		6453	7688
Swine	69718	74002		78094	82072
Poultry	274330	308725		263090	85000

The amount of synthetic fertilizer used annually was estimated using the data provided by the national fertilizer import and marketing companies. It is considered that all fertilizer imported in a given year has been fully utilized and that synthetic nitrogen fertilizers contain 27% of nitrogen.

Table 51: Amount of synthetic fertilizer and emission factors

Year	Annual amount of N applied Kg N/year	Emission factor Kg N_2O-N/kg N
1995	78452,98	0,01
2000	62762,38	0,01
2005	96597,60	0,01
2010	91006,90	0,01

Source: Data from national enterprises importing and selling fertilizers and emission factors of IPCC 2006.

2.2.3.3.4 Indirect N_2O emissions

Indirect N_2O emissions stem essentially from two phenomena:

- Atmospheric deposition of nitrogen by volatilization - emissions occur when part of the nitrogen present in synthetic and organic fertilizers, and in grazing animal waste, used as fertilizers, volatilize in the form of NH_3 and NO_X;

- Nitrogen leaching and runoff - emissions occur due to the use of nitrogen in agricultural soils through synthetic and organic fertilizers, and from grazing animal wastes.

For indirect N_2O emission estimates, the methodology defined by the IPCC 2006 was used through the inventory software and the default factors defined in the IPCC 2006 guidelines, Tier 1, were considered.
The amounts of N regarding animal waste released to the soil, either in grazing or daily distribution, and synthetic fertilizers are calculated by the software and are the source of the N_2O direct and indirect emissions.

Table 52: Emission factor to estimate N_2O indirect emissions

Emission factor	
Volatilization (kg N_2O-N/kg NH3-N+NO_X-N)	**Leaching ((kg N_2O-N/kg N)**
0,01	0,025

The following Table depicts CO_2eq emissions in agriculture subsector activities in 1995, 2000, 2005 and 2010.

In 2005, burning of agricultural waste accounted for 36.41% of total CO_2eq emissions in the agriculture subsector, followed by indirect N_2O emissions with 33.45% of total emissions. In 2010, indirect N_2O emissions accounted for 36.20% of total CO_2eq emissions in this sector, followed by direct N_2O emissions, and together totaled 72.22% of total emissions in this subsector.

Total emissions from the agriculture subsector in 2010 increased by approximately 12.20% to reach 72.60 Gg CO_2 eq. In 2005 this figure was 64.71 CO_2eq.

Table 53: CO_2 eq emissions, in Gg, in Agriculture subsector in 1995, 2000, 2005 and 2010

Subsector	**1995**	**2000**	**2005**	**2010**	**Variação %**	
	Gg CO_2 eq				**2000-2005**	**2005-2010**
Burning of agriculture waste	19,48	19,21	23,56	20,09	22,66	-14,74
Urea application	NE	0,03	0,09	0,08	217,22	-6,18
Direct N_2O emissions	24,56	25,70	19,42	26,15	-24,46	34,67
Indirect N_2O emissions	20,25	22,20	21,64	26,28	-2,52	21,44
Total	**64,30**	**67,14**	**64,71**	**72,60**	**-3,62**	**12,20**

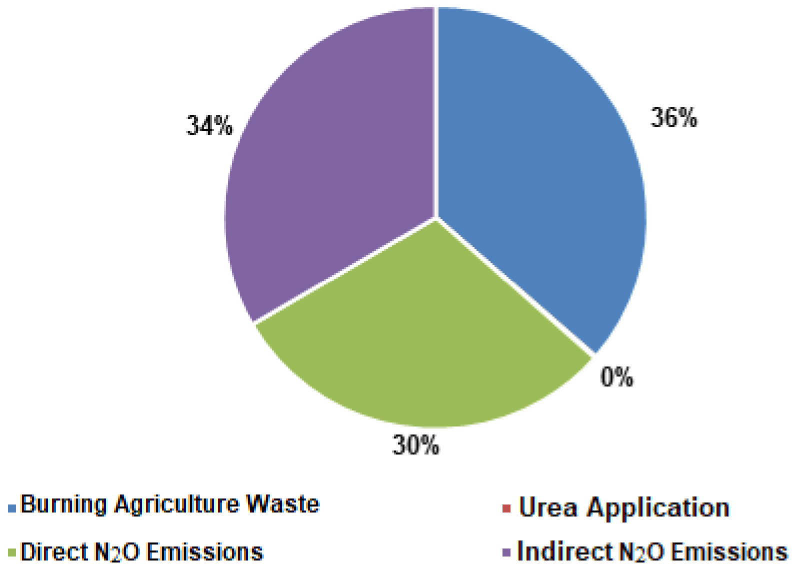

Figure 32: CO_2eq emissions in Agriculture subsectors in 2005

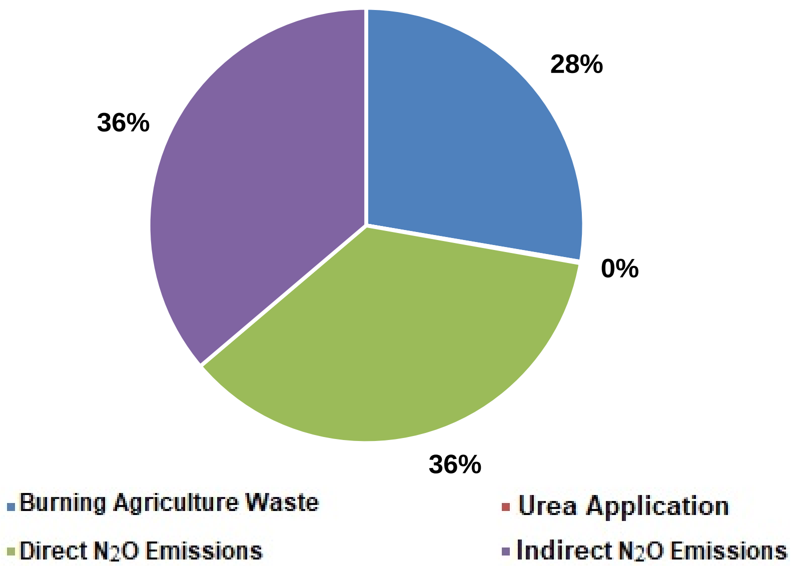

Figure 33: CO_2eq emissions in Agriculture subsectors in 2010

2.2.4 Waste sector

Waste sector includes GHGs derived from the treatment and disposal of solid waste, domestic and industrial waste water, and emissions resulting from solid waste incineration. Waste from agricultural activities, such as animal manure and agricultural crop waste, were logged in the AFOLU sector emissions estimates.

One of the relevant gases produced in waste treatment is CH_4. Significant amounts of this gas are produced and released into the atmosphere as a by-product of anaerobic waste decomposition, the two largest sources being the disposal of waste in dumps and the anaerobic treatment of effluents.

The organic matter present in the effluents, in a situation of absence of oxygen, favors the action of methanogenic bacteria that decompose it, generating CH_4. In addition to this gas N_2O and CO_2 are also produced.

Emissions from the waste sector in Cabo Verde are associated with landfills (CO_2) and open-air incineration (CO_2 from fossil source materials e CH_4 and N_2O) from urban solid waste.

Hospital waste (industrial waste) is the only waste that is incinerated in the country. However, for ease, it was considered that 20% of urban solid waste would be burned in open-air, the rest taken to dumps less than five meters deep. In the composition of municipal waste, 4.5% would be made of plastics, according to the IPCC

The calculation of GHG emissions was based on the methodology proposed by IPCC 2006. It provides baseline data when there is no available local data and exposes the level of local knowledge about the data needed to estimate greenhouse gas emissions.

In the case of Cabo Verde, taking into account the reliability of the data, methodological level 1 was used, for landfills, using standard and predefined parameters. Tier 1 involves multiplying a default emission factor by an activity data, usually the quantity of production itself, being the simplest method for estimating emissions.

Table 54: Methodological process and guidelines in Waste Sector

Categories	Methodological level	Guidelines
4 - Waste		
4.A – Solid waste	1	IPCC 2006
4.C – Incineration and burning of waste	1	IPCC 2006
4.D – Wastewater treatment	1	IPCC 2006

2.2.4.1 Solid Urban Waste

Solid urban waste can be disposed of in landfills, recycled, incinerated or even used for power generation. The quantities of CH_4, CO_2 and N_2O emitted vary according to the volume of waste produced, the percentage and characteristics of the organic matter composing them, anaerobic or aerobic conditions of their decomposition or stabilization and the conditions of their management. According to the IPCC 2006 methodology, emissions can be estimated from the urban population, the rate of waste generation and its composition.
Data referring to 1970 to 2000 were extrapolated to construct a historical series of waste deposition.

Os dados referentes, aos anos de 1970 a 2000, foram extrapolados, para se construir uma série histórica de deposição de resíduos.

Table 55: Urban solid waste in 2005 and 2010

Year	Capitation (kg/inhab/day)	Urban population
1970 - 2000	0,53	75.731
2000	0,53	323.147
2005	0,64	274.003
2010	0,74	303.673

Fonte:DNA,INE, ANAS

2.2.4.2 Treatment of domestic, commercial and industrial effluents

Domestic effluents have high levels of organic matter and therefore have a high potential for CH_4 emission. The organic matter present in these effluents is expressed in terms of Biochemical Oxygen Demand (BOD), which is the main determinant of methane generation potential. They may also be a source of N_2O and CO_2 emissions, but this CO_2 from wastewater is not considered in the IPCC guidelines because it is of biogenic origin.

The IPCC 2006 recommends that emissions from domestic, commercial and industrial wastewater should be determined taking into account their importance.
For the calculation of the emissions from the wastewater sector, the IPCC 2006 guidelines were used. The values of the advanced emission factors were also taken from the waste sector guidelines.

Based on census information (2000 and 2010) and QUIBB (2006 and 2007), the calculation of emissions in this subsector was simplified in three systems - WWTP, septic tank and nature (around the house, others, etc.), in this inventory represented by the latrine system. The following Table shows the utilization quotas for each of the systems identified.

Table 56: Disposal by type of system

Area	Type	1995	2000	2005	2010
Rural	WWTP	-	-	0,003	0,011
	Tank	0,040	0,052	0,059	0,440
	Nature	0,960	0,948	0,938	0,549
Urban	WWTP	0,150	0,164	0,210	0,288
	Tank	0,200	0,221	0,325	0,492
	Nature	0,650	0,615	0,465	0,220

Table 57: CO_2eq emissions (Gg) in Effluent treatment subsector in 1995 - 2010

Subsector	1995	2000	2005	2010	Variation %	
	Gg CO_2eq				2000-2005	2005-2010
Urban waste disposal	8,44	10,58	13,47	17,67	27,32	31,14
Waste burning	1,31	1,63	2,27	2,96	39,03	30,28
Effluent treatment	18,12	13,45	16,61	36,91	23,44	122,25
Total	**27,87**	**25,67**	**32,35**	**57,54**	**26,03**	**77,9**

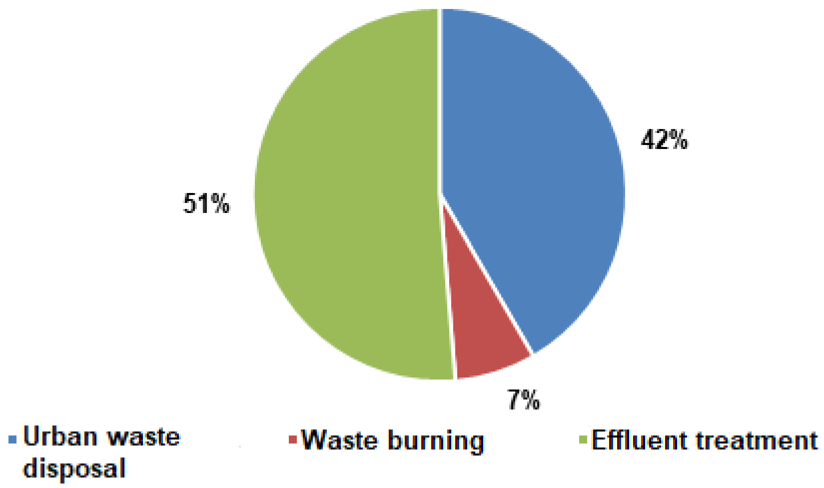

Figure 34: CO_2 eq emissions by waste subsector in 2005

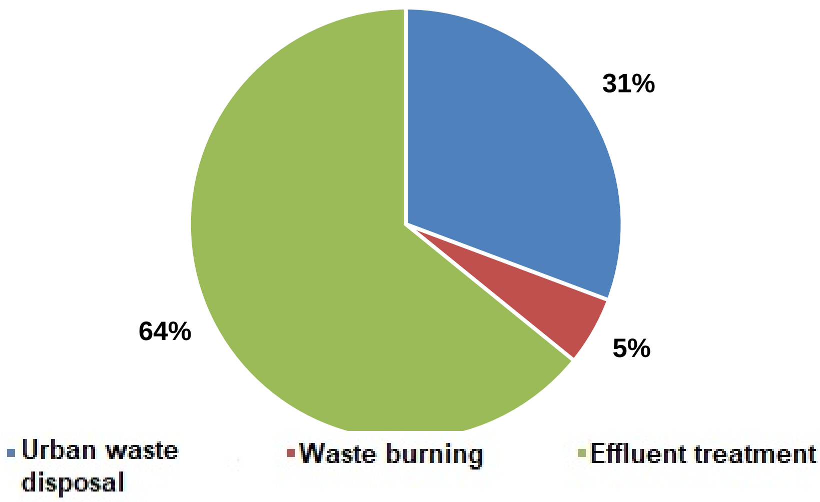

Figure 35: CO_2eq emissions by waste subsector in 2010

Total CO_2eq emissions in this sector increased by 77.85% in 2010 compared to 2005, reaching 57.54 Gg CO_2 eq. In 2005 total emissions were 32.35 Gg CO_2eq. Treatment of effluents is the activity that contributes most to emissions in this sector, having contributed in 2005 with 51.33% of the total emissions, followed by urban solid waste disposal.

In 2010 this contribution of effluent treatment contributes with 64.15% of the total CO_2 eq emissions in waste.

2.3 Uncertainty assessment

The inventory of GHG emissions and removals, as well as any study involving data collection, treatment and estimation of entails errors associated with uncertainties, which in turn must be reduced to the extent practicable, in order to allow decision-making with reasonable confidence.

Uncertainty estimates are an essential element of a complete inventory of greenhouse gas emissions and removals. According to the 2006 IPCC guidelines the assessment of uncertainties should be based both on the emissions level and the trend, as well as on the components such as emission factors, activity data and other assessment parameters for each category. This guidance develops a structured approach to estimating inventory uncertainty that includes the following steps:

- Identification of uncertainties in individual variables used in the inventory (eg estimates of specific category of emissions, emission factors, activity data);
- Put component uncertainties together for total inventory;
- Identification of uncertainty in trend; and
- Identification of significant uncertainty sources in the inventory to help prioritize data collection and efforts to improve the inventory.

According to the 2006 IPCC guidelines the quantitative uncertainty analysis is performed using the 95% confidence interval of the emissions and removal estimates for the different sectors and subsectors and for the total inventory.

The uncertainty analysis for the said inventory was calculated according to the IPCC 2006 guidelines and with the assistance of the IPCC Inventory Software. The uncertainty presented includes the sectors listed in said software, and the uncertainties associated with the forestry subsector are not included. Annex II present the uncertainties associated with the emission factors and activity data by type of gases extracted from the software.

Uncertainties associated with the calculations of emissions and removals from 1995 to 2010 stood at 5.03%.

2.4 Conclusions

GHG emissions and removals in Cabo Verde totaled 452.54 Gg CO_2eq in 2005 and 485.26 Gg CO_2eq in 2010. The Energy subsector accounted for most of the emissions in 2005 and 2010. In 2005 it produced 548.60 CO_2eq and in 2010 542.16 GgCO_2eq.
The AFOLU sector, with net removals from planted forests, contributes to the reduction of the country's emissions.

At international level, for aviation and the shipping industry, GHG emissions in 2010 decreased by 11.97%, with 279.24 Gg CO_2eq, compared to emissions in 2005, which corresponded to 317.21 Gg CO_2eq. GHG emissions from biomass were almost constant between 2005 and 2010, reaching in 2010 near 147.49 Gg CO_2eq, less 4.43% compared to 154.33 Gg CO_2eq in 2005.

Of the GHGs estimated, CO_2 shows the highest prevalence; in 2005, 297.40 Gg CO_2 was produced in this sector and in 2010 it totaled 292.84 Gg CO_2, corresponding to a 1.54% decrease. The second most important was CH_4, followed by N_2O, with 24.7% and 14.4% of emissions in 2010, respectively. HFC-134a completes the picture in 2005, contributing with 0.76 Gg CO_2eq and in 2010, 2.48 Gg CO_2eq, 0.5% of this year's total.
Emissions per inhabitant in Cabo Verde in 2010 totaled approximately 0.99 tCO_2eq. This represents a 1.02% increase in emissions per inhabitant in 2005 with 0.98 tCO_2 eq.

Although the country is not subject to any restriction in terms of increase in emissions, some measures that may mitigate its future evolution are under way, namely the mitigation measures defined in the INDC presented by the country with measures essentially in production power.

GHG emissions and removals forecasts, if implemented the mitigation measures presented in the INDC, indicate that total emissions and removals might increase by 17.63% in 2030 compared to 2010. This increase is mainly due to the contribution of emissions from the Transports sector, since it is expected that there will be an increase in the volume of activity in the ports and airports of Cabo Verde, as well as in the car park.

The purpose of the inventory was to present the estimates for GHG emissions and removals in Cabo Verde. However, with the implementation of some measures, both at legal level to improve the quality of activity data used in the preparation of inventories and in training of more national technicians to prepare inventories and more involvement of universities that can contribute in the research of national emissions factors, it is expected that in future inventories the availability and quality of the data will be much better.

2.5 Difficulties encountered

The difficulties encountered in preparing the GHG inventory were, for all sectors listed, related to issues in obtaining reliable and real data that allow the preparation of inventories, mainly:

- Inexistence of an information system that allows sector data collection and treatment;
- Week cooperation from institutions/enterprises in data collection. Available data are often dispersed and incoherent, implying loss of time when treating them;
- Inexistence of national emission and conversion factors to estimate emissions from the sectors listed, imposing the use of default factors indicated in the IPCC or data from counties in the sub-region;
- The non-command of IPCC methodology by consultants has hindered GHG sector estimates;
- Difficulties faced in using the IPCC Inventory Software to estimate sector emissions and compilation;
- Lack of disaggregated data on energy consumption and per productive sector, leading to only consumption estimates;
- Scattered data on forest areas and unavailability of detailed data have significantly hindered GHG estimates in the forestry subsector; and
- Few national technicians with needed capacity and training to estimate GHG emissions

2.6 Recommendations

The National GHG Inventory is an important instrument for the country, as it allows to know GHG emission estimates in a given year, and to develop and identify mitigation projects. In general, the major difficulty found in the preparation of inventories was the collection of data on the different sectors.
To help improve the quality of the next GHG inventories, the following recommendations are made:

- Respect the need for preparing sector GHG inventories as an annual activity, which allows routine creation of GHG estimation and enhances data collection;
- Strengthen regular capacity building/ recycling actions and not only when the country's GHG inventories are carried out, which allows the creation of national expertise for GHG estimation;
- Strengthen legal instruments so that institutions can provide annual activity data, regardless of the sector;
- Strengthen partnerships with universities and educational institutions in order to promote studies to determine national emission factors, with a view to improving the quality of national GHG inventories;
- Improve data sources for preparation of the land use matrix and thus estimate emissions and GHG removals in the forestry sector;
- Update inventories of Firewood and Coal, agriculture and livestock to help know the consumption per subsector, to know the progression of cultivated and burned areas and the number of livestock in order to improve the evaluation of emissions from the sectors listed; and
- Analyze the need for capacity building and awareness of data providers, the importance of providing information for GHG estimation.

CHAPTER III – ABILITY TO REDUCE GHG EMISSIONS

Cabo Verde is an island state with scarce natural and financial resources and a high external energy dependence, both for energy production and transport, since it needs to import the most used fuels, namely petroleum products and their derivatives.

However, it has a significant potential for Renewable Energy (RE), on which in 2010 the country began to focus heavily for electricity generation, namely solar and wind energy, currently (2017) with a contribution of near 20% RE penetration in the grid.

As such, renewable energy is the opportunity for Cabo Verde to solve, in a structured manner, energy sector related constraints, reducing energy costs and prices, minimizing uncertainty and exposure to international fuel prices. The lower costs will allow the implementation of a set of active policies to reduce losses, ensuring that the cost of energy is shared by all who benefit from it, while safeguarding those with the lowest economic conditions.

Although the current Government rejects PNAER's absolute goals of covering 100% of electricity needs by 2020 through renewable sources, the Government's Program for the IX Legislature continues with renewable energy focused policy, provided it is technically possible and economically viable.

However, the approach and intervention strategic axes listed in the document aiming to provide a favoring environment for an energy transition in the country are not cast-off. Following this scenario, possible mitigation options for the sector and their respective contribution to reducing greenhouse gas emissions were assessed. To this end, intense consultation and analysis of relevant studies, plans and documents from the energy sector, public institutions and private sector was conducted to identify mitigation projects, in accordance with the objectives and priorities of the 2017 Strategic Plan for Sustainable Development- PEDS 2017-2021, and the Intended Nationally Determined Contribution (INDC).

However, with the constant technology innovation, there are numerous new ways of producing clean and renewable energy. Some of these new forms are already used in Cabo Verde. Due to limitations in economic, financial and endogenous resources, it almost obliges the country to invest in solar and wind technologies.

The proposed mitigation strategies are intended to contribute to the efforts of the international community to combat climate change in a sustainable development context.
The methodology used focused on preliminary research on the scope of benefits, definition of projections, identification of the different stakeholders relevant to the viability of the projects identified and on the approach taken to evaluate mitigation measures.

In general, for the energy production sector, according to the Strategic Plan for Renewable Energy Sector (PESER), Resolution No. 7/2012, of February 3, 2012, near 500 MW were identified for priority projects as part of the national mitigation action plan and were object of preliminary studies to evaluate avoided emissions, estimate the necessary investment, being distributed by:

- Wind – 263 MW,
- Photovoltaic Solar – 318 MW,
- Urban Solid Waste– 7,5 MW,
- Water (forced pumping) - 70 MW,
- Geothermal– 3 MW
- Oceans/ Waves – 3MW

The consolidation of project avoided emissions allowed stablishing the likely emission mitigation scenario dby 2030.

3.1 Energy Sector Main Directions for Mitigation

Cabo Verde is expected to implement a proactive energy strategy that promotes the country's transition to renewable energy and creates energy efficiency through the main energy-consuming sectors of the economy (residential, transportation, industry and tourism). In order to support this energy strategy, financial mechanisms should be created to stimulate private sector involvement and facilitate the establishment of public private partnerships.

The commitment of the government and the public institutions (ARE, ECREEE, CERMI, IEFP and Technical and Professional Schools in the country) and private institutions that were created to support the energy vision in Cabo Verde, is to stimulate the establishment of projects in the priority areas of energy, economically feasible and technically possible, in accordance with the Government Program of the IX Legislature.

One of the guidelines to be followed by 2020 will be the "Cabo Verde 50% Renewable" Action Plan which will result in the installation of more than 100 MW of renewable energy through an investment plan of more than € 300M. This plan will allow the creation of more than 800 direct and indirect jobs and will reach 2020 with costs 20% lower than the current power generation costs. More than € 30m (thirty million euros) of imports, equivalent to more than 60 million liters of 180/380 fuel oil or diesel fuel and over 200,000 tons of CO_2 emissions, will also be avoided.

The national strategy focused on renewable energy and energy efficiency addresses environmental issues expressed, in particular, by industry activities. Thus, Cabo Verde could aim for the "Green Island" brand, which the country longs for tourism promotion.

Following government guidelines, increasing renewable energy in the energy mix and establishing energy efficiency as a national priority will be based on the mobilization of international funds through private investment. Its implementation will allow the establishment of a mix of diversified and optimized energy around clean, reliable and competitive technological choices. In Annex III Table - Overview of all measures.

3.2 Emissions from Non-Energy Categories

Non-energy emissions include emissions specific to the sectors themselves, which do not result from the burning of fossil fuels in energy use but which, on the other hand, occur in industrial processes, land use and forests, agriculture, and in waste treatment and disposal.

3.3 Baseline Scenario (Business as Usual)

The Business as Usual scenario involves GHG emissions produced in a system where no emission control policy is in place, i.e. without further investments in renewable energy projects, without efficiency measures energy and without efforts in road transport with hybrid and / or electric systems. This baseline made it possible to estimate the effectiveness of the policies and measures made to face GHG emissions.

In this context, a baseline scenario was defined reflecting the expectation of evolution in the energy demand in the country, associated with population growth and GDP. Electricity generation only increases by the amount needed to meet the increase in demand. In the results of the baseline scenario, the main sources of final energy are petroleum products (diesel / fuel oil), consumption of which is increasing by 2030. Also the use of electricity and other final energies have increasing values, linked to the country´s expected economic growth.

For reasons of consistency with the baseline scenario presented in Cabo Verde's INDC 2015, the proportions of energy use were linearly adjusted until a similar percentage of final energy use was reached in 2030. In sector terms, the residential sector is the most expressive in energy use, reaching approximately 6.3 PJ/year in 2030, followed by transport, with 5.2 PJ in 2030, and lastly, industry and services, with 1,1 and 0.2 PJ in 2030, respectively.

The baseline scenario, business-as-usual type, of energy production and consumption, and consequent emissions was object of an assessment following the steps below:

1. Total energy consumption in Cabo Verde, by final energy
2. Total energy consumption in Cabo Verde, by sector
3. Emissions only from energy demand in Cabo Verde, by sector (excluding electric production)
4. Emissions from electricity generation in Cabo Verde,
5. Emissions from non-energy subcategories in Cabo Verde
6. Total emissions in Cabo Verde, by primary energy
7. Total emissions in Cabo Verde, by category

The final energy computation is made in PJ, and emissions in kt CO_2eq.

3.3.1 Scenario for Energy Use by 2030

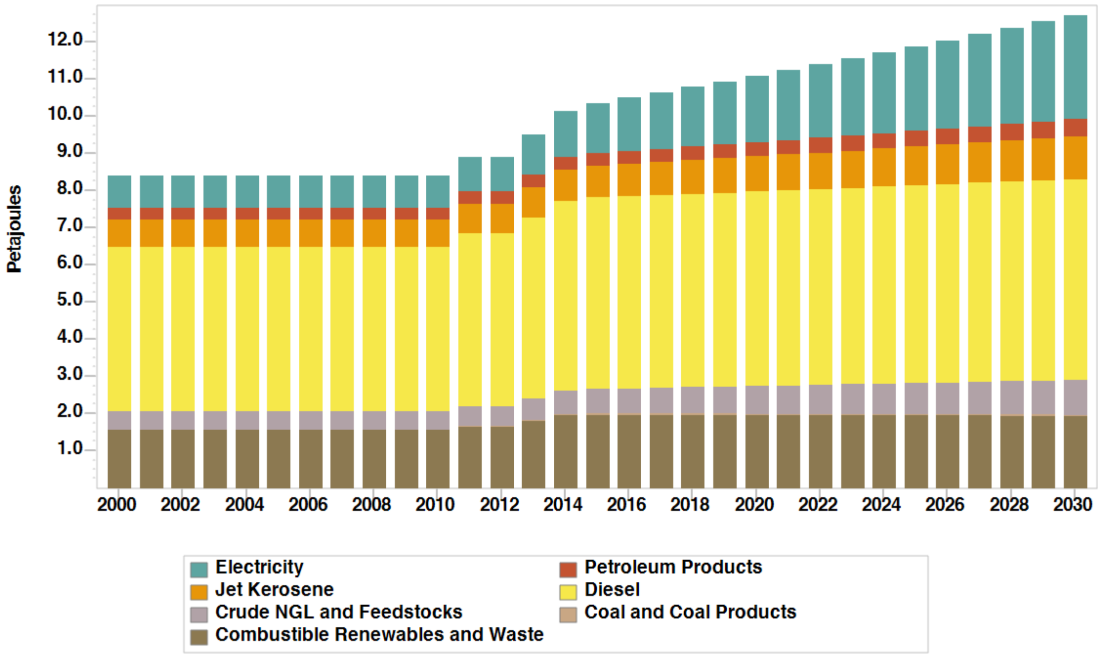

Figure 36: Energy consumption by final energy (PJ), baseline scenario, 2000-2030

Source: Sousa, R et al. 2016.

In figure 36 we have the distribution of the total consumption in Cabo Verde by the final energy uses in the country. In the absence of specific information for all historical years, it is assumed that the distribution remains unchanged between 2000-2010. We note that a significant portion of this consumption refers to the use of diesel / fuel oil 180/380. In a sense of aligning the final energy demand with the baseline scenario presented in Cabo Verde's INDC 2015, a similar proportion of energy types was considered in 2030: 30% biomass, 30% gas oil, 30% electricity and 10% gas butane. All other energies follow the same growth trend, coupled with the expected growth of the economy and population.

In another perspective the following figure shows the same total energy consumption in the country, but divided by the existing sectors. As in the previous chart, between 2000-2010 the use of energy is constant, due to lack of additional information. It is noted that the residential sector is the most expressive. Services, industry and transport have a growth in energy use in proportion to the growth of their Gross Value Added (GVA) defined in the assumptions. Energy consumption in the residential sector grows in proportion to the per capita income growth.

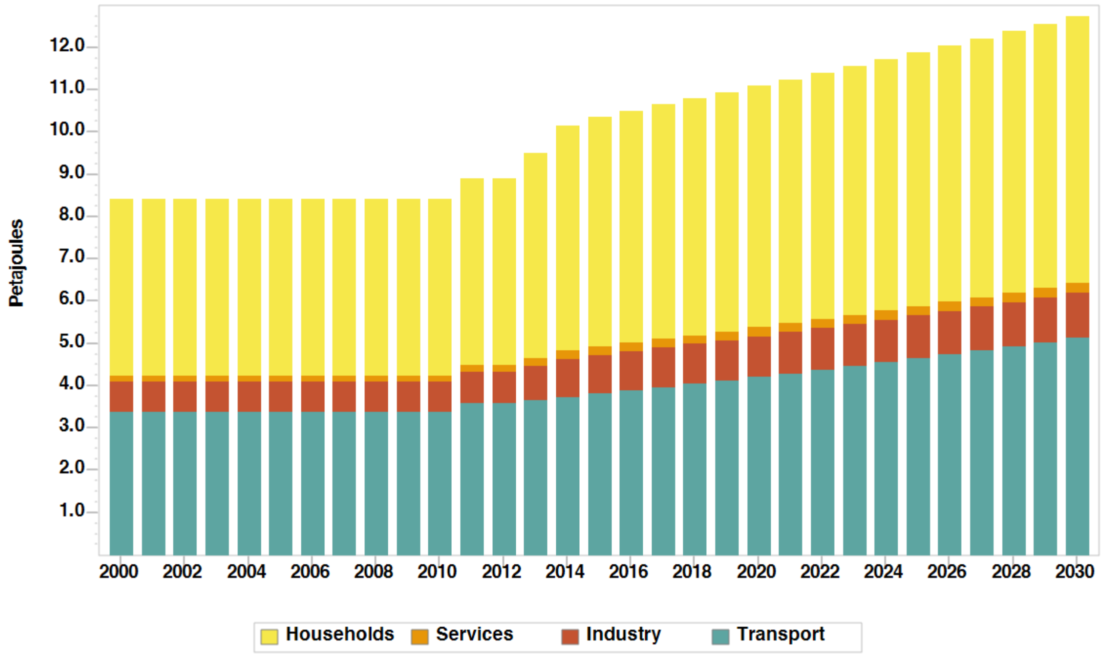

Figure 37: Energy consumption by sector (PJ), baseline scenario, 2000-2030

Source: Sousa, R et al.2016.

According to the National Energy Efficiency Plan of Cabo Verde, current primary energy consumption will increase to near 2% by 2020 and thereafter will increase at 3% per year from 2020 to 2030 (" Baseline Scenario "). The general energy demand in 2030 is calculated to reach approximately 2,700 GWh.

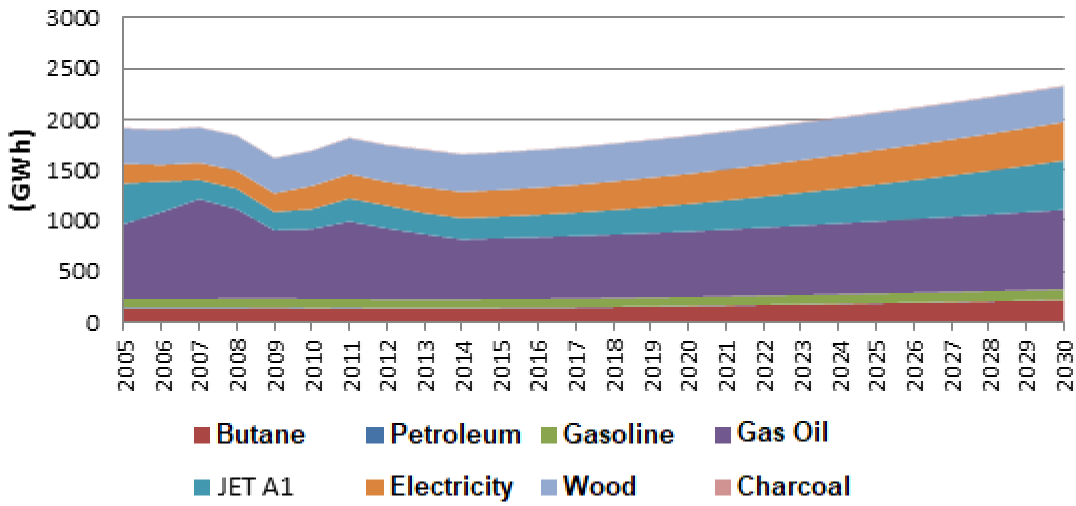

Figure 38: Energy final demand- Baseline Scenario, 2005 – 2030

Source: PNAEE, SE4ALL 2015

3.4 Emission Scenario by 2030

In the first chart emissions are presented only for energy consumption by sector. Emissions from electricity generation are excluded and presented below.

In energy demand, the transport sector presents the highest GHG emissions over the years, averaging approximately 342 kt CO_2eq/ year between 2020 and 2030. By 2030 the transport sector is estimated to produce 376 kt CO_2eq. However, the residential sector also produces relevant amounts of GHG in the country, reaching an average of approximately 210 kt CO_2eq./year for the same years. The growth rate of emissions is constant and is near 2% annual growth in transport, and 1% in services and industry, values closely associated with the increase in energy intensity, a variable that relates the energy used to GDP and the population in Cabo Verde. In the case of the residential sector, the volume of emissions is slightly decreasing (-0.01% on average), due to the fact that an increase in the use of electricity has been considered, in order to level up the proportion of demand for fuel with the information from the baseline scenario in the Cabo Verde INDC 2015.

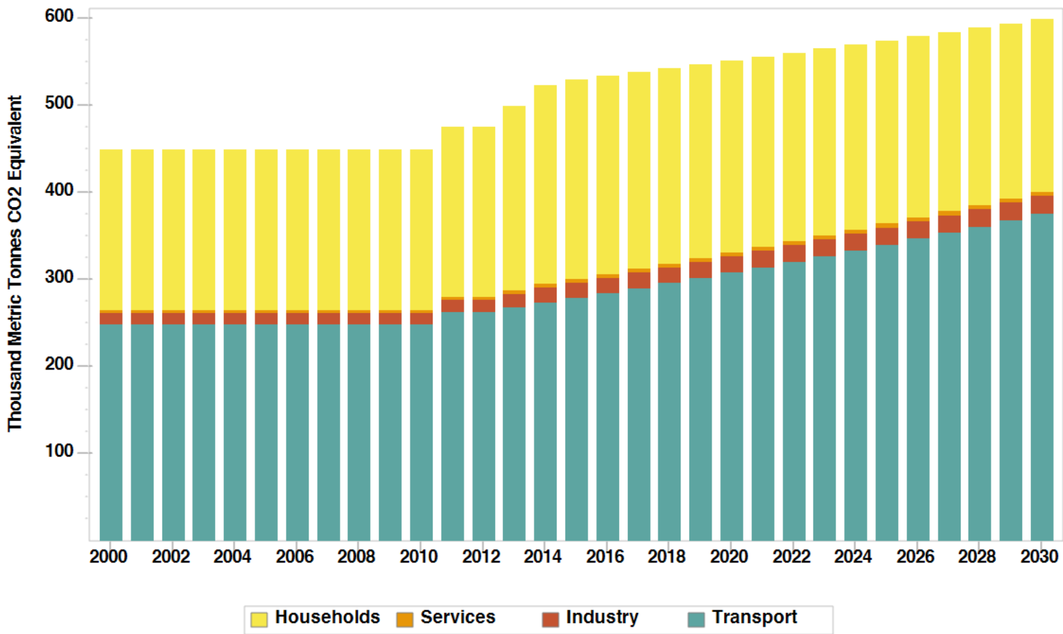

Figure 39: Emissions from energy consumption, excluding electricity generation (kt CO2eq.), by sector, baseline scenario, 2000-2030

Source: Sousa, R et al.2016

Overall, according to figure 40 below, it is estimated that energy demand categories are responsible for emissions of near 600 kt CO_2eq. in 2030, which corresponds to approximately 44% of the country's total emissions.

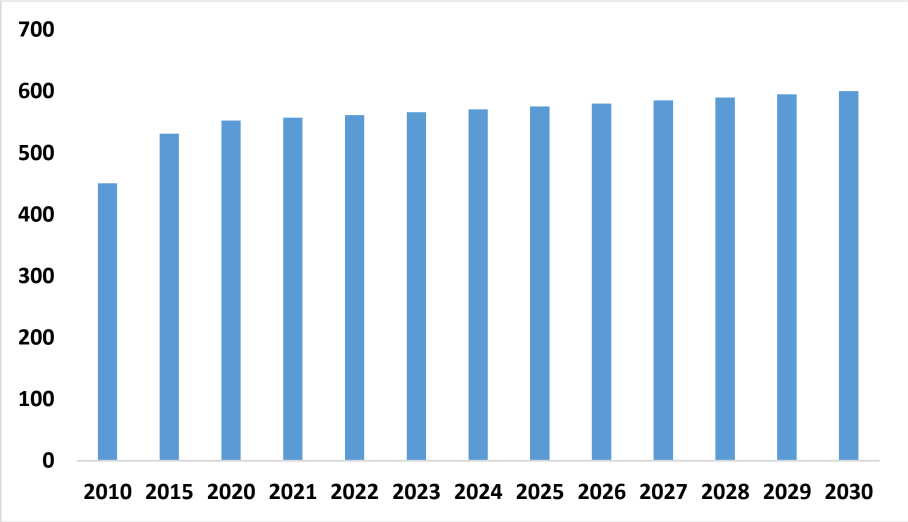

Figure 40: Emissions from total energy demand (kt CO_2eq.), 2010 to 2030

Source: Sousa, R et al.2016

Regarding GHG emissions from burning of fossil fuels for electricity generation, it can be noted in figure 41 below that the evolution of emissions reflects the growth in electricity generation through installed thermal capacity, to accompany the growth in energy demand.

In this baseline scenario, the business-as-usual scenario is realized, where it is considered that the proportions in the electric generation mix (thermal vs. renewable) are likely to remain the same as in the last known historical year (2012), with 87% thermal capacity, 8% wind capacity and 5% solar capacity, but unfortunately with the installation of more thermal power, electricity generation is becoming increasingly thermal.

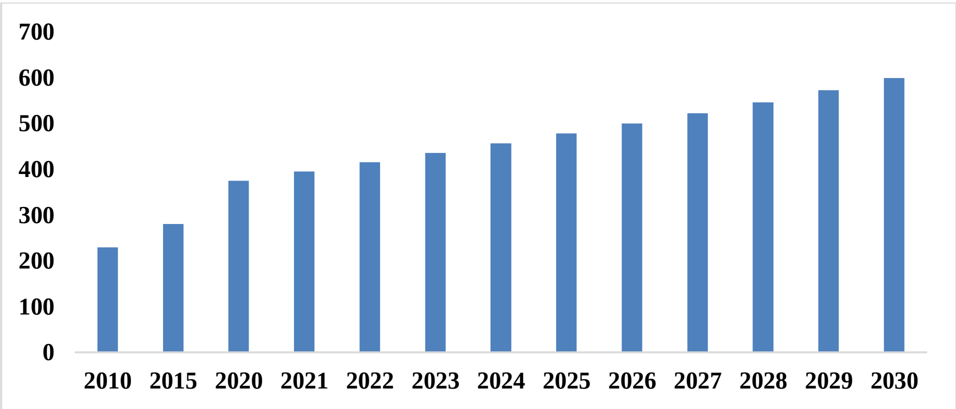

Figure 41: Emissions from electricity generation (kt CO_2eq.), baseline scenario, 2010-2030. Source: Sousa, R et al.2016

Emissions in energy demand in Cabo Verde are growing at a virtually constant rate of 0.8%/year, a calculation associated with the increase in the energy intensity of demand, as previously mentioned. They reach 531,23 kt CO_2eq. in 2015 and 600,45 kt CO_2eq. in 2030. Emissions also increase in the energy transformation category (electricity generation) from 280,32 kt CO_2eq. in 2015 to 598.82 kt CO_2eq. in 2030.

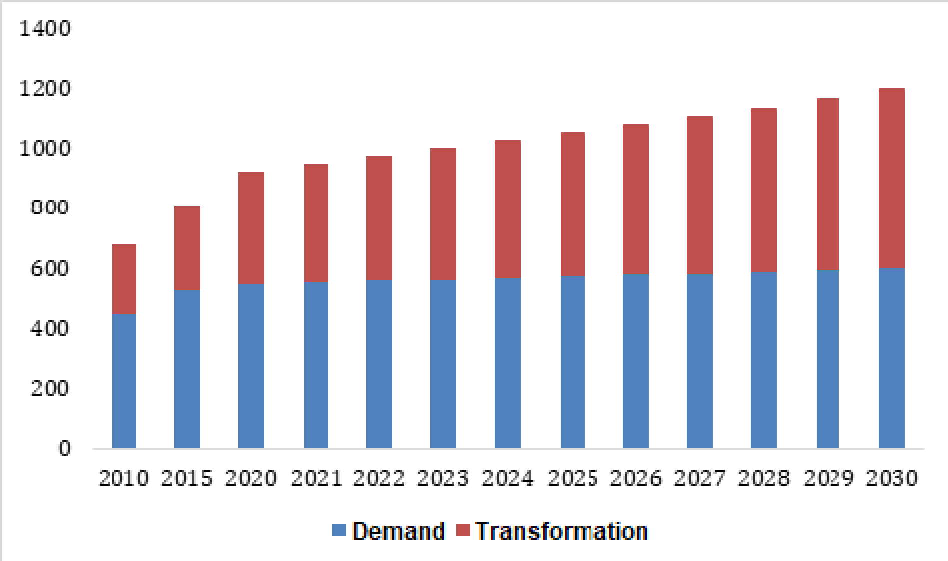

Figure 42: Total emissions in energy sector (kt CO_2eq.), by category, baseline scenario 2010-2030. Source: Sousa, R et al.2016

It is estimated that in the baseline scenario, the energy sector will produce near 927,34kt CO_2eq. in 2020, reaching 1 199.27kt CO_2eq. in 2030, an average of 2.23% annual growth.

3.5 Mitigation Measures and Scenarios

After establishing the baseline scenario, in terms of energy use and production, and respective emissions, the measures to mitigate climate change are evaluated.

The National Action Plan for Renewable Energies (PNAER), Resolution No. 100/2015 of October 15, 2015, has been a reference document for Cabo Verde's energy transition, which includes a compilation of public policy documents, including the National Action Plan for Energy Efficiency (PNAEE) and the Sustainable Energy for All Agenda for Action (SE4ALL).

It is indicated that the country's energy plan by 2030 provides for some measures that imply mitigation of GHG effects. The starting point to define the measures to be implemented were the main mitigation targets that the country chose to establish in INDC 2015, which include:

- 30% of renewable energy based electricity in 2025
- Reduced energy demand by 20% up to 2030
- Increased efficiency in transport sector
- Afforestation and reforestation of 10 000 ha by 2030.

The values indicated are applied in a linearly increasing manner until reaching the proposed goal. Regarding the selection of measures, in line with the calculation methodology used, the solutions that typically contribute to the goals sought in INDC2015 were proposed. It should be noted that the INDC also refers to the renewable energy strategy based on the objective of reaching 100% of all electricity produced in Cabo Verde from renewable energy sources in 2025, either in the main network or in micro-networks in individual systems, provided that the necessary international technical and financial support is ensured (in an appropriate, timely and predictable manner). Therefore, the provision of international credit lines for Private Financing will be crucial for the implementation of the measures recommended.

The implementation timeline will be:

- 35% of RE penetration rate in 2016-2018
- 50% of RE penetration rate in 2018-20205
- 100% of RE penetration rate in 2020 a 2025

Under the national structural reforms planned under the Cabo Verde Transformation Agenda, the country aims to achieve a fully decarbonized electricity system in 2030, while responding to increased demand.

3.6 Measures of Energy Demand by 2030

The measures proposed here are based on the targets proposed in the PNEAR, where the country pointed to a concrete objective of reducing the energy demand by 10% by 2030 included in the mitigation scenario, instead of the savings achieved by each of the measures of energy demand, listed below:

- **Category- Services:**
    - Efficient public lighting– 3 000 units

This measure considers replacing 3 000 conventional luminaires for efficient LEDs. It is estimated this measure saves 1.31 GWh/year on electricity.

- **Category- Transport:**
    - Electric cars– 500

This measure considers the replacement of 500 gasoline cars from the government fleet for electric cars. It is calculated, greenhouse gas abatement cost model (GACMO), this measure saves 750 thousand liters per year in gasoline.

3.7 Energy transformation measures by 2030

In Cabo Verde, in the absence of oil refining, measures related to the energy transformation category are limited to electricity generation. This has relevant impacts in a country like Cabo Verde, where the electricity generation mix is, in the year 2000, mainly of fossil origin (87% of thermal origin, and 13% of renewable origin). It is worth highlighting the range of the proposed 30% renewable energy production targets, which require a high increase in solar PV production capacity (25MW) and wind power (30MW), as well as the reduction of losses to 8%.

Cabo Verde proposes to implement wind and solar power so that 30% of the electricity from renewable sources can be achieved by 2025.

The measures incorporated in this section include an estimate of the growth in endogenous capacity, which allows to comply with the percentage of renewable production required. In particular, the production of electricity from:

- Wind Energy: 30MW installation
- Photovoltaic (PV) solar: installation of 25MW

Also the cost assessment of these measures was made from the GACMO model. In these measures the calculations are quite standardized and implementation costs are generally known. The values of the projects proposed by GACMO were changed to better represent a projected national reality. In the specific case of electricity generation, since the technologies have already been developed, a higher discount rate (15%) was considered, which represents a lower financial performance value of the project.

3.8 Mitigation Scenario

To build the emission mitigation scenario in Cabo Verde, by 2030, the baseline scenario previously constructed is incorporated.
Regarding measures to reduce energy demand, since Cabo Verde has defined a concrete reduction target, the savings potential of the measures identified above (efficient public lighting and hot water for services) is not included, which alone do not exhaust the desired goal of a 10% reduction in energy demand.

Specifically, it applies to the baseline scenario

- A general reduction in energy demand, between 2020 and 2030
- New capacities of renewable electric energy, by 2025

In most measures a linear growth of the variable is considered, until reaching the final objective in the established date. For example, if we have a growth of part of renewables by 2025, it is considered it stabilizes between 2025 and 2030.

The reduction in energy demand, which has been applied increasingly since 2020 to reach 10% by 2030, proposed as a mitigation objective in energy demand, allows the accumulation of emission savings of 337 kt CO_2eq. by 2030, according to figure 43 below.

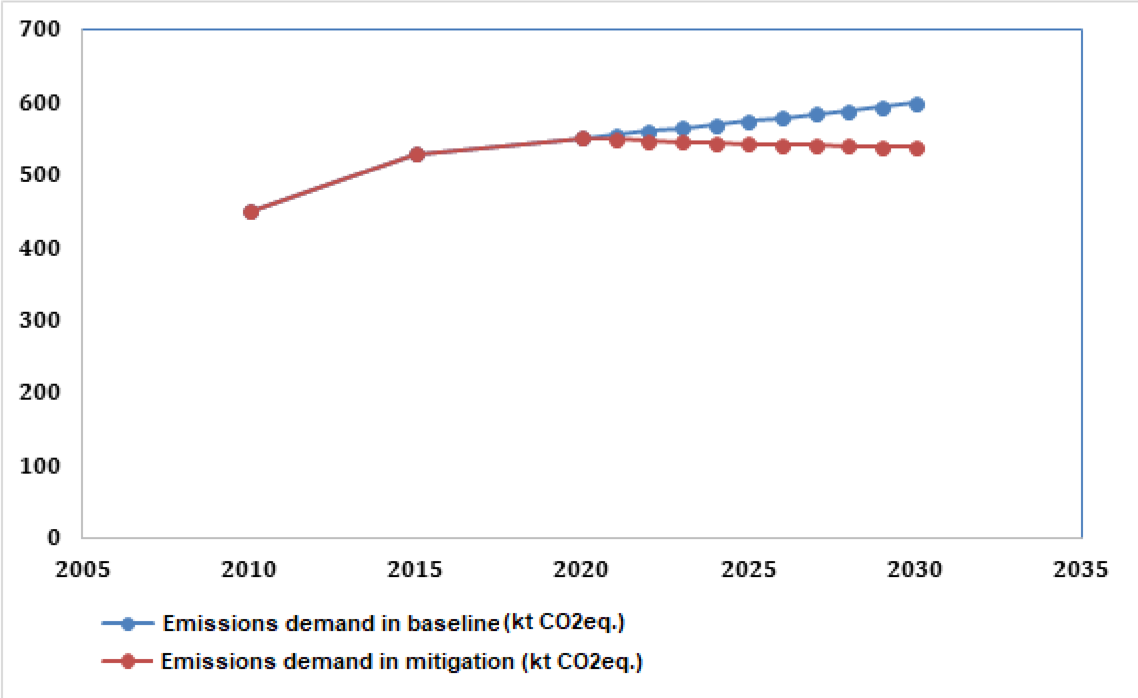

Figure 43: Emissions from category energy demand, in baseline and mitigation scenarios (kt CO_2eq.), 2005-2035. Source: Sousa, R et al.2016.

As mentioned in the chapter on mitigation measures assessment, the need for carefully evaluating these results is recalled, since they have been prepared based on standardized projects, from other places, with different geographic and socioeconomic characteristics.
Thus, by comparing the baseline and mitigation scenarios for energy transformation, taking into account the quoted output of the generic installation of solar and wind power capacities indicated above, the results in Cabo Verde's emissions savings are shown in figure 44 below.

In the mitigation scenario assessment and under energy transformation measures, it is noted that the promotion of renewable electricity, materialized in wind and solar production, will replace production from petroleum products (diesel and fuel oil 180/380). In this sense, in spite of the total electric production increase, the proportion originating from the combustion of primary fossil energy will decrease, which leads to a curve emission in the mitigation scenario as shown below, in figure 44. The introduction of renewable production in the model is made via additional capacity. That is, production capacity is added to produce 30% of the electricity from renewable sources by 2025. The new capacity is introduced in a linearly increasing manner by 2025. The initial drop in 2013 is related to the start-up of wind farms.

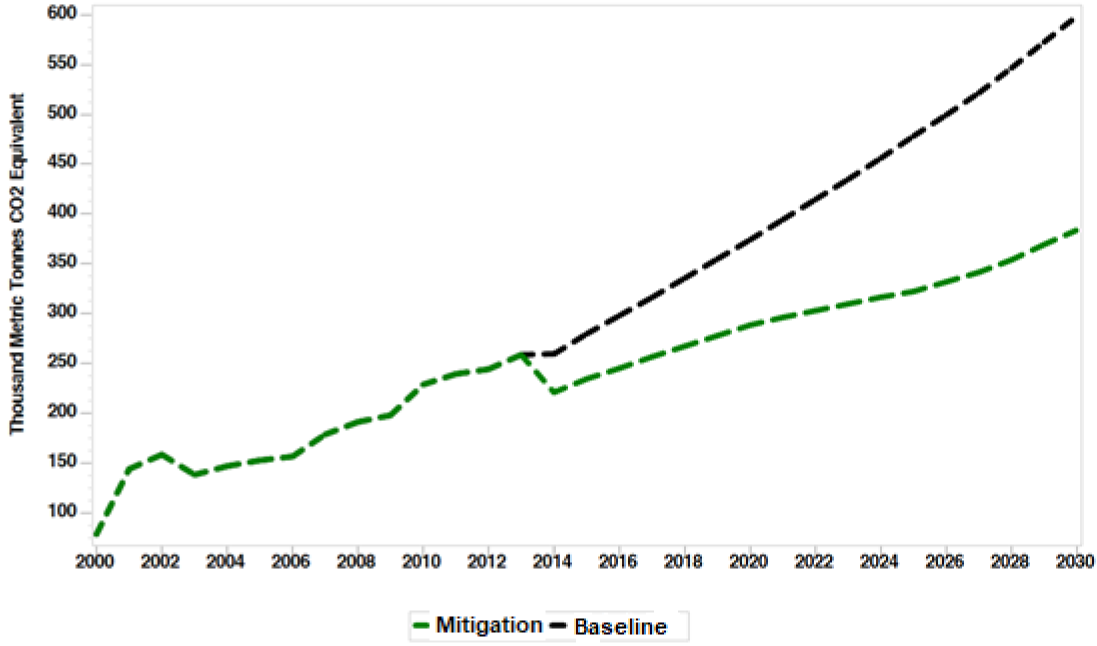

Figure 44: Emissions from category energy transformation, in baseline and mitigation scenarios 2000-2030. Source: Sousa, R et al.2016.

With these measures, it is estimated that the country accumulates 2 016 kt CO_2eq. of saved emissions by 2030, which is equivalent to a presumed saving of around 36% of the sector's emissions in 2030, regarding the non-installation of these capacities.

In the particular case of measures to reduce energy demand, since Cabo Verde has defined a concrete reduction target, the savings potential of the measures identified above (efficient public lighting and domestic hot water for services) is not included, which alone do not exhaust the desired 10% reduction in energy demand.

Specifically, to the baseline scenario is applied:

- A general reduction in energy demand, between 2020 and 2030,
- New capacities of renewable electric energy, by 2025,
- New emissions in non-energy category, between 2020 and 2030

In most measures a linear growth of the variable is considered, until reaching the final objective in the established date. For example, if we have a growth of part of renewables by 2025, it is considered it stabilizes between 2025 and 2030.

3.9 Final comparison of scenarios

By aggregating the emissions achieved in the different categories, and noting the characterization of emissions in Cabo Verde, it is evident that the significant savings of emissions stem from the measures that make the electricity generating facilities more renewable. The remaining measures for energy demand and non-energy categories comprise the final savings effect.

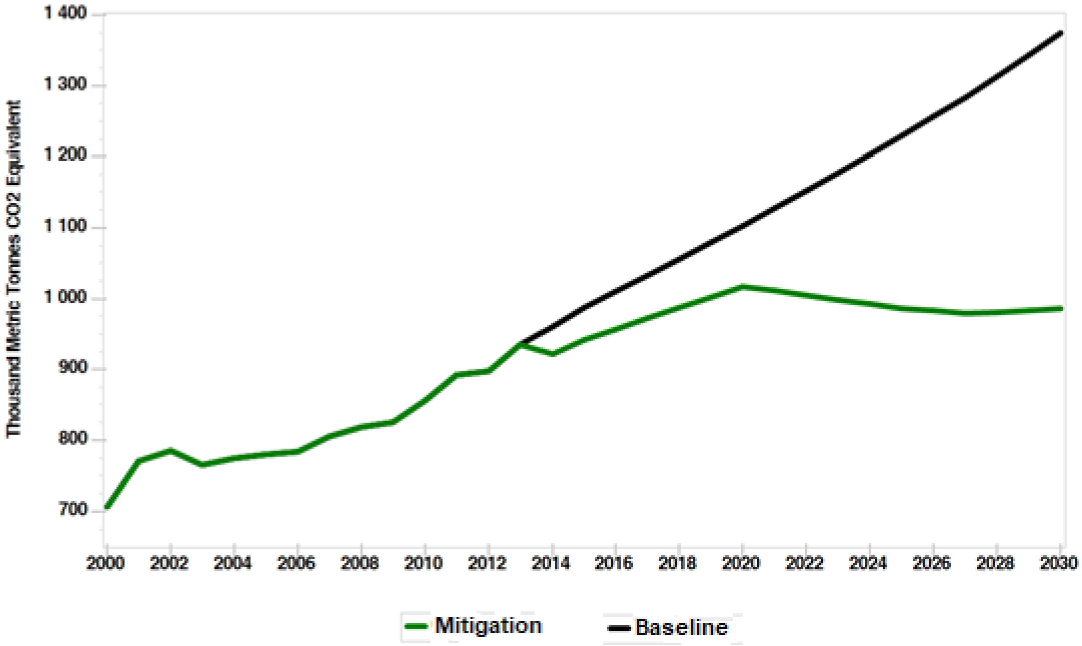

Figure 45: Total emissions in Cabo Verde in baseline and mitigation scenarios (kt CO_2eq.), 2000-2030. Source: Sousa, R et al.2016.

In the mitigation scenario, with lower emissions than in the baseline scenario, there is also an effective reduction in emissions from 2020, when most mitigation measures are implemented. A total of 2 984.55 kt CO_2eq is ultimately calculated from emissions cumulatively saved up to 2030. This is achieved by including in the model the standardized measures listed in the previous sections, which corresponds to a savings of approximately 28% in 2030, compared to the baseline scenario.

The identified and evaluated sectoral mitigation projects are presented in annex III, where it should be noted that measures and programs to mitigate GHG emissions, as viewed as a whole as a single project or a single program, would reach a maximum annual reduction potential of 149.99 kt CO_2eq., with a net annual cost of US $ 2.05 million, a negative emission reduction cost of US $ 199.86/ t CO_2eq.

3.10 Emissions and removals projections

Future projections of GHG Emissions and Removals for 2015, 2020, 2025 and 2030 were estimated based on the mitigation component presented in Cabo Verde's Intended Nationally Determined Contribution (INDC) 2015. The mitigation targets, related essentially to the production of electric energy, defined in the INDC, as presented above.

Projections of emissions and removals were estimated taking into account the following assumptions:

- For 2015, with activity data available in sector reports and emission factors for each type of gases and activities, emissions were estimated from the following categories: Energy, IPPU, Livestock and Waste;
- For 2015, in the agriculture and forestry subsectors, due to data unavailability, emissions were estimated using the Excel linear regression model, which allows us to calculate and / or predict a future value knowing the historic data;
- Estimates of GHG emissions for 2020, 2025 and 2030 were calculated for the IPPU, waste and transportation, industry, trade and domestic subsectors using the Excel forecast function; and;
- Estimates of GHG emissions for the energy industry subsector were estimated from the mitigation targets defined in the INDC.

The forecast function is used as follows: FORECAST (x, y value known, x value known)
Where:

- X – is the value we wish to know or predict;
- Value y – is the known or historic data interval;
- Value X – is the known matrix for values x

The equation for FORECAST is as follows: $a + bx$, where

$$a = \bar{y} - b\bar{x}$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

And where x and y, are the AVERAGE sample (x known) and AVERAGE (Y known).
The table below represents emission projections during the interval from 2015 to 2030 for the different sectors and subsectors listed:

Table 58: Projection of CO_2 eq emissions and removals, in Gg, by sector by 2030

Sectors	1995	2000	2005	2010	2015	2020	2025	2030
Energy	233,74	300,29	548,60	542,16	516,40	528,85	555,83	572,00
IPPU	0,35	0,51	1,35	3,37	3,44	4,00	4,96	6,51
AFOLU	-96,27	-123,47	-129,77	-117,81	-118,47	-108,49	-105,48	-96,29
Waste	27,87	25,67	32,35	57,54	59,78	69,41	79,00	88,60
Total Emissions and removals	**165,70**	**203,00**	**452,54**	**485,26**	**461,14**	**493,76**	**534,32**	**570,82**
GHG emissions /capita (tCO_2 eq)/capita	0,43	0,47	0,97	0,99	0,88	0,89	0,91	0,92

The forecast describes that CO_2eq emissions in Cabo Verde have a growing trend, even with the introduction of mitigation measures under the INDC related to the total electricity generation from renewable sources.

Despite the decrease in CO_2eq emissions in the energy sector in 2015 and the mitigation measures implemented, the emission forecast in this sector points to an increase in emissions from 2020. This increase is mainly due to the contribution of emissions from the transport sector, as it is expected there will be an increase in the activity volume in the ports and airports in Cabo Verde, as well as in the car park.

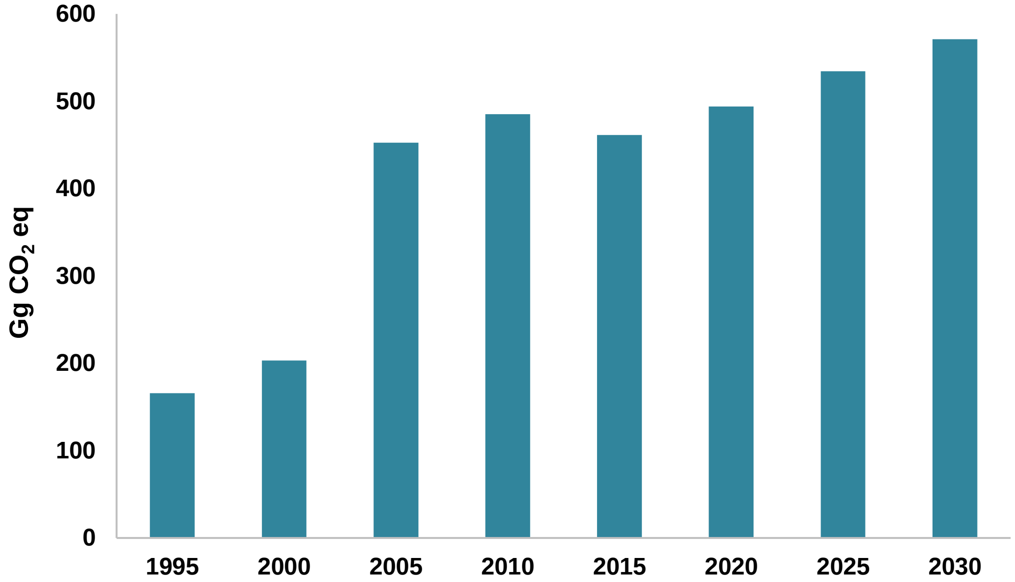

Figure 46: Estimates of CO_2 eq emissions and removals by 2030

In this CO_2eq projection exercise, concrete measures related to the forestry sector were not included, but if the measures recommended in the INDC are implemented, total CO_2eq emissions may by 2030 be lower than what is presented in the forecast.

CHAPTER IV- CLIMATE CHANGE VULNERABILITY, ADAPTATION AND IMPACTS

4.1 Current climate variability

4.1.1 Atmospheric dynamics in Cabo Verde region

Cabo Verde is located in a region where the variability of the Azores subtropical acts as regulatory factor of the anomalies of rainfall, by controlling the seasonal oscillation characteristics of the trade winds of maritime and continental features during the dry months (November to June). In the rainy season (July to October), there is the oscillatory movement of the ITCZ, characterized by southeast winds and disturbances from the east. Between December and February, the islands are affected by air masses from extra-tropical latitudes.

Cabo Verde archipelago are conditioned by the location and intensity of the action centers, most of them located in the Atlantic, namely four systems considered, such as the subtropical anticyclone of the Azores, low equatorial pressures, the Canarian sea current and thermal depression on the African continent during the summer. The region of the sub-tropical anticyclones is characterized by high pressures, divergence and subsidence in the air circulation. Its orientation and location influence and characterize the air masses that penetrate the Cabo Verde region throughout the year.

At altitude, the circulation is dominated by the East flow, with maximum intensity values conditioned by the location of East African (JAL) and East Tropical (JET) jets, according to Hall etal (2006). Located at the 600 hPa level, with maximum velocities of 10 m/s between 10° N and 15° N, JAL is the result of heat sinking by thermal depression, while JET, which is located at 200 hPa south-lagged to the equator, is fed by deep convection (Mohr and Thorncroft, 2006). This dynamics of seasonal circulation on the West African coast with the consequent southern movement of the ITCZ marks the rhythm of the rainfall regime on the west coast of Africa and, consequently, on the Cabo Verde region.

4.1.2 Evolution of climate parameters

The analysis of the archipelago climate variability was based on more complete chronological series of meteorological observations, with the concern of trying to detect any trend of pushing away significantly from the climatological normal. The series of the Mindelo, Sal and Praia stations were used, corresponding to the air temperature and amount of precipitation for the period from 1960 to 2015. We also analyzed the way the series behave over time. Assessments of other parameters such as wind, relative humidity and cloudiness were also made.

4.1.2.1 Average temperature

In Cabo Verde, the average annual temperature ranges between 23°C and 25°C, in the northern islands, and between 24°C and 26°C, in the southern islands of the archipelago. In the months of January and February, the temperatures reach minimum values that vary between 15ºC and 18ºC. The maximum values are recorded in August and September, reaching average levels of 32ºC to 34ºC. The spatial variation shows that the average temperature increases when it moves in the southern direction of the archipelago, where the temperature values are generally 1 ° C above the average values recorded in the northern islands. The explanation is found in the climatic characteristics of the geographic location of the archipelago, between latitudes 14º and 18º north.

The variability of the annual average temperature series in Cabo Verde (Mindelo, Praia and Sal) from the 1960 to 2015 period, through an analysis of the annual cycle of average temperatures, shows that, since the 1990s, there is a growing trend of the annual average that has been maintained in the last 15 years, presenting average values of + 0.2ºC above the climatological normal of 1961-1990. This behavior is similar comparing the data of the three stations under study, with a more pronounced trend in the Mindelo station (Figure 47).

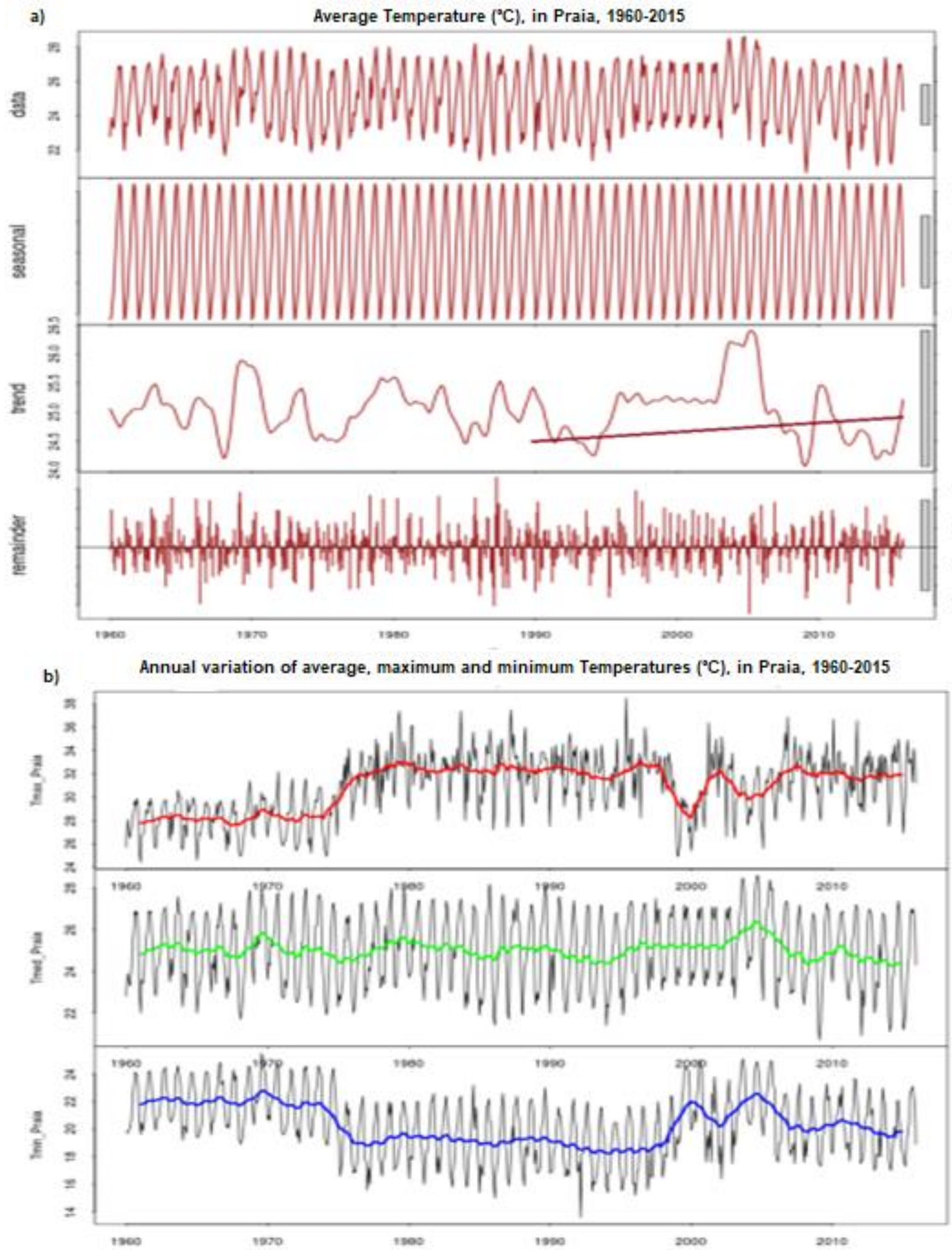

Figure 47: a) e b) – Charts on behavior of temperature historic series (maximunm, average and minimum (ºC) in Praia station, in 1960-2015 period, including seanability and trend

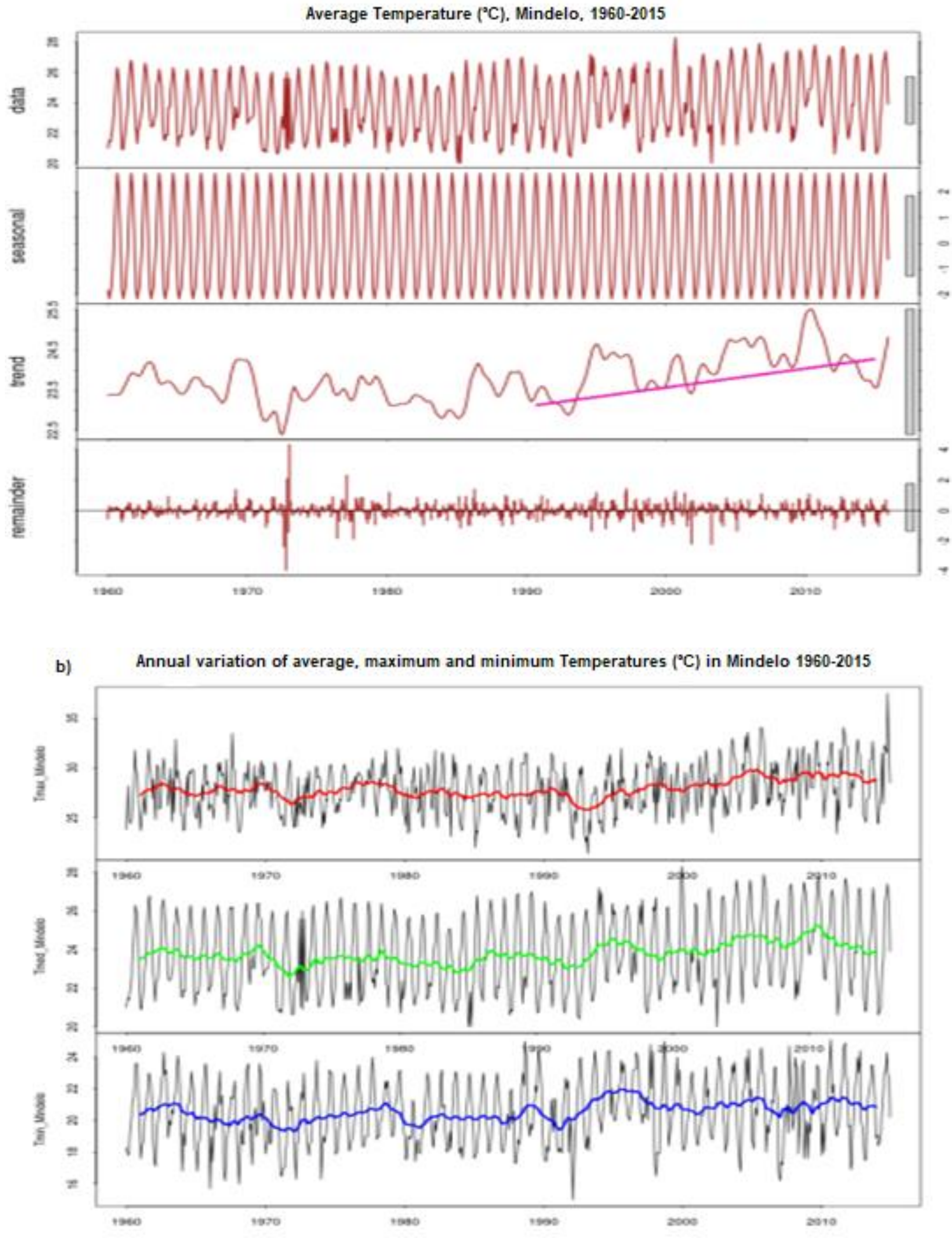

Figure 48: a) e b) - Charts on behavior of temperature historic series (maximum, average and minimum (°C) in Mindelo station, in 1960-2015 period, including seasonability and trend

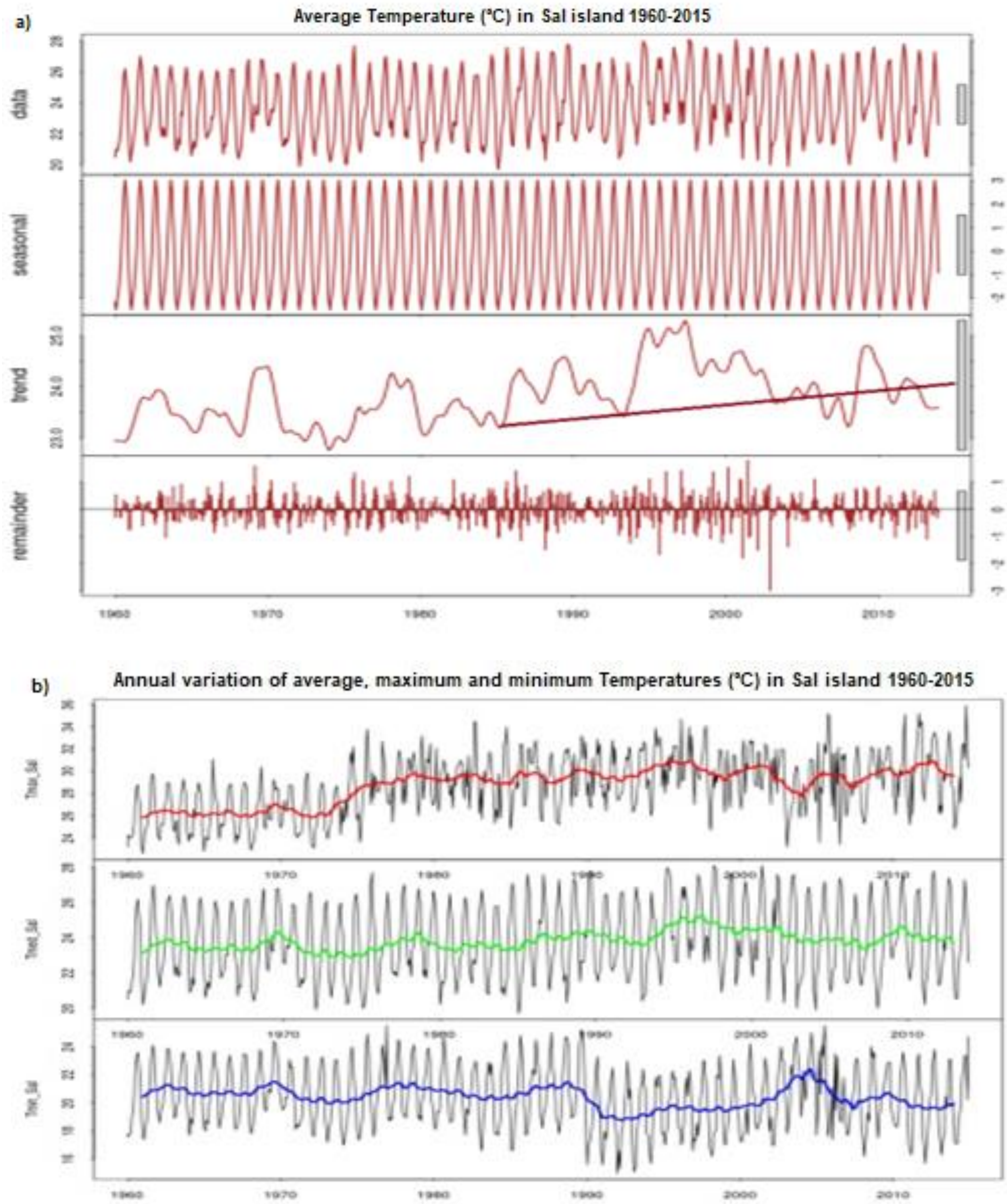

Figure 49: a) e b) - Charts on behavior of temperature historic series (maximum, average and minimum (ºC) in Sal station, in 1960-2015 period, including seasonability and trend

Extreme temperature variation (maximum and minimum) has the same behavior as the average temperature, with an increasing trend since 1995. Although the variation of the minimum temperature is less pronounced than the maximum temperature, in the last five years this growth has slowed down, as can be noted in Figures 48 (a) and (b).

This increasing trend also occurs in the seasonal variation with more evidence in the hot season, during the months of June, July and August (JJA) and September, October and November (SON), while in the colder seasons, this increase is less pronounced.

The lowest variability occurs in the JAS and OND periods. Given that the JAS quarter is warmer, it does not suffer the influence of cold air masses and there is an increase in occurrence of rainfall, which act as a thermal regulator factor. The positive anomalies observed since 1995 indicate that the average monthly temperature during these last years reached an average value of 0.4ºC above the 1960-1990 climatological normal.

4.1.2.2 Rainfall

The annual rainfall cycle in the Sal, Mindelo and Praia stations is represented in Figure 50, with well-defined periods: a dry period, which runs from March to June, and a wet season, which begins in July and prolongs until October.

The accumulated rainfall during this period reaches average values between 150-300 mm in wet years. In drier years the rainfall usually does not exceed 100 mm. In general, this precipitation is concentrated in the month of September. The less humid period, from November to February, sometimes shows weak precipitation, with greater expression for the islands of Barlavento, reaching sporadically values of up to 50 mm.

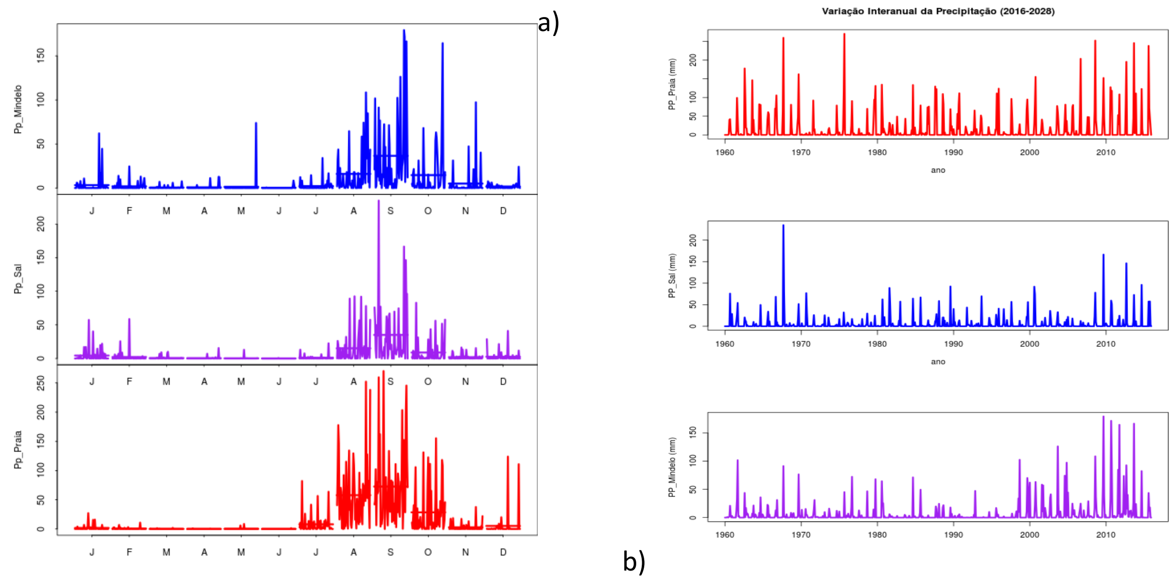

Figure 50: a) e b) – Annual rainfall cycle in Mindelo, Sal and Praia stations, and respective variation in the 1960-2015 period

The analysis of the interannual rainfall variation in the three seasons under study shows that, within the frequent annual oscillations in the rainfall variation, there is a trend for a remarkable increase in rainfall, from mid-1990s. This trend is confirmed by the analysis of climate data

Statistical analysis of annual rainfall between 1960 and 2015 shows that rainfall in the southern islands is more frequent and has intensified since 1998. In the northernmost islands rainfall is irregularly distributed and less frequent. There has been a trend for increase since the 2000, similarly to the southern region of the country

4.1.2.2.1 Seasonal variation

The assessment of the seasonal rainfall variation in the three seasons during the different seasons of the year in the period from 1960 to 2015 - Figure 51 a) and b), shows two distinct periods: a first period from the sixties to mid-1990s, where the decrease in values is evident, which corresponds to a long period of droughts; and a second, as of 1998, with a slight upward trend towards normal rainfall regimes, extending throughout the wet season from July to October. There is also a trend for rainfall increase during the transition period, which indicates a possible return of "winterings". This slight rainfall may be directly related to the slight trend towards a rise in the average temperature on the archipelago, evidenced in Mindelo, Praia and Sal station series.

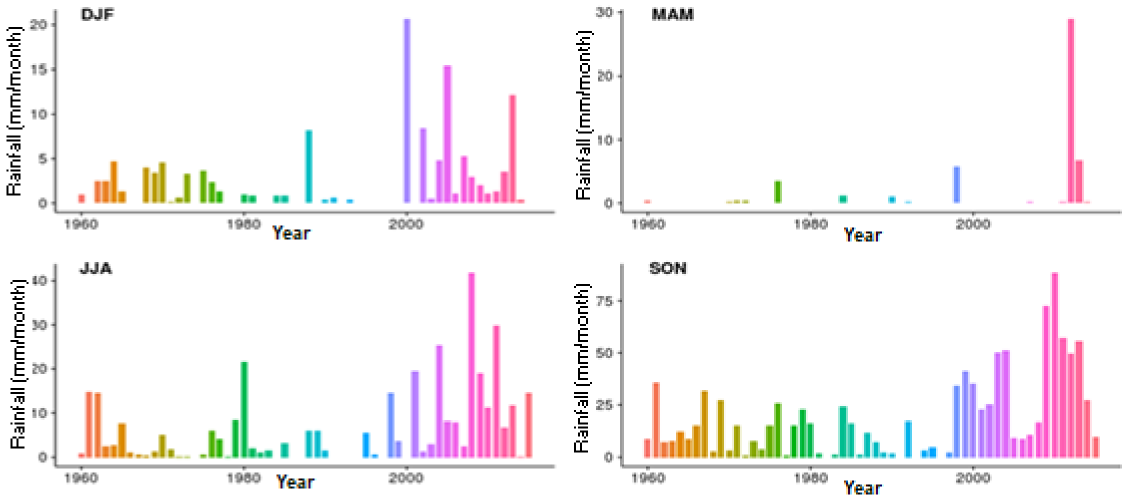

Figure 51: Chart on quarterly rainfall variation (DJF, MAM, JJA and SON) in Mindelo station, in the 1960-2015 period

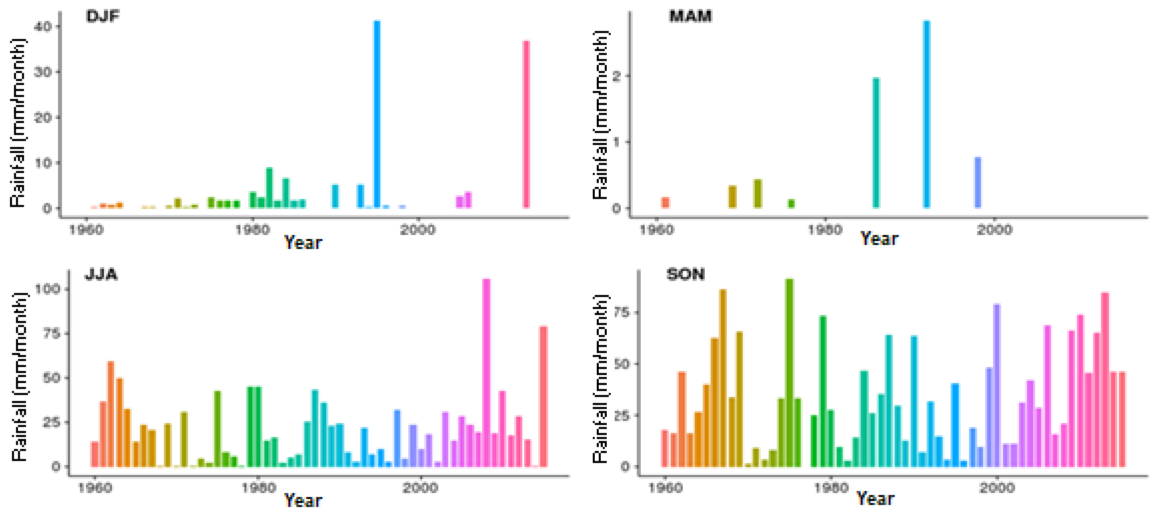

Figure 52: Chart on quarterly rainfall variation (DJF, MAM, JJA and SON) in Praia station, in the 1960-2015 period

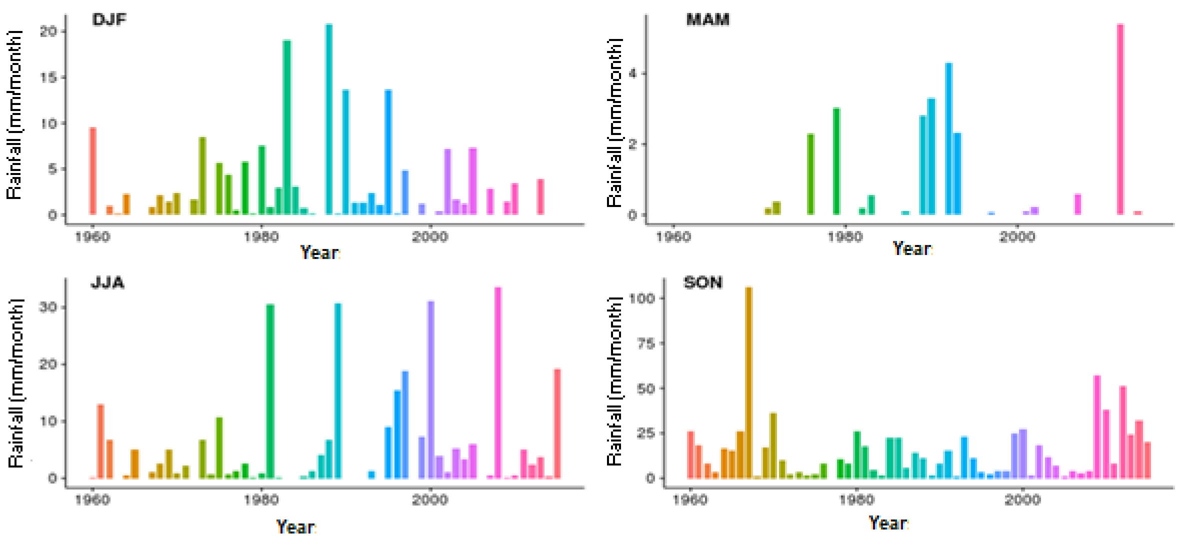

Figure 53: Chart on quarterly rainfall variation (DJF, MAM, JJA and SON) in Sal station, in the 1960-2015 period

4.1.2.3 Wind

Consistent with the pressure field and because the archipelago is located on the outskirts of the Azores anticyclone, NE trade winds are the dominant winds, with annual frequencies between 60% and 80% (figure 54). The SE and SW winds appear periodically with the ZCIT approach between the months of July and October, when most rainfall occurs. During the dry season, the continent's winds predominate and are responsible for transporting the desert dust to the archipelago.

During this period the visibility is often less than ten kilometers and the relative humidity decreases considerably.

The intensity of the wind tends to maintain its annual variation with an average speed oscillating between 6 and 7 m/s. The seasonal behavior of the wind intensity presents periodic oscillations and there is no tendency for significant changes in variability.

The highest wind intensity occurs during JFM and AMJ periods, with average velocities varying between 6 and 10 m/ s, to decrease during the JAS period, where it reaches the minimum values, and to increase again in intensity in the period OND. The average wind speed and the frequency of directions in the three stations are shown in figure 54. Winds blowing from the North and Northeast are more frequent and more intense, with an average intensity of near 25 km/h. Winds blowing from the South are less frequent.

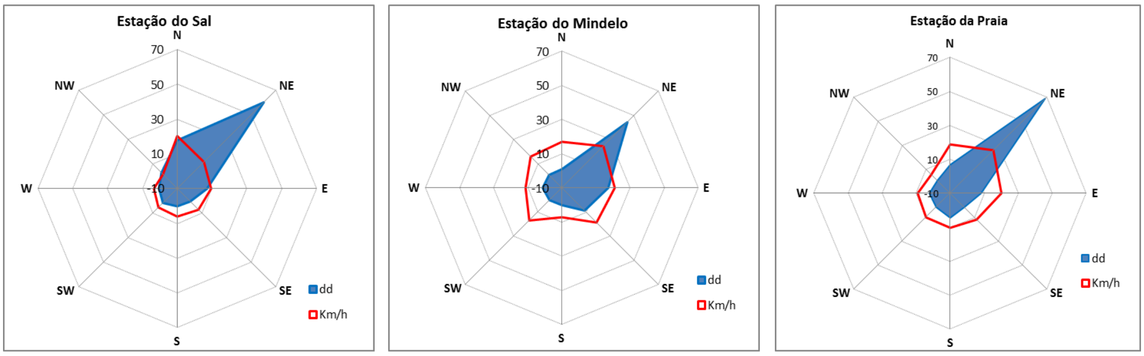

Figure 54: Chart on wind annual frequency in Sal, Mindelo and Praia stations, in the 1960-2015 period

4.1.2.4 Relative humidity

In average terms, the air relative humidity varies between 60% during the day, with higher temperatures, and 90% during the dawn or periods of cloudy sky and rainfall, with lower temperatures, strengthened on some islands by orographic influence. The highest values occur between July and October.

Values may exceed 95% during the night or when the ITCZ reaches its extreme north position. The annual average ranges from 67% to 71%, with minimum values in March (59%) and highs in September (77%), with the highest variation occurring in the southern islands. The minimum coincides with the period when there are more frequent Eastern and Northeast winds, accompanied by suspended dust and low relative humidity, often less than 35%.

4.1.2.5 Cloudiness

Generally, surface cloudiness depends on the distribution of the world´s seas and continents. The larger amount of water vapor in the atmosphere on the oceanic and coastal regions leads to more cloudiness.

Annual variation, although not very constant, presents two sharper types: i) in average latitudes, excepting for certain coastal regions, cloudiness has maximum and minimum values in winter and summer, respectively; (ii) In hilly mid-latitude regions and tropical regions with rainy season in summer, similarly to Cabo Verde, the same occurs, with more cloudiness occurring during the months of July to October, when the clouds base height is smaller during dawn and in the morning.

As a rule, cloudiness is less during the afternoon and early evening, between March and June. This variability is associated with i) the ITCZ movement towards the archipelago region, ii) the influence of the middle latitude and hemisphere circulation phenomena (south-north), causing strong currents in altitude on the islands during the January to February period, and iii) by the change of the winds regime, when they start blowing predominantly from the continent.

4.1.2.6 Dust

The suspended dust, the so called "haze" in Cabo Verde occurs when in the region's circulation a current from east or east-northeast is established on the African continent, between latitudes 15º and 25º north, following the formation of a thermal depression, between 10º to 20º north on the continent, strengthened by the Libya anticyclone in the North Africa region. Under these synoptic conditions, the subsidence in the lower troposphere is sharp and air temperature inversion sometimes reaches 1000 to 1500 m in altitude, blocking vertical upward movements.

In dusty conditions, the sky usually presents few clouds of the stratocumulus type and the wind blows from the northeast, ranging between 18.5 and 33.3 km/h. With this type of events, large amounts of solid suspended particles are transported from the African continent by the E/ENE current, corresponding to the harmaton, hot and dry wind coming from Western Sahara, which occurs approximately two days after the establishment of the east current over Africa.

The most intense episodes often reduce visibility to values between 2 and 4 km, sometimes even less than 1 km. This situation usually lasts for 4 to 8 days, and remains stable for over two weeks. On the other hand, there is no good correlation between the various episodes of dust coming from the continent during the years considered dry and/or humid, taking into account their random occurrence both in dry and wet years.

Figure 55 presents the monthly evolution of dust in the 1985-2015 period. It shows that, when the wind blows more intensely, the months of December to March present more intense episodes. Its presence is felt more in altitude during the dry and humid seasons, a situation that has maintained the same stable trend in recent years. The months of January and July present the highest number of consecutive dusty days (21 days). The months of May, October and November present fewer occurrences of 6 and 7 days, respectively.

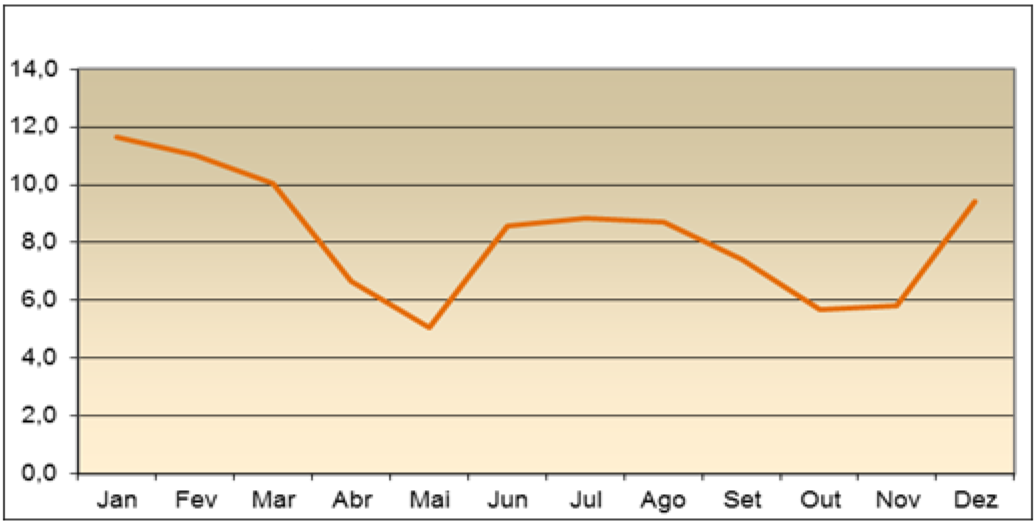

Figure 55: Average monthly number of haze days, in the 1985-2015 period

4.2 Phenomena associated with climate variability

Phenomena that most affect and condition the climate environment in the Cabo Verde region are the Azores anticyclone variability, the cold current from the Canary islands, the oscillation of the intertropical zone of convergence, the formation of depressions and tropical cyclones, the persistence of the " harmaton "during the dry season, random variability of rainfall intervals, temperature fluctuations, intense storm lines, frequent episodes of dry haze, and jet streams in altitude above the region.

As far as air temperature is concerned, any increase, though minimal, would further affect the already fragile environment, contributing to increasing or prolonging drought episodes, causing heat waves and wind-blown dust with consequences on soil erosion and degradation and a possible rise in sea level, which could severely affect coastal areas and cause negative impacts on tourism and the economy. Exposed to sea currents, the coastal zone is permanently exposed and highly vulnerable to aggressive waves, more specifically austral waves.

In low latitudes on the ocean, such as the region where the archipelago is located, circulation conditions favor the development of highly energetic systems such as tropical cyclones, also known as hurricanes or typhoons.

High temperatures of the sea water (T> 24ºC) and the existence of atmospheric disturbances in the trade winds, associated to a force of coriolis of sufficient intensity, are favorable conditions for the formation of meteorological phenomena of this nature. Although they sporadic and regional character events, these Atlantic tropical storms, also known as "Cabo Verde cyclones", can be organized over the western region of the archipelago, when the force of coriolis is strong enough to make its effect felt. Their formation has been observed on several occasions on the islands.

4.3 Impacts of climate variability

Agricultural productivity has shown great sensitivity to the interannual change in rainfall, including the start and end dates of the rainy season. Thus, yields can be significantly affected by the negative, dry anomalies, which will have serious implications for the country's economy. On the other hand, the reverse happens with positive precipitation anomalies. Pest outbreaks and movement may be conditioned by temperature and rainfall variability. The same can be said for the health sector, with the spread of diseases related to regional climate variability. In this case the problem has to be addressed and addressed regionally.

4.4 Global phenomenon and Regional Dynamics

Rainfall models in West Africa are linked to the seasonal movement of the intertropical convergence zone, where the warm, dry, tropical air from the Northeast meets the hot, humid air masses coming from the south associated with the monsoons.

The semi-arid zone in which the archipelago is located is marked by a single rainy season (July-September), with occasional occurrence of a second rainy season (January-February) marked by higher latitude phenomena. The remaining months are dry, marked by the passage of dust from the Sahara Desert. Temperature variations in the oceans, which are sensitive to global climate change, will undoubtedly have repercussions on the monsoon in the western coastal region of Africa.

In addition to these phenomena, the global effect of continental surface processes (vegetation, soil moisture, water cycle or albedo) on the monsoon dynamics would have remotely affected this region. However, it should be noted that interactions/retroactions between continental dynamics and climate are still poorly understood. The considerable variations in rainfall (less in the coastal zone and higher in the north - south axis) are evidence of this: deficit periods in the last fifty years have identified a clear rupture for 1968-73, 1982-84 and 1997.

Since mid-1990s, there has been a return to better rainfall conditions as well as the return of positive anomalies of seawater in the eastern Atlantic and the westernmost coast of Africa. Another climate variable is the particular fact that changes in West Africa and the Sahel region in terms of temperatures have been faster than global warming. The increase in temperature ranged between 0.2°C and 0.8°C since late 1970s. This trend is particularly strong for maximum and minimum temperatures.

4.5 Change scenarios

4.5.1 Uncertainties

There is significant uncertainty in rainfall projections for West Africa. Recent evidence has demonstrated the limited capacity of climate forecasting models for West Africa. A comparison between the Sahel climate observed between 1961-1990 and the climate simulated by six general circulation models recommended by the IPCC illustrates this deficiency. Contrary to the actual situation, in relation to the data observed, the models show a marked rainy season almost all year round, together with a considerable discrepancy (140-215 mm/year) of the estimated total annual rainfall.

4.5.2 Coastal areas and vulnerable ecosystems

It is estimated that during the 20^{th} century, on average, sea level rose by 1.7 mm per year, that is, 17 cm in 100 years. Current world projections point to an increase in sea level of around 30 to 50 cm in the 1990-2100 period. Considering the reality of an island country, where most of its population lives on the coast, almost every national coastal area and its ecosystems are vulnerable to any change in temperature, rainfall or sea level, including incidents arising from the extremes sea events. Rising sea levels would have a direct impact on coastal submersion and erosion, increased flooding areas and salinity of small estuaries, streams and coastal waters.

4.5.3 Disease spatial changes

Several vector-borne diseases prevail in West Africa, including malaria, sleeping sickness, dengue fever, or even the almost eradicated yellow fever. Rainfall, temperature and hygrometry play an important role in the occurrence of these vectors. Reduced rainfall and desertification may limit the development of these species. But dry climate does not automatically lead to a decrease of these insects in growth areas. Any increase in the number of extreme weather events (irregular rains in particular) could increase the chances for these insects to augment, affect human health and force animals to migrate to areas where forage is more available. The risk of contact with other disease carriers may lead to the emergence of new pathologies.

4.5.4 Soils and land management

Soils in Cabo Verde are fragile, poor in carbon and plant nutrients. Maintaining soil fertility through organic or inorganic sources is the key to sustainable agriculture. Soils are inherently fragile and prone to erosive transport by torrential summer rains. Considering the torrential rainfall and insignificant soil depth in slopes, water absorption and retention by the soil is very difficult, especially if plant coverage is almost absent. Due to the characteristics of the country´s terrain, the surface runoff is significant, with large annual soil losses. Loss of soil (which contains most of the plant nutrients) through water and wind erosion is a major setback for agricultural sustainability and food security in the country. Considering the evolution of climatic extreme events, a considerable reduction in rainfall and rise in temperature could lead to an environmental catastrophe. Thus erosion control in Cabo Verde would be in the sense of keeping the vegetation cover on the soil surface, clearing the fields after the storms and reforesting.

4.6 Establishment of scenarios

Reduced annual precipitation (-20 to -10%) combined with raising temperature up to 2.5°C will expose a large proportion of the rural population to food insecurity and drastically affect the economy. Rain fed agriculture will no longer be feasible in many areas. To adapt to these changes in the driest periods, the following measures have been suggested:

- Crop diversification and increased use of crops better adapted to drought;
- Supplemental water mobilization and irrigation techniques;
- Use of drip irrigation for more efficient use of irrigation water;
- Development of animal breeding and grazing fields in areas inadequate for corn production;
- Promotion of grain legumes and fodder to improve soil conditions and animal productivity; and
- Use of efficient crop calendar.

However, for better adaptation, there are strategies to be implemented that involve generating scenarios for the anticipated knowledge of the future of variability and climate change. Generating climate change scenarios is the first step to represent the future climate, for the probabilistic view of the atmospheric state, and to determine uncertainties related to the effect of increased concentration of some gases on the atmosphere and on the global climate.

4.6.1 Current scenario

As regards temperature, the annual average has increased from 0.6°C since 1960, at an average rate of 0.14°C per decade. The growth rate was faster in the rainy season, the ASO at 0.23°C per decade. It is noted that there is a lack of observation data available on a daily basis in order to identify trends in daily temperature extremes. As for rainfall, the annual average for Cabo Verde has not shown any consistent trend since 1960. Some abnormally significant rains occurred between November and February, which is unusual for this dry season. For this parameter, observations on the daily rainfall are also insufficient, from which it would be possible to determine the changes in the extremes of the daily rainfall data.

4.6.2 Future scenario

4.6.2.1 Data used in projections

A portion of the data used in this study stems from the results of the 15 GCM models used by the IPCC's 4th Assessment Report, which are a simulation of the global physical system´s response to the increase in greenhouse gas concentrations. For the preparation of this document, estimated data on temperature and rainfall variations in different periods and scenarios were assessed. Data include future variations and representations of past models which, according to the IPCC report, should not be taken for instrumental or observed data.

In order to overcome uncertainties associated with the spatial representativeness of the results obtained with global models, the downscaling method was also used with the Eta model, climate version, applied to the Cabo Verde region in the 2017-2023 period.

For 2020 to 2039, country specific data from global models were used to assess scenarios A2 and B1. These correspond to economic and ecological extremes, including quantiles, ensemble periods and historical (monthly and annual) data. Anomaly and temperature evolution trend assessments were also made based on global model data, using baseline control periods from 1961-2000 and 1981-2000. The results were compared with those of some countries in the subregion.

4.6.3 Projections

Based on the analysis of temperature and precipitation historical series of models for Cabo Verde, there is a trend for temperature increase from early 1980s, in line with the standards in the western African region, and a trend towards stabilization of rainfall average values, discarding the 2011 and 2012 values which are below the average. By contrast, regional patterns indicate a considerable increase in recent years, figure 56.

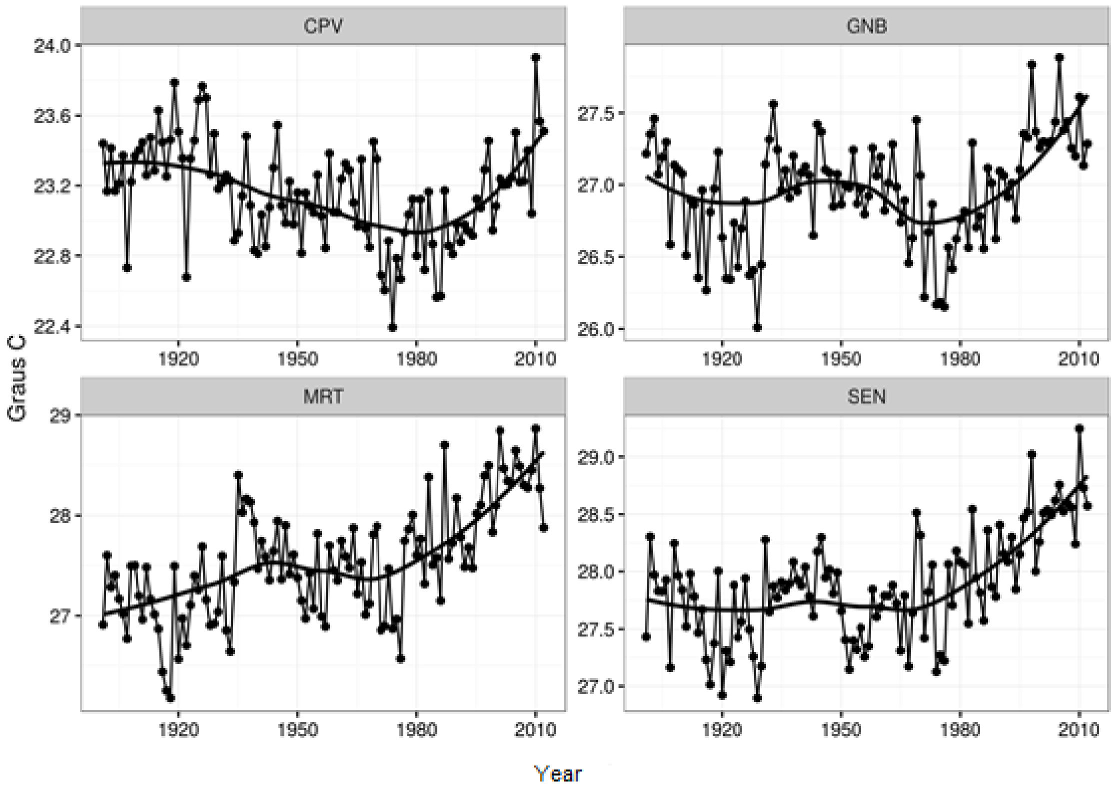

Figure 56: Comparative evolution of temperature (1900-2012) in Cabo Verde, Bissau Guinea, Mauritania and Senegal

The results from assessments of sea surface temperature anomalies using the 1951-1980 baseline period show that, for the Cabo Verde region, the changes are not significant for 1981 to 2015, positive anomalies between 0.2ºC and 0.4ºC. When the 1980-99 period is taken as the baseline, the projected values are also very similar for the 2000-2015 period, for the months from July to September. For the period between May and October (1981-2015), the GCM models also project averages of positive anomaly of 0.3ºC temperature. The results are shown in Figures 57 and 58.

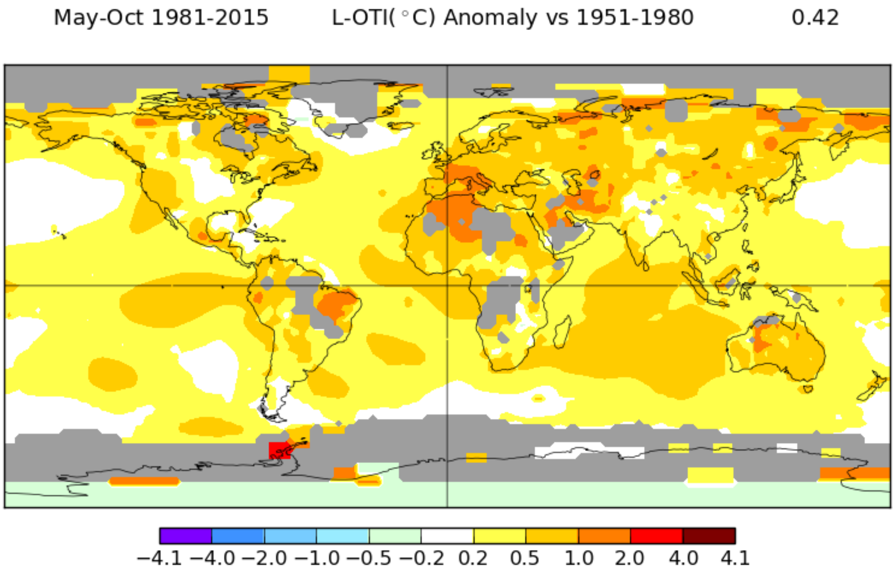

Figure 57: Global temperature anomalies using baseline years from 1951-1980

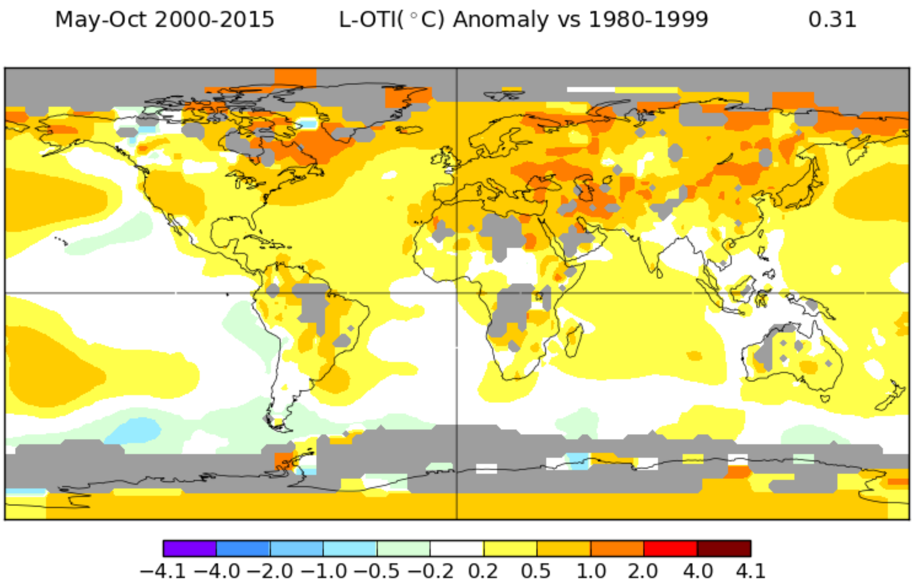

Figure 58: Global temperature anomalies using baseline years from 1980-1999

4.6.3.1 Eta model (2017-2023)

In order to facilitate assessment of the time series evolution of the average data obtained from the Eta model, four regions were defined over the archipelago, such as the Northwest region, covering the islands of Santo Antão, S. Vicente and S. Nicolau, the Northeast region, covering the islands of Sal and Boa Vista, the Southeast region, including the islands of Maio and Santiago, and the Southwest region, with the islands of Fogo and Brava. Based on the time series of the anomalies obtained from the Eta model, assessments were conducted with the following results:

a) Average temperature

In general, there is a trend for a slight increase in average temperature over the 2017-2023 period throughout the archipelago. This trend is, however, more evident from February to June, being more pronounced in February, month generally colder climatologically. From July to November, although this slight trend for increase is visible, it is very little pronounced, being possible to consider a stabilization of the average temperature during the hotter months, during the period in reference.

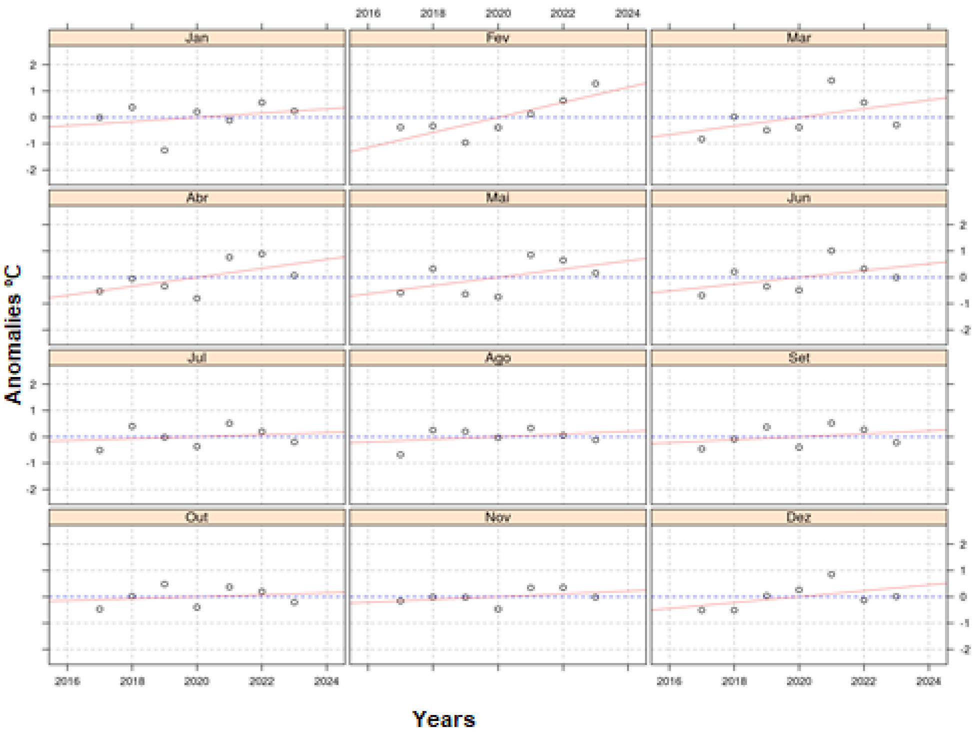

Figure 59: Results of average monthly temperature projections for the Northeast region of Cabo Verde (2017-2023)

b) Maximum temperature

Similarly, to the average temperature behavior, there is a trend for a slight increase in the maximum temperature throughout the archipelago, in the 2017-2023 time horizon. This scenario of increase is, however, more evident in the colder months, specifically in February.

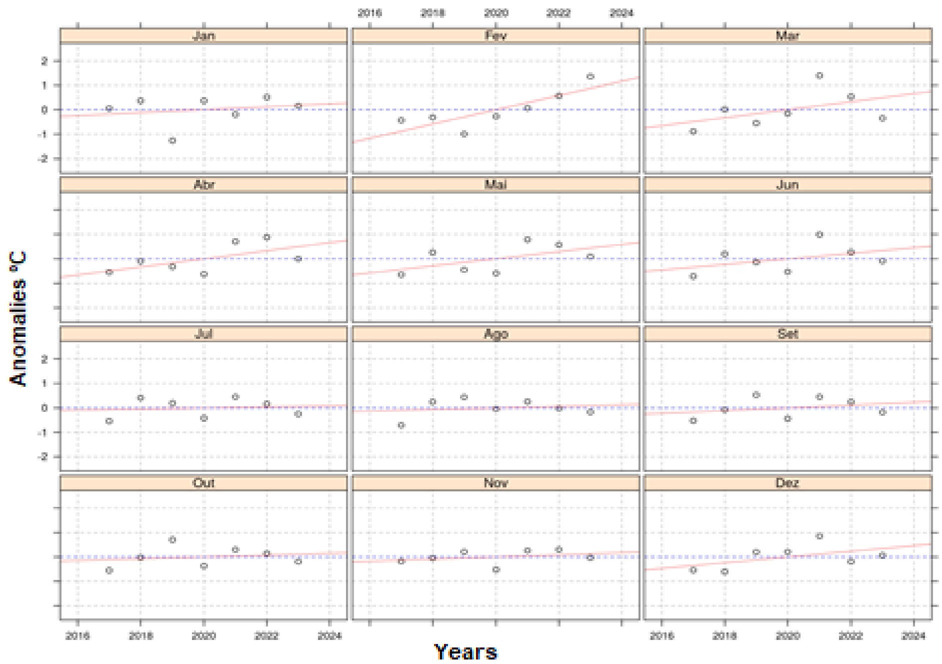

Figure 60: Results of maximum monthly temperature projections for the Northeast region of Cabo Verde (2017-2023)

c) Minimum temperature

Minimum temperature behavior is also similar to maximum and average temperature behaviors, that is, there is a trend for a slight increase, with more emphasis in cooler months of the year, more specifically February. As for warmer months, the trend is for the minimum temperature values to remain very close to the recently recorded values or, then, to experience a very slight rise.

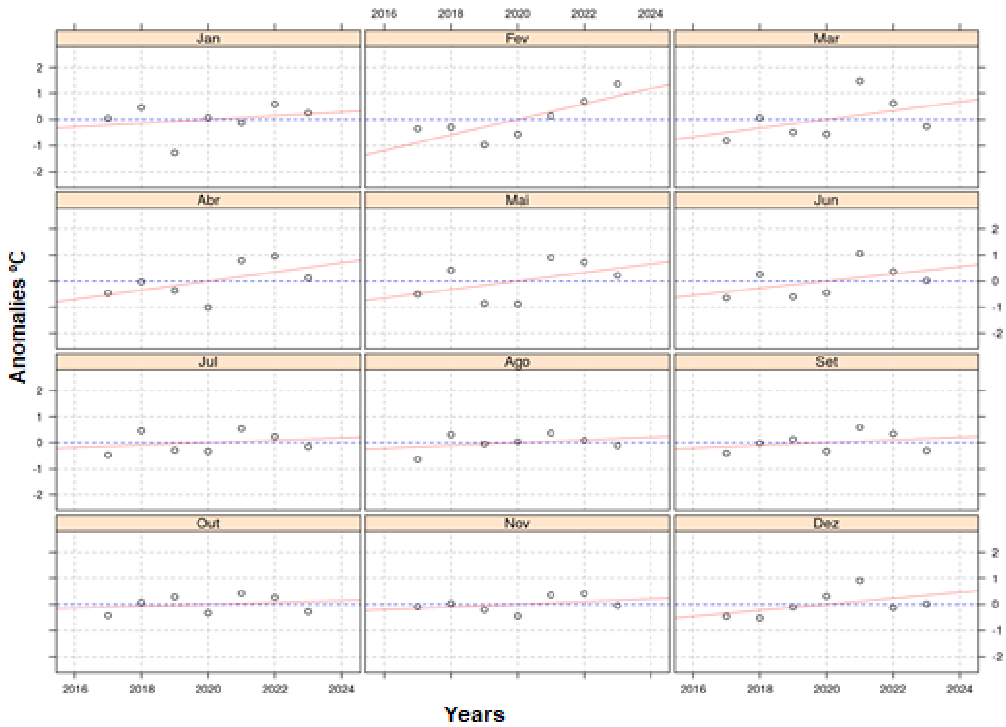

Figure 61: Results of minimum monthly temperature projections for the Northeast region of Cabo Verde (2017-2023)

In a conclusive way, the scenario for the 2017-2023 time horizon is of slight rises in average, maximum and minimum temperatures throughout the Cabo Verde archipelago, with greater relevance for climatologically cooler months, with an inverse process in some years.

This temperature behavior seems quite logical if we take into account the geographic context of an island country size of which islands is not very expressive, allowing the ocean, which functions as a thermal regulator, to ease any upward or downward trend in temperature. Spatial projections of the temperature (maximum, average and minimum) for 2017-2023 for the national territory are represented in figures, in Annex IV.

4.6.3.2 Global models (2020-2039)

According to the projections conducted, the possible scenarios proposed by the global models for Cabo Verde are 0.2ºC minimum and 0.4ºC maximum temperatures up to 2039, based on the baseline periods used.

The climate scenarios considered are an estimate of the likely evolution of Cabo Verde's climate over the 2020-2039 horizon, in light of the behavior and future options of the global society. For this purpose, two greenhouse gas emission scenarios were considered based on data resulting from simulations of several global models.

From the scenarios considered, the difference between the various results allows to conclude, with some associated uncertainty, the climatic projections described above.
The results obtained for scenarios A2 and B1 generally point to the increase of the average temperature between 0.2ºC and 0.4ºC in the 2020-2039 time horizon for the Cabo Verde region, with some negative fluctuations (cooling) in a few years.
As can be seen, the projected increase does not appear to be very severe. This is due to the fact that Cabo Verde is an island country, where the ocean acts as a temperature regulator due to its significant thermal inertia and the permanent exchange of sensible and latent heat between the sea and the surrounding atmosphere.

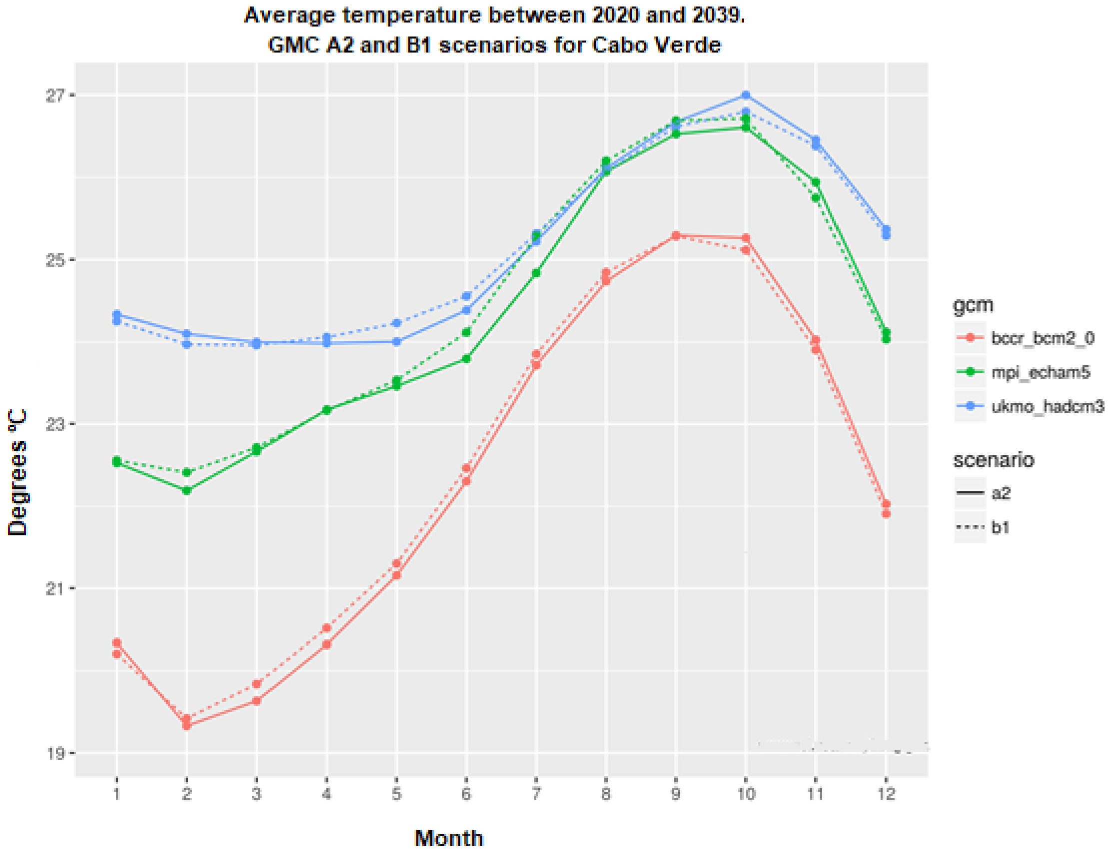

Figure 62: Projection of A2 and B1 scenarios regarding average monthly temperature with bcm2_0, echam5 and hadcm3 global models (2020-2039)

With regard to rainfall, the uncertainty associated with the future is more significant. For this variable, the projection for the 2020-2039 period indicates a slight decrease, reduction in the period of occurrence and increase in episodes of intense rainfall.

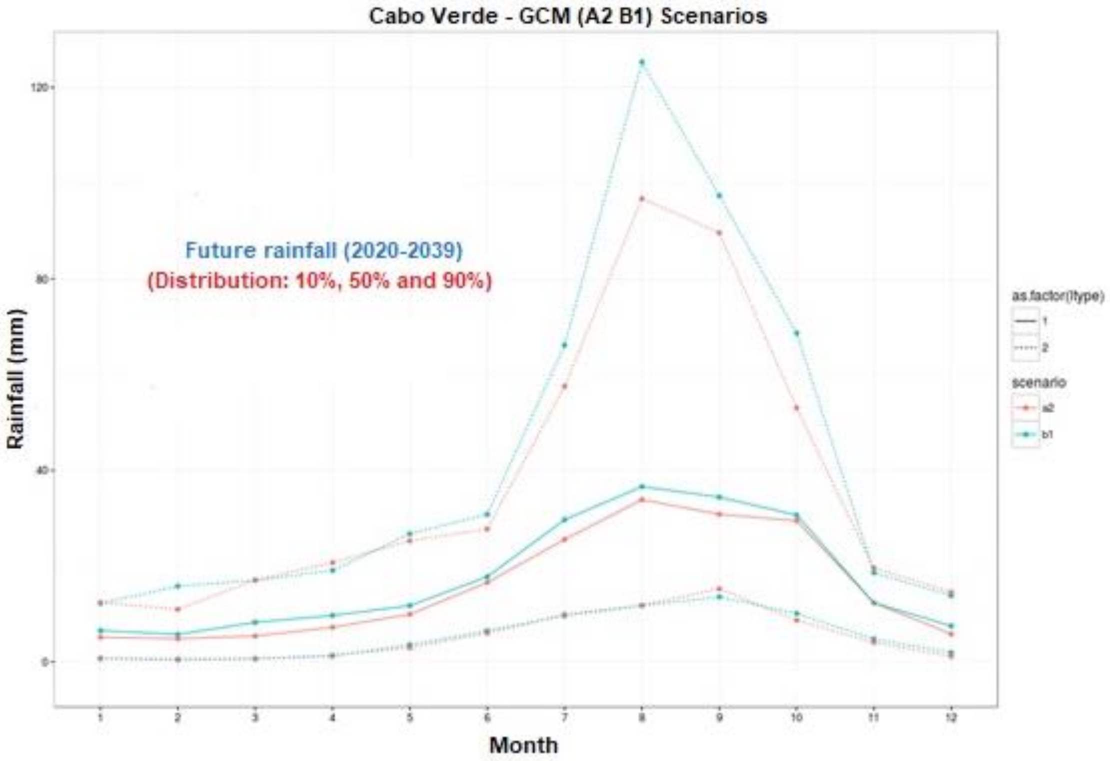

Figure 63: Chart of A2 and B1 scenarios of monthly rainfall distribution for the 2020 2039 period, produced by the 15 GCM models

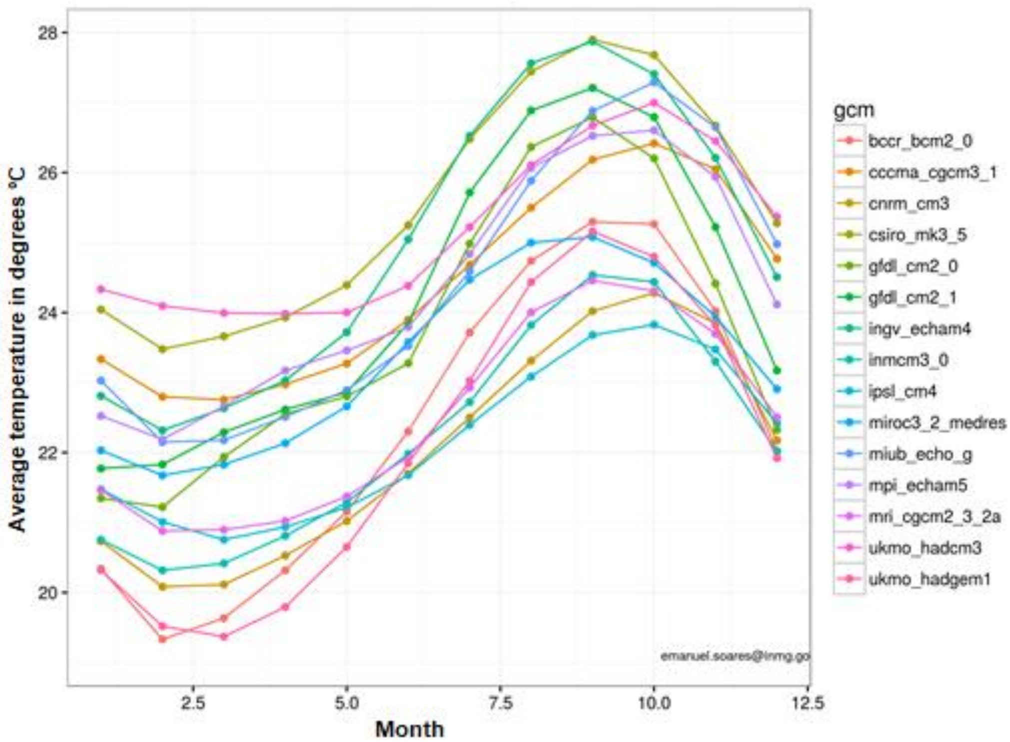

Figure 64: Chart of average monthly temperature evolution for the 2020-2039 period produced by the 15 GCM models

When analyzing in a particular way each model for a given scenario, it is observed that some point to a trend for temperature increase during the cooler months and a certain stability in the average temperature in the warmer months, while others indicate a slight increase in the average temperature for the warmer months, maintaining stable the averages in the cooler months, with very faint fluctuations. When using the average of the results of all models, it is observed that, in general, the changes are not very significant when compared with the 1960-2015 baseline.

The results of the spatial temperature projections for the 2017-2023 period are provided in Annex IV.

4.6.4 Sea level

As regards sea level, Cabo Verde Islands are very vulnerable to any increase. In relation to 1980-1999, by 2090 the climate models projected a sea rise in this region according the following three levels, i.e. from 0.13 to 0.43 meters (SRES B1 scenario), 0.16 to 0.53 meters (scenario SRES A1B) and 0.18 to 0.56 meters (SRES A2 scenario). However, based on the facts mentioned above, there is great uncertainty surrounding these projections.

4.7 Trends, Likelihoods and Consequences

4.7.1 Trends

Climate and climate change trends in the 21st century offer today significant challenges for scientists. The difficulty in quantifying climate change in Africa exists to some extent due to regional climate complexity and associated geographic features. Africa is almost symmetrical in relation to Ecuador, which creates lagged stations between the northern and southern hemispheres. Hence, the rainy season in the northern hemisphere (June to September) corresponds to a dry season in the same season in the southern hemisphere.

Adding to this complexity, deserts and mountain ranges can alter the regional climate regime and weather patterns, adding to the fact that there are several large lakes and the continent is cloistered between the Atlantic and Indian oceans. Any change in the coast of Sahelian Africa will also affect the Cabo Verde archipelago, whose climate is in close correlation with climatic events that may occur on the continent.

In Cabo Verde, there is a drop in temperature between the 1960s and 1980s (~ 0.15ºC), followed by dry periods, and an increase between 1980 and 1990 (~ 0.21ºC), followed by an unchanged period. After 1990, there was an increase in temperature at a rate of 0.04 °C/year. Although precipitously, rainfall has been more frequent in recent years. Due to this, it can be concluded that there is a close relationship between temperature and rainfall in Cabo Verde. The projections, using the downscaling technique with the ECHAM model boundary conditions point to temperature increase by 0.4º-0.7ºC for the 2020 horizon, and believing that this growth rate will remain, to a 0.5-1.0 ºC increase by 2090.

That is to say that global models would be overestimating the temperature rise in Cabo Verde. Concerning rainfall, believing in the close correlation between temperature and rainfall shown by the assessment and national data, the country will be more humid and rainy, with drier intermittent periods. Although surface observations in Africa are poor, the existing network indicates that, as in Cabo Verde, temperatures have warmed up throughout the 20th century and during this period periodic droughts occurred in large areas.

4.7.2 Probabilities

The models indicate the likelihood that the African continent will continue to have a warming of near 1 to 4 ° C throughout the 21st century, with more or less regionalized warming. If this happens, one of the assumptions is that the heating implies increased evaporation of the soil moisture leading to its reduction inside the continent, if there is no corresponding increase in rainfall. In the case of Cabo Verde, the islands would suffer an increase in rainfall in the July-October period.

However, rainfall variability across Africa during the 21st century presents major uncertainties, with some global MCGA climate models suggesting more humid conditions and some suggesting drier conditions. This uncertainty is partly due to the model of the different climate parameters and sensitivities in the models, due to their low resolution (finer scale and better physical parameterizations), which requires as a new approach the use of downscaling techniques to increase of the resolution with the consequent reduction of these uncertainties, which can lead to different results for the rainfall simulations.

4.7.3 Consequences

Droughts and floods associated with climate change will have a negative impact on food security in Africa, particularly in Cabo Verde. Droughts have an immediate and negative impact because of low family incomes. However, given the demographic fluctuations and population growth in urban areas, there will be a need for increasing agricultural production and road networks (national and urban roads), and drainage systems should be improved if rainfall increases in the future.

A monitoring system and medium and long-term study for climate change should be developed using existing technologies (observations, satellite and others) and investments should be made in building/ replacing infrastructure where necessary to closely monitor physical and natural systems, vulnerable to human-induced climate change, for the protection of populations.

There is also a need for investing in human resources to increase the number of scientists whose direct mission is to study, monitor and report on climate change over the next few years.

Policymakers need to be informed and updated on local and regional climate change so that defined national policies can address potential impacts and provide solutions. In this context, there should also be awareness-raising programs for the general public, so that Cabo Verdeans can understand the recent and future climate change phenomenon and its consequences, which will allow them to follow and materialize possible adaptations.

4.8 Evaluation of adaptation to climate change

Adaptation assessment is the ability assessment of particular systems and groups to adapt to specific constraints.

In view of the relatively recent timeframe of the more critical advent of this issue, an evaluation has not been carried out in this document, but rather an analysis of a set of measures implemented (torrential correction works, conservation of soil and water, afforestation, among others) to cope with adverse weather and climatic conditions.

Thus, over the years and particularly in the post-independence period, in the face of the adverse effects of climate variability, the adaptation measures implemented by the populations and successive governments aimed above all at creating conditions to ensure the minimum existence in terms of availability in water and food security, in the face of years with weak agricultural production.

Although an extensive impact assessment of all implemented measures has not yet been made, its positive effects are seen both from the point of view of environmental and landscape changes and from the socio-economic point of view.

4.8.1 Framework for adaptation strategies and measures

To prepare strategies and their adaptation measures, it is necessary firstly to take into account the direct and indirect interactions between the different climate factors and the productive sectors of society. Therefore, the approach used was the same as the approach applied in the preparation of the National Program of Action for Adaptation to Climate Change (NAPA), concluded in late 2007, with the support of UNDP/GEF, Cabo Verde government and involvement and participation of a wide range of national and international partners.

The assessments carried out under various baseline studies on current and future adverse effects of CC in Cabo Verde have pointed to rainfall variability and randomness as one of the most striking characteristics of the climatic conditions in the country that, in the main sectors of socio-economic development, already identified as being very vulnerable in the NAPA framework. In addition to this natural constraint, continued population growth and the consequent increase in water consumption, as well as strong demand from rapidly growing economic sectors such as agro-pastoral, tourism, construction, industry, a strong pressure on water resources which makes this vital resource a critical factor in the construction of the country's strategy and measures to adapt to Climate Change.

4.8.2 Objectives of the climate change adaptation strategy

Overall, the National Adaptation Strategy for Climate Change aims to increase resilience and create the country´s necessary resilience to face variability and climate change in order to achieve the development goals set in the different programs and sector strategic plans in the perspective of introducing actions that, in the long term, aim to reduce GHG emissions.

Thus, the intervention strategies are oriented around the following strategic objectives capable of:

- Promoting water resource integrated management to ensure water to populations, food production, ecosystems and tourism industry;
- Developing adaptation capacity of agriculture/forestry/grazing livestock production systems as to improve agriculture production and promote food security of populations; and
- Protect coastal areas against environmental degradation caused by extreme climate events and anthropic pressure to ensure a rational management of its resources.

4.8.3 Global adaptation measures by sector

4.8.3.1 Preliminary remarks

After the vulnerability assessment related to different parameter behavior and their respective impacts conducted through sector vulnerability and adaptation studies and shared with stakeholders, a set of adaptation measures were proposed to all the sectors that have been subject to vulnerability analysis - Water Resources, Agriculture, Forestry and Grazing Livestock, Coastal Areas/ Tourism, Biodiversity, Fisheries, Energy/Industry and Health and main characteristics of which are highlighted below.

4.8.3.2 Water resources

In Cabo Verde, irregular, high-intensity and rainfall poorly distributed in space and time, coupled with poor infiltration, make water one of the limiting factors for the socio-economic development of the country. Population growth, urban development and increasing demand for irrigation, tourism and industry, together with the drought in recent years, have led to shortages, which tend to worsen over time.

Thus, the strategy to adapt to the impacts of Climate Change on Water Resources aims to reduce the country's vulnerability to water-related impacts in a way that is technically, economically, environmentally and socially sustainable. For the sector, the strategies focus on the following center lines of intervention: integrated management and sustainable use of water resources, access to water, political-institutional adaptation, improved governance, CC capacity building and awareness. The proposed measures are summarized in Annex V.

4.8.3.3 Agriculture, forestry and grazing livestock

The proposed national strategies and measures meet and respond to the objectives of the various regional and global initiatives for the sector. Adaptation measures, in addition to contributing to the resilience of agriculture to current and future climate change, should be applicable to the different production systems, responding to the challenges identified in each system.

Thus, in the rainy agricultural system, adaptation measures aim to meet the challenges related to irregular and deficient rainfall, poor diversity of species and varieties, steep slopes, high water erosion rate, low productivity, cultivation, low fertility and organic matter of the soil, species and varieties not suitable for the rainy season, weak adoption of cultural techniques improved by farmers, among others.

In relation to irrigated agriculture, proposals should address the constraints related to low productivity, soil salinization, low fertility and organic matter, unsuitable species and varieties, poor water availability, inadequate cultural techniques, irrigation systems ineffective, infestation of bio-aggressors, poor technical assistance, among others.

Implementing these measures promotes the conservation and restoration of agricultural diversity and provides opportunities to increase agricultural productivity in the face of uncertain scenarios of future climate change. The approach to agricultural production to be followed must be based on agroecology, which provides a range of technological options that respond directly to these challenges. Agroecology uses both the knowledge of traditional agriculture and modern technologies in the agricultural production process, and can be adaptable to small and large-scale farming systems, increasing productivity and creating long-term resilience.

In this context, seven strategic axes and a set of measures are proposed that aim to mitigate and/ or adapt Cabo Verdean agricultural systems, making them resilient to climate change. These axes range from the adaptation of agricultural systems; sustainable management of agricultural land; the sustainable and intelligent management of crops; the integrated management and sustainable use of water and irrigation; the management of agricultural information; governance, training and awareness; and the political-institutional aspects are summarized in Annex V.

4.8.3.4 Tourism and Coastal Areas

Coastal area is very sensitive to changes in climate, particularly sea level rise. Thus, Cabo Verde, as a small island country, is under direct threat of natural phenomena related to this sea level rise. Similar to volcanic islands, the archipelago has a relatively small appropriate space for human habitat and economic activities, therefore many buildings are concentrated on coastal areas.

In Cabo Verde tourism is considered as the engine of the national economy. Therefore, the construction of tourism enterprises, human settlements and tourism support services (ports, airports, water and energy) are mostly located on coastal areas.

In order to establish the most appropriate adaptation measures, it is important to take into account climate projections, focusing on the consequences of climate variability, temperature and precipitation patterns, and the rise in average sea level, and the tourism segment linked to local and national context. Some measures adopted in Cabo Verde to mitigate climate change are provided in Annex V, Table Summary of types of adaptation and strategies implemented in Cabo Verde.

4.8.3.5 Biodiversity

Currently there is evidence globally that climate change is affecting biodiversity, mainly due to the observed changes in ecosystems The vulnerability of marine species in Cabo Verde, especially on coastal areas has increased, despite the existing legal measures to minimize the pressure on them and their habitats. Notwithstanding such measures, the marine environment has experienced changes as a result of overharvesting of commercial species, extraction of aggregates and sediment deposition on coastal areas as a result of activities in the inner parts of the islands.

Biodiversity adaptation to climate change is mainly related to the increase in the species' resilience. Therefore, it focuses on reducing the vulnerability of natural systems so that they can accommodate and respond to climate change.

Measures to adapt biodiversity policy to minimize the negative impacts of climate change on biodiversity have been discussed by a large number of international organizations, including IUCN. Annex V provides a Table summarizing the main measures to implemented in Cabo Verde.

4.8.3.6 Fisheries

A widely discussed issue in different studies is the location of the population and its proximity to the coast, which has caused significant human pressure, which, combined with the geomorphological conditions and fragility of the Cabo Verde ecosystems, demand special attention by the society, researchers and authorities with responsibilities in research, legislation, planning and monitoring.
Given the potential impacts of climate change on the fisheries sector, efforts should be made to increase resilience of the fisheries sector and reduce vulnerability. Annex V proposes a range of measures to adapt the fisheries sector to climate change in Cabo Verde.

4.8.3.7 Energy and industry

The trend toward expansion, accelerated economic growth and growing demand for tourism environment are factors that have increased energy consumption in the country, creating strategic planning and infrastructure challenges. Thus, the need for promoting efficiency in the energy sector, behavioral change for resource use and increased penetration of alternative energy sources have been selected as strategies for building an energy-independent future.

Regarding industry, there are no contracts in the country related to waste disposal, consequently contamination of land adjacent to these spaces, with a relevant bearing on both human health and environment. This issue mainly relates to the use of old or obsolete technologies. Moreover, in the construction sector, extraction of aggregates has been significant, constituting a major environmental problem to address.

4.8.3.8 Health

Currently, the country is in an epidemiological transition, and there is a progressive increase in non-transmissible diseases (hypertension, stroke, diabetes, cancer, etc...) compounded with infectious diseases. Globally, the most used indicators assess climate change impacts relate to vector-borne diseases (malaria dengue and zika) and water-borne diseases or those related to poor hygiene, exaggerated exposure to environmental factors and malnutrition.

For Cabo Verde, as indicators were considered the reappearance of yellow fever, dengue, malaria, zika, diarrheal diseases and some viral infections, while also considering the possibility of accidents and injuries in cases of heavy rains and flooding. It is also considered that the outbreak of some vector-borne diseases are associated with imported cases, above all from countries where high incidence rates still prevail.

4.9 Summary of the main impacts and proposed adaptation measures to CC

The tables in Annex IV provide a summary of the main impacts related to a set of natural and anthropogenic phenomena that can produce climate change, as well as proposed options for adaptation. The tables also show some difficulties/constraints the respective sectors face in implementing such options.

4.10 Recommendations for initiatives and policies in Science, Technology and Innovation

The identification and prioritization of the measures previously presented are options for global measures for all priority sectors. Afterward, a detailed analysis was conducted of some of these measures specifically for agriculture, water resources and coastal areas, from a science, technology and innovation (ST&I) perspective, and considering aspects such as vulnerability, impacts and adaptation.

As a result, matrices providing a set of recommendations were developed to serve as the basis for the development of initiatives and policies with regard to vulnerability, impacts and adaptation, and from a ST & I perspective. This document includes only a summary of Adaptation options and the three sectors mentioned above (see Annex IV).

4.11 Needs for technology transfer in adaptation related issues

Similarly, to the methodology used to identify adaptation measures, a survey of needs for adaptation regarding technology transfer was conducted with the participation of various partners and stakeholders. This survey covered areas such as agriculture, water supply, coastal area and energy. Please note that in some areas Cabo Verde has the technology and can also "export" to other countries. (Annex IV).

4.12 Stakeholders awareness program on climate change impacts

Regarding Promotion and Strengthening of Stakeholders Training, Information and Awareness the following deficiencies were identified:

- Insufficient information on Climate Change Convention, Kyoto Protocol and all issues related to climate change;
- Insufficient awareness and training of an important portion of the population on the effects and negative impacts of MC on the most vulnerable sectors;
- Lack of awareness of farmers/fishermen due to their low education level;
- Poor information dissemination by the media and relevant institutions on ”Climate Change” issues; and
- Lack of information /training in school curricula.

To reach these objectives a group of activities should be implemented, including:

- ✓ Development of documents on CC related issues, as well as thematic brochures, documentary films, radio programs, among others;
- ✓ Training and/or retraining of staff at central and municipal levels, as well as NGOs and Community Associations;
- ✓ Information and awareness campaigns targeted to a wide range of stakeholders: policy makers, deputies, locally elected officials, technical staff, and students from different levels of education (primary, secondary and college), private operators, NGOs, community associations and general population;
- ✓ Holding of conferences and brainstorming on CC related issues attended by distinguished specialists.

CHAPTER V – OTHER INFORMATION ON THE IMPLEMENTATION OF THE UNFCCC

Recognizing the importance of the topic and the need for solutions, on March, 29 1995 Cabo Verde ratified the United Nations Framework Convention on Climate Change (UNFCCC). Since then, the country, as a contracting party to the Convention, has undertaken to develop, among other documents to be requested, the National Communication to the Conference of the Parties (COP), where it reports on the national circumstances in which the country evolves in terms of concrete action in climate change context.

Thus, over the period, with funding from GEF/UNDP, the Government of Cabo Verde and other development partners, the country has developed and implemented projects and programs under this issue, such as:

- First and second National Communications to the UNFCCC (2000 and 2010)
- National Strategy and Plan of Action on Climate Change (2000)
- First and Second National Inventories of Greenhouse Gas Emissions and Removals (2000 and 2010)
- National Program of Action for Adaptation to Climate Change (NAPA, 2007)
- NAPA-Follow-Up Project, to implement adaptation measures of the Water Resources sector
- Clean Development Mechanism (CDM) Project (2012)
- Low Carbon and Resilient Development Strategy (2015)
- Intended Nationally Determined Contribution (INDC, 2015) for the 2015/2030 horizon
- Signed and ratified the Paris Agreement through the National Assembly with the approval of Resolution 35/IX/2017, of May 12. Acceptance of ratification of the Paris Agreement by the UNFCCC secretariat on April 22, 2016 which entered into force on October 21, 2017.

For better follow-up on climate change issues, through Resolution No. 16/2009 of 2 June, Cabo Verde created the Multiministerial Committee on Climate Change, which also functions as the Designated National Authority, with the purpose of articulating governmental actions resulting from the United Nations Framework Convention on Climate Change, the Kyoto Protocol and its subsidiary bodies of which Cabo Verde is a party.

In view of the new ambitions and instruments developed within the UNFCCC framework, the Government of Cabo Verde is preparing and aligning the tools required for better monitoring and actions that allow it to access the Funds and Programs created to ensure countries sustainability in climate change context.

5.1 Actions completed or planned to implement the Convention and Kyoto Protocol

To better monitor the process, the country defined cross-cutting strategies and presented plans of significant relevance, which are materialized in the following documents that aim at adapting the socioeconomic development sectors and promoting mitigation of GHG emissions:

- National Action Plan for Energy Efficiency, 2015 (PNAEE),
- National Action Plan for Renewable Energy, 2015 (PNAER),
- National Strategic Plan for Water and Sanitation (PLENAS),
- Growth and Poverty Reduction Strategy (DECRP III),
- Cabo Verde Transformation Agenda for 2030

As a Contracting Party to the UNFCCC, Cabo Verde, as Small Island Developing State (SIDS), participates in the preparatory meetings and conferences of Parties held under the UNFCCC. Although with a small delegation it has accompanied the negotiations in meetings of the groups: AOSIS (Alliance of Small Island States), African and G77 + China.

Also for technical-scientific issues the country has participated in the sessions of the Intergovernmental Panel on Climate Change (IPCC) and events held both nationally and internationally.

The Government Program for the IX Legislature (2016-2021) and the Strategic Plan for Sustainable Development (2017-2021) have chosen climate change as the center of internal concern, involving regional entities and United Nations specialized agencies.
The government understands that the potential effects of climate change on the country recommend the to be at the center of the authorities' concerns, supported by an appropriate scientific approach, involving national knowledge centers.

The approach to the potential climate change effects on the country should be shared with municipalities, as it affects areas under their management, as well as with communities and citizens in real involvement of the population in the precautions to be taken.

The Cabo Verdean press has a decisive role in providing information, in a correct and objective way, to the community, being an integral part of the reflection on this topic.
The document highlights that the Cabo Verdean government will continue, as in the past, to participate in global and regional environmental research networks, particularly those dealing with climate change phenomena.

The Government's Program for the IX Legislature and the country's Strategic Development Plan (PEDS) were the main references in terms of national priorities with which the United Nations Development Assistance Framework in Cabo Verde (UNDAF) 2018-2022 is fully harmonized.

The Government's concern with climate change issues is reinforced in the UNDAF and fits in with the vision of the Global Agenda 2030 and its Sustainable Development Objectives (ODS).

The Global Agenda 2030 elects the Planet as the second pillar where climate change issues are referenced through the UNDAF outcome which states that *by 2022 the population of Cabo Verde, in particular the most vulnerable, will benefit from improved national and local capacity to apply integrated and innovative approaches to sustainable and participatory management of natural resources and biodiversity, adaptation to climate change and mitigation and disaster risk reduction.*

Both the Planet pillar and the above result fit into the PEDS "New Economic Growth Model" economy pillar aligned with ODS 1, 2, 6, 7, 9, 11, 12, 13, 14, and 15.

UNDAF stresses that integrating the resilience concept into development policies and environmental preservation is essential to reverse the exposure and vulnerability of countries to natural disasters and climate change, in particular SIDS, such as Cabo Verde. Strengthening resilience to climate change and natural disasters is therefore crucial to protecting the country's resources and directing them towards sustainable development.

In the last decades, Cabo Verde has made important progress in its climate strategy, guided by a vast set of strategic plans and tools of which we highlight:

- First National Action Plan for the Environment (PANA I)
- National Forest Action Plan (PAFN)
- National Action Plan to Combat Desertification (PAN-LCD)
- Second National Action Plan for the Environment (PANA II)
- National Strategy and Plan of Action for Biodiversity (NBSAP)
- First and Second National Communications on Climate Change
- Plan of Action for the Integrated Management of Water Resources (PAGIRH)
- Cabo Verde 50% Renewable - A Way to 2020
- National Action Plan for Renewable Energy (2015/2020/2030)
- National Energy Efficiency Action Plan
- Low Carbon Resilient Development Strategy
- Integrating Adaptation to Climate Change into the Development Process
- NAMAs in the energy / energy efficiency and waste sector
- Agriculture Strategic Development Plan (PEDA)
- National Agricultural Investment Plan (PNIA)
- Intended Nationally Determined Contribution of Cabo Verde (from INDC)
- National Strategic Water and Sanitation Plan
- International Center for Scientific Research and Technological Development of Cabo Verde, dedicated to biofuels

5.2 Programs and actions related to sustainable development

Some of the programs and activities for sustainable development in Cabo Verde are related to renewable energy and conservation and/or energy efficiency. These programs will contribute to Cabo Verde´s cleaner energy matrix (penetration rate above 25%), thus contributing to stabilizing concentrations of greenhouse gases in the atmosphere and developing long term sustainable development.

The commitment to renewable energies is considered a structuring factor for the country, allowing improved energy independence and, on the other hand, access to energy at competitive costs for families and businesses. On the other hand, the ambitious goals pursued constitute a proposal for a profound transformation of the energy sector, implying changes in technologies, procedures, markets and their agents.

Given this challenge, it will be necessary to innovate, both in terms of technology and processes, in management and financing models, and in technical, social and environmental monitoring. The way forward will be, therefore, a source of experience and knowledge that should be translated into added value in a broader regional context.

In this context, the National Action Plan for Renewable Energies was drawn up for the 2015-2030 period and the National Action Plan for Energy Efficiency, complemented by the actions contained in the Intended Nationally Determined Contribution (INDC-2015), which was the commitment of Cabo Verde to the Framework Convention on Climate Change for the Paris Agreement.

The Cabo Verde government's vision for the energy sector, expressed in Cabo Verde's Energy Policy Document, is "Building a safe, efficient, sustainable and non-fossil fuel dependent energy sector."

This vision is based on four fundamental pillars

1. Energy security and decreased dependence on imports
2. Investment in RE
3. Sustainability
4. Effciency

To materialize this vision, the government adopted a strategy with the following objectives:

- Increase renewable and alternative energy penetration rates;
- Promote energy conservation and efficiency in the energy sector;
- Increase electric energy production capacity;
- Increase coverage and ensure access to energy;
- Improve institutional and legal framework;
- Create a Fund for energy security;
- Promote research and adoption of new technologies.

5.3 Projects and activities in place

Cabeólica Project (wind power)

Cabeólica is the main producer of renewable energy in Cabo Verde, producing sustainable electricity with an average total penetration rate of 22% in the country.
With four wind farms operating on the islands of Santiago, S. Vicente, Sal and Boavista, the project produces 375,000 MWh of clean energy that is supplied to the electrical networks on the four islands. With this production, the country no longer imports 15 million liters of fuel every year. With the entry of the wind farms in operation there was a reduction in CO_2 emission of 260,000 tons. The record 24% annual penetration rate was reached in 2014.

CO_2 Reduction

As wind energy does not produce gas emissions, this type of energy production plays a central role in the fight against climate change by reducing the CO_2 emissions that would be produced by conventional electricity generation.
Throughout the wind farms useful life, Cabeólica aims at substantially reducing GHG emissions in the country, estimating they will save near 55,000 tons of CO2 for each full year of operation.

In the global effort to halt climate change, CO_2 reductions from the company's activities help Cabo Verde as a country to align itself with its sustainable development responsibilities and the Paris Agreement.

Photovoltaic plant projects

With the objective of promoting distributed production and self-production, the Cabo Verdean government has been increasing taxes and customs incentives. Therefore, the trend across the country is to increase production outlets from renewable energy sources.

Thus, several initiatives at City Councils, Private Sector and NGOs level are being carried out to promote renewable energies in their projects

Santiago Solar Power Plant- Installed power 5MW; Energy produced: 8,128 MWh: start of operations: 2010; annual fuel savings: near 1,8 thousand t, the equivalent to near 136 million ECV/year.

Sal Solar Power Plant - Installed power 2,5MW; Energy produced: 4,064 MWh; start of operations: 2010.

Carriçal Photovoltaic Plant – installed in 2015, the system includes 88 photovoltaic panels, resulting a total production of 22 kW.

Cutelo Photovoltaic Plant – made of 19 giant panels, with unit capacity to produce 9.500 Watts and overall production of 180 kWatts of energy.

Aguada de Janela Wind Power Plant –equipped with 2 wind mills producing 500 kW of energy.

Vale da Custa Mixed Plant Project –the first community in the entire island of Santiago to benefit from 100% renewable energy and with positive environmental impact. The Vale de Custa mixed power plant also includes a photovoltaic park with a capacity of 20 kWp and a wind farm with a capacity of 10.5 kWp, a storage system.

APP Projects – Águas Ponta Preta - founded in 2000 by the CASSA and Cabocan group, is located in Santa Maria, Sal island, has for mission to provide basic services of energy, water and sanitation in the hotel sector of Ponta Preta, allowing the tourism development in this part of the island.

5.4 Energy preservation programs and initiatives

The Cabo Verde government's vision for the energy sector, expressed in Cabo Verde's Energy Policy Document, is "Building a safe, efficient, sustainable and non-fossil fuel dependent energy sector.

In this context, the National Action Plan for Renewable Energies was designed for the 2015-2030 period and the National Action Plan for Energy Efficiency, reinforced at INDC-2015, proposes to have a sustainable country based on four fundamental pillars mentioned above.

Energy Security, as a way to facilitate continuous access to energy supply, in quality conditions, demands investing in renewable energy and new technologies, with the consequent reduction of dependence on fossil fuel imports.

Sustainability as one of the pillars of environmental, socio-political and economic development in Cabo Verde, entails energy efficiency ensuring an adequate system in the efficient supply and distribution of energy throughout the country.

In order to materialize this vision, the government adopted a strategy including the main following objectives:

- Increase renewable and alternative energy penetration rates;
- Promote energy conservation and efficiency in the energy sector;
- Increase electric energy production capacity;
- Increase coverage and ensure access to energy;
- Improve institutional and legal framework;
- Create a Fund for energy security;
- Promote research and adoption of new technologies

Energy preservation programs in Cabo Verde are reflected in the national renewable energy strategy and are based on the objective of achieving 100% of all electricity produced in Cabo Verde from renewable energy sources by 2025/2030, whether on the main grid or in isolated micro-networks, or in individual systems. Source and technology selection will be made by an Electric Sector Master Plan. The selection of sources will take into account not only technical parameters but also the social, economic, environmental and consumption profile of each of the nine inhabited islands.

Other sources and technologies, such as solar power for domestic water heating or industrial preheating, will be important in order to achieve energy independence goals. Thus, solar thermal systems will be mandatory, starting in 2016, in new residential buildings and selected service buildings. See Annex V for a summary of the proposed targets for renewable energy.

Partnerships with international institutions underway:

- *Pump Storage* – energy storage, funded by the European Union and program "Technical Assistance Facility for the Sustainable Energy for All, Initiative West and Central Africa.

- Energy Efficiency in Buildings and Equipment, funded by GEF IV, started in January 2017 and will run for 3 years.

- Energy Sector Master Plan, funded by the EU and program "Technical Assistance Facility for the Sustainable Energy for All Initiative West and Central Africa.

- Pilot projects, Photovoltaic and Solar Micro-generation Systems for 6 hospitals, with the partnership of Distributed Solar Energy Systems Project and the World Bank under SIDS.

- Assessment of Solar Market Potential, with the partnership of *Distributed Solar Energy Systems Project* and the World Bank under SIDS.

5.5 Climate change mitigation actions and programs

The different programs the Government of Cabo Verde implemented over the last five years seek to increase and replace high carbon content fossil fuel sources with less or almost zero carbon energy sources. These forms of energy are intended to help the country mitigate the effects of climate change and contribute to Cabo Verde achieving the ultimate goal of the United Nations Framework Convention on Climate Change.

This is the case of four wind farms built on the islands of Santiago, Boavista, S. Vicente and Sal, a private public project with the participation of the Government of Cabo Verde, Electra and the English company Infraco.

With a total installed capacity of 28 MW, the wind energy produced represents 25% of energy generation. With this project, Cabo Verde reduces the import of fossil fuel by near 20 thousand tons a year, which represents approximately 30% of fuel imports. Cabo Verde will save € 13,000,000 on fuel imports per year. In terms of greenhouse gas emissions, at least 50,000 tons per year of carbon equivalent is reduced.

Photovoltaic systems for energy production were also installed on the islands of Sal and Santiago. On Sal, the installed capacity is 2.5 MW, in the first phase. For Santiago, 5 MW, the two plants have a penetration rate corresponding to 4% of energy produced.

In public lighting, 36 micro generators are being installed on the islands of Sal, Santiago, S. Antão and Fogo for energy production through solar power panels. In partnership with the City Councils, these panels will be installed in various ceilings of buildings, which will represent 25% of energy consumption.

Other private initiative projects are being implemented. These include electricity generation through a mini-hydro, on the island of Santo Antão, and ELECTRIC, for Porto Novo, also in Santo Antão, with 1 MW of wind power produced, a pilot project for rural lighting in Ribeira dos Bodes and Ribeira Fria, both in Porto Novo, island of Santo Antão, developed by Associação para a Defesa do Ambiente e Desenvolvimento (Association for Defense of Environment and Development) (ADAD). Awaiting installation are two sets of 5 kW photovoltaic panels and two 10 kW wind generators. The total energy penetration is 30 kW, corresponding to an annual reduction of 267 tons of $C0_{2.}$

National Greenhouse Gas Inventory System (SNICV) is a proposal for a legal instrument, prepared under the Third National Communication, which should facilitate overcome the constraints related to the availability of data by some key agencies and private sector. The implementation of the SNICV will promote a better quality national GHG inventory that requires principles of transparency, accuracy, fairness, comparability and consistency (TACCC) to ensure best practice in accordance with the requirements, guidelines and guides recommended by the Intergovernmental Panel on Climate Change (IPCC).

Waste Roadmap aims to promote achieving the millennium goal and ensure environmental sustainability through the development of a Waste Roadmap. In the first phase, it contemplates the preparation of Cabo Verde's Strategic Waste Management Plan (PENGeR), in line with the objectives of the United Nations Framework Convention on Climate Change and the Kyoto Protocol in the field of waste and climate change. In the second phase, it is planned to carry out a training / information and awareness program for the various civil society stakeholders, as well as the preparation of operational plans for waste management in the short term.

According to ANAS, the first phase of the Roadmap project was conducted in collaboration with all 22 municipalities, the private sector and civil society, noting that the preparation of operational waste management plans will enable municipalities to implement management systems in accordance with the strategic guidelines of the National Strategic Plan for Waste Management, but adapted to the reality of each municipality.

NAMAs in Energy and Waste sectors, under *Africa Climate Change Fund* (ACCF), Cabo Verde developed 2 mitigation projects, in waste and energy sectors.

In the energy sector, NAMA includes 2 components:

- Support Cabo Verde´s goal to have by 2030 electrical system supplied 100% from renewable energy sources. NAMA will, based on studies already undertaken in the sector, support the implementation of projects and seek funding for them.
- Support the design of energy efficiency projects, especially in the tourism sector. The central idea is that with this NAMA concrete projects already identified in other studies to be potentially funded by climate funds will be prepared.

In the waste sector, NAMA includes the following components:

- Create a sustainable waste strategy and a collection and management plan.
- Support the development of a waste inventory (covering household, industrial and agricultural waste) and waste monitoring system;
- Seek support and funding for the implementation of effluent and solid waste projects (to be identified: integrated bio-effluent facilities in tourism centers, industrial facilities and agro-livestock processing)

EBAC Project (Low Carbon Development Strategy), the main objective of the project is to provide Cabo Verde with the necessary skills to design, implement, measure, report and verify the low carbon development strategy intended to be resilient to climate change impacts and also consistent with sustainable development goals. The project envisaged identifying training actions appropriate to the national circumstances, preparing and implementing a Low Carbon and Resilient Development Strategy, Design Nationally Determined Mitigation Actions.

5.6 Programs and measures on impacts and vulnerability to climate change and adaptation measures in Cabo Verde

Due to its small island, volcanic and geographic characteristics, Cabo Verde is a highly vulnerable country due to its exposure to natural phenomena of various dimensions. The lack of arable soil (only near 10% of the soil is arable) means that the country imports between 80% and 90% of its food needs. In addition, the country's coastlines are very vulnerable to rising sea levels and erosion. approximately 80% of the population currently lives in these coastal areas. Cabo Verde's coastal areas are also important in promoting and supporting the local tourism industry, the main driving force behind the country's service-oriented economy.

Climate models presented during the NAPA assessment for the 2008-2012 period show that the country's natural vulnerabilities, coupled with their social and economic implications, are most likely to be exacerbated by climate-related disruptions in the coming decades. These include the most frequent extreme events such as storms, floods and droughts, as well as shorter rainfall seasons with immediate impact on livelihoods, infrastructure, sanitation conditions, reservoir replenishment, and crop productivity.

Cabo Verde is affected by severe water shortages (both surface water and groundwater). Annual average rainfall levels are uneven and have declined considerably since 1970. Rainfall projections for 2020 reveal values below the historical normal.

Thus, the country has regularly installed and maintains near 20 very costly water desalination units and energy consumers. The daily water needs of population centers, tourism and agriculture are projected to increase fourfold, from approximately 50,000 m^3 to 200,000 m^3 by 2030, so the potential of different and sustainable water supply options should be better exploited as soon as possible.

Despite the existence of wastewater treatment facilities in major urban areas, wastewater is rarely managed in Cabo Verde. The country intends to conduct an ambitious operational review of its sanitation management system to overcome the existing infrastructure challenges, in particular, the expansion of the water supply network, by improving sewage and rainwater collection, disposal and storage to make better use of this resource even for agricultural purposes.

5.6.1 Strategic axes and adaptation measures

As adaptation measures, the Government has established the following strategic axes:

- Promote integrated management of water resources, ensuring a stable and adequate water supply (for consumption, agriculture, ecosystems and tourism);
- Increase the adaptability of agro-sylvo-pastoral production systems in order to guarantee and improve the production of national food;
- Protect and prevent degradation of coastal areas and their habitats.

5.6.2 Existing policies and actions

The main lines of the national strategy for the Water Resources sector (identified in the NAPA as being vulnerable and a priority requiring urgent measures) are expressed in the National Strategic Plan for Water and Sanitation (PLENAS). This instrument provides the strategic guidelines at various levels of Government and includes a detailed planning process to be carried out on the islands.

A key strategic objective of PLENAS is to ensure that every citizen has a daily minimum water consumption of 40 l and a maximum of 90 l. The extension of water supply is intended to align measures to improve the General Sanitation System, optimize resource use, reduce losses during water distribution, and promote rainwater harvesting and reuse.

There are other initiatives, such as the UNDP and GEF's Adaptive Capacity Building and Resilience to Climate Change project in the water sector, which aim to create a more systematic response to climate change until policies and adaptation measures are developed to manage climate vulnerability through the implementation of targeted investments.

For the Agrosylvopastoral sector identified in the NAPA as being vulnerable and a priority requiring urgent measures, the following plans were prepared: Agriculture Strategic Development Plan (PEDA); Specific Action Plans for Agriculture Development (PADA). Following the guidelines set out in the PEDA, Cabo Verde launched the PADAs for the

islands of Santiago, Fogo, Santo Antão and São Nicolau and defined a detailed sector orientation for local authorities on, among other things, agriculture and fisheries adaptation actions.
Since the United Nations has chosen Small Island Developing States (SIDS) as a focus of special attention because of the particularities of its characteristics, causing it to be especially vulnerable to climate change impacts, the Community Action Plans (PACACV) was designed to be implemented on the nine islands, due to the need to adapt the countries and their communities to a resilient development pattern.

The PACACV intends to work with communities on each of the islands and in one of its main sectors of activity to increase Cabo Verde's resilience to climate change impacts.

The IAC Project (Integration of Adaptation to Climate Change in the Development Process) aims to strengthen the capacity of climate change related focal points in institutions, but also in the various key sectors for integrating adaptation to climate change into policy design and projects in Cabo Verde.

The "Adaptation of Agriculture to Climate Change" project implemented by the program to promote rural socio-economic opportunities (POSER) aimed at contributing to the improvement of the living conditions of the rural population. The project will have intervention in 10 localities/watersheds, on the islands of S. Nicolau, Santiago, Fogo and Brava, benefiting approximately 6,075 people. Focus will be on women and young heads of households, helping the country improve its resilience to climate change.

5.7 Promoting CC scientific research and systematic observations

5.7.1 Scientific research

Scientific research in Cabo Verde is conducted by the University of Cabo Verde, which has a functional unit that provides technical advice and logistical support to Scientific Councils, Research Centers and Centers and other scientific research units.

Its responsibilities also include technical and administrative coordination of scientific research actions and procedures, in coordination with said entities, in view of the overall coherence, efficiency and effectiveness of Uni-CV performance in the fulfillment of its mission.

The University of Cabo Verde has been developing a set of priority actions with the main purpose of integrating university extension with teaching and research and taking full advantage of national and international partnerships.

On the other hand, it has increasingly invested in academic mobility programs (students, academia and staff) coordinated by prestigious universities, that potentiate excellent partnerships between researchers and institutions, guided by international quality standards.

The university promotes teachers' integration into national and international research teams, centers and research centers, in addition to guiding research results aiming at the country's sustainable development and the university's external projection.

5.7.2 Research projects related to climate change

Uni-CV and other universities are developing research projects related to climate change, including:

- Characterization of green spaces in Praia
- Study of the Coastal Area
- Characterization of the geological resources on the island of Santiago
- Characterization of the bioclimatic stages on the island of Santiago
- Perception of Risks and Climate Change among farmers and rural producers in the Ribeira Seca basin, Santiago island, Cabo Verde
- ProWATER - Desalination of sea water with wave energy
- Capacity building project for adaptation and resilience to climate change in the water sector in Cabo Verde - CIDA / UNDP
- MEGAHazards2 - Study of Mega-Slips in Cabo Verde (has a component for paleoclimatic studies)
- Cabo Verde reservoirs: Hydrogeological characterization for sustainable management (preliminary data)
- SOLTRAIN Program (ECREEE) - Training Program and Demonstration of Solar Thermal Energy in ECOWAS countries
- Renewable Energy Integration Project for electricity generation at the Palmarejo Campus (UniCV)
- Volcanic - geochemical and geodetic monitoring of the Fogo volcano (UniCV)
- VOLRISMAK - Strengthening R+ D+i for monitoring volcanic activity in Macaronesia (UniCV).

Other research projects in Cabo Verde:

Cabo Verde Atmospheric Observatory, operates since 2006 and belongs to the world atmospheric watch network (GAW). The research program is aimed at studying small constituents of the atmosphere and aerosols in the low and medium troposphere, whose concentration and composition have multiple effects on the climate in any region. Likewise, cooperation with the INDP in the installation and operation of an Oceanographic Observatory of Cabo Verde (OOCV) is under way with the objective of promoting research based on ocean observations covering biogeochemical, biological and physical parameters.

ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE), this center was created with the objective of promoting research in Cabo Verde and member countries of West Africa in the fields of renewable energy and energy efficiency. It is the first ECOWAS institution to settle in Cabo Verde. As its name indicates, this body aims to develop renewable energies in the West African region, starting with the Cabo Verdean archipelago.

Rainfall Seasonal Forecast for the West-Africa Subregion - Rainfall seasonal forecasts for the West African subregion is prepared each year in the African Centre of Meteorological Application for Development (ACMAD) with the participation of Cabo Verde experts for the period from July to September, after the results of the PRESAO consensus meeting. The forecast is based primarily on the characteristics of the atmosphere, the anomalies of sea surface temperature (SST), probability estimates of rainfall of Global Centers models (ECMWF and IRI) and regional and local statistics.

Long term forecasting using the "downscaling" technique-National Center of Climate Modelling - The study presents simulation results of the main climatic parameters for the 2010- 2012 period over Cabo Verde region using the dynamic downscaling technique, which consists of using Numerical Weather Prediction (SRM), linked to the Atmospheric General Circulation Model. In numerical simulations ETA model was used. It was developed by the NCEP linked to MCG ECHAM4,5 model developed by the Max Planck Institute.

Air quality and its relationship with climate change - This project aims at characterizing the air quality in Cabo Verde and creating conditions to investigate the cause-effect relationship between pollutants, as well as between greenhouse gas emissions and climate change.

Based on high resolution meteorological model and multivariate statistical models, it is intended to create a system of weather forecasting, dispersion and transport of air pollutants and impacts on quality of life and environment. A second component relates to collecting data and information to support decision makers in defining appropriate strategies under the UNFCCC and Kyoto Protocol.

Cabo Verde International Scientific Research and Technological Development Center, dedicated to biofuels.

5.7.3 Cabo Verde Atmospheric Observatory / Systematic observation

Through the Regulatory Decree of July 2009, the National Institute of Meteorology and Geophysics of Cabo Verde is the national authority in the fields of meteorology, climatology and geophysics. Its mission is the pursuit of national policies in the fields of meteorology, climatology and geophysics. As a member of the World Meteorological Organization, it develops and operates several weather and climate observation networks within its global programs, in particular the World Weather Watch, through the Global Observing System , GOS), but also the Global Atmosphere Watch (GAW), Climate Prediction Center (Africa Desk), Numerical Model Perdition (Tropical Tidbits and West Africa Weather and Climate Nexus), Eta Model with downscaling for Cabo Verde area, WRF and SWAN models.

INMG has made every effort to ensure the operationality of the weather stations network, maintaining and monitoring the quality of the observations and their subsequent archiving. In September 2017, there were 32 weather stations (automatic and classic) operating in Cabo Verde, more than a hundred rain stations, 4 maritime stations and an air quality mobile station. Of these nine weather stations, reports are prepared in the form of CLIMAT codes, which contain monthly climatological data and are disseminated monthly through the global WMO meteorological telecommunications system.

INMG also coordinates the following national programs:

- Reduction of natural disaster risks (monitoring of earthquakes and extreme weather and climate events, information and dissemination to Civil Protection and Government members);
- Geophysical surveillance - national monitoring and follow-up at the São Vicente laboratory;
- Weather and Climate Surveillance - daily forecasts of weather and sea condition;
- Climate Change - climate monitoring and studies;
- Air Quality Monitoring in the main urban centers;
- Agro-climatic surveillance - follow-up of the agricultural campaign (Period before and during rains).

5.7.4 Ocean climate observation climate

The National Institute of Meteorology of Cabo Verde is a partner in the Marine Meteorology Project for the Northwest African Basin and Macaronesia, whose objective is to increase the capacity of the National Meteorological Services of the countries in the West Coast to deal with meteorological monitoring activities and forecast.

5.7.5 Land observation system

The National Institute of Meteorology of Cabo Verde, as a Member of the World Meteorological Organization, enjoys some services and products, made available by this organization, in the observation of the atmosphere by meteorological satellites of interest to the region, as are the cases of the NOAA and EUMESAT satellites.

The INMG also has an Altitude Meteorological Station, which performs daily atmospheric surveys, to observe weather and climate parameters.

Cabo Verde is part of GMOS - Global Mercury Observation System, a global observing system of mercury, consisting of surface, altitude and sea level stations, guaranteeing high quality data for its application in atmospheric models. It observes the concentration of mercury in the atmosphere, its cycle and its implications on the biosphere in ecosystems for different socioeconomic and climate development scenarios. In Cabo Verde, a surface station is installed and operational at the Atmospheric Observatory of Praia Grande in São Vicente.

5.8 Education, training and public awareness building

In accordance with Article 4, paragraph 1 (i) of the UNFCCC, " All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances promote and cooperate in education, training and public awareness on climate change, and encourage the broader participation of nongovernmental organizations."

The various environmental education programs implemented in Cabo Verde are in line with the objectives of the Framework Convention on Climate Change, with particular emphasis on the National Environmental Education Program. The environmental education sector defined as strategic vision "a population formed, informed and committed to the environment and sustainable development". In order to achieve this vision, it is required to establish a multisector education system with sufficient flexibility to accommodate technical and educational innovations appropriate to environmental awareness and planning of educational projects and activities and environmental awareness.

The Government of Cabo Verde has approved the National Plan for Environmental Education (PNEA) 2013-2022, which came into force on February 15, according to a Cabinet resolution aiming at ecological social responsibility and sustainable use of resources.

Resolution No. 10/2014, published in the official gazette of February 14, approving the PNEA, recognizes environmental education as a "challenge for Cabo Verde" because of its small, archipelagic vulnerable characteristics, which "require" a behavioral change so that the Cabo Verdean acquires a new environment friendly culture and new patterns of consumption and rational use of natural resources.

Its target audience will be the institutions involved in this area, the general population and communities, and its purpose is to educate, train and inform to ensure improved sustainability of the interventions. Special attention will be given to children, adolescents and young people with the aim of transforming them into actors of change and transmitters of good messages on environmental protection.

The University of Cabo Verde has been developing a set of priority actions with the main purpose of integrating university extension with teaching and research and taking full advantage of national and international partnerships. On the other hand, it has increasingly invested in academic mobility programs (students, academia and staff) coordinated by prestigious universities, that potentiate excellent partnerships between researchers and institutions, guided by international quality standards. It also promotes integration of teachers into national and international research teams, centers and research centers, guiding research results for the country's sustainable development and enhancing the university's external projection.

The Environmental Assessment System website has been an area of public awareness on different current issues, as it provides diverse information on climate and climate change.

Several meetings have been held in recent years to raise awareness and train stakeholders who directly or indirectly deal with to climate change issues.

5.8.1 Pre-school education

Climate change issues should be introduced from pre-school and according to the curriculum guidelines of the Ministry of Education, "Pre-school education is the first stage of basic education in the process of lifelong education "It creates conditions for the successful learning of all children as it promotes their self-esteem and self-confidence and develops skills that allow each child to recognize their possibilities and progress”.

Environmental Education is one of the values that can be transmitted to children in preschool. In Cabo Verde, most pre-school facilities have the environmental component in their curricula, many of them are creating school gardens, as a way to create a good relationship between pupils, nature and the environment.

5.8.2 Secondary education

Secondary education in Cabo Verde aims to make it possible to acquire the technological and cultural scientific basis necessary for further study and entry into active life and, in particular, allows the achievement of professional qualifications through technical channels for insertion into the labor market.

There is an Environmental Education Network (REA) within the Ministry of Education, which is responsible for various activities and conferences in schools on the environment and climate change.

5.8.3 College education

At higher education level, the University of Cabo Verde for the academic year 2017/2018, are teaching several courses and post-graduation courses:

- Masters in Environment and Environmental Development
- Masters in Spatial Planning
- Masters in Education for Sustainable Development
- Masters in Agricultural Information Management and Precision Agriculture
- PhD in Environmental Management and Policy
- Masters and PhD programs in Oceanography and Marine Resource Management

5.8.4 Access to information and public participation

The SIA website is a Government website, installed in DNA, where we can find all the legislation on the environment, projects and studies for public consultation and notices for training workshops, training and dissemination of the most diverse environment and climate change issues.

On the same site, we find the compilation of all the documents, plans, studies of the Ministry of Environment.

5.8.5 Involvement of Environmental NGOs

In Cabo Verde there are several NGOs dedicating almost exclusively to environmental issues/climate change. Most of these organizations have strong national and international credibility; they aim promoting sustainable development as a way to generate socio-environmental transformations and offering innovative solutions in different sectors such as environment, energy, fisheries, youth, economy, water and sanitation, health and agriculture.

The most prominent non-governmental organizations in Cabo Verde are the following:

- ACÁCEA - Cabo Verde Association for Enviromental Education
- ADAD - Association for the Defense of Environment and Development
- MORABI - Association for the Support to Women Self-promotion in Development
- Association for S.Francisco Development
- CITI-HABITAT- Intermediate Techonology Research Center for Habitat
- ODEFA - Family and Enviroment
- BVRS - Red brigade of the Santiago Region- community development, education/training/environment
- Association of Capeverdean Geographers
- BIOSFERA –Association for Environmental Preservation.

5.8.6 Participation in international activities

Cabo Verde participates in several international activities related to Climate and Climate Change i.e. IPCC, UNFCCC, GEF, Desertification and Biodiversity and Ozone Layer meetings.

The country also participates in some international projects, such as the CPLP Climate Change Network, in Caboeólica projects, ECREEE (Center for Renewable Energy and Energy Efficiency - ECOWAS), Cabo Verde Atmospheric Observatory, belonging to the global watch network (GAW), MARINEMET (Marine Meteorology Project for the Northwest African Basin and Macaronesia), Western Africa Seasonal Forecast, International Center for Scientific Research and Technological Development of Cabo Verde, dedicated to biofuels. Cabo Verde is part of the GMOS - Global Mercury Observation System, a mercury global observing system.

5.9 Development of technologies to reduce and prevent emissions

In Cabo Verde, there are four areas where it is possible to significantly reduce greenhouse gas emissions: energy distribution and generation; construction sector; transport sector; industry sector

5.9.1 Development of technologies to reduce emissions in the energy sector

According to the Directorate General for Energy, the energy sector has the main potential for reducing emissions, through the use of smart energy networks, the so-called smart grids, which may allow reaching a "total integration of renewable energy sources in progress in the country”.

The Energy Efficiency Program is being implemented with the distribution of approximately 300,000 low energy light lamps in Cabo Verde.

5.9.2 Development of technologies to reduce emissions in the construction sector

For this sector, construction of smart building is increasing. The Project developed by the Directorate General for Energy, in partnership with several municipalities, aims to install in some buildings selected by their respective City Halls solar panel ceilings with a production capacity of up to 25% of the total consumption.

The Government has approved the establishment of legal and tax incentives for the implementation of microgeneration projects on buildings, private houses and hotels.

5.9.3 Development of technologies to reduce emissions in the transport sector (NAMAs in transports)

For the development of technologies to reduce emissions in the transport sector, the Government of Cabo Verde is implementing a project to update the car fleet by reducing import taxes and providing other incentives. Also related to this project, the government has imports of unleaded gasoline in progress. The project also proposes to develop a NAMA that will increase the energy efficiency in the transport sector, including national maritime and air travel, and evaluate the options of available policies and actions with the purpose of reducing the impact of GHG emissions produced by this sector.

Initially, NAMA will focus on the collection of important data for the sector, including, but not limited to, type and fuel consumption by mode of transportation, technology performance, fuel substitution possibilities, cost estimates and an up-to-date profile of GHG emissions for light commercial vehicles as well as for freight and passenger transport services.

This NAMA could also consider the possibility of introducing by 2030 a fleet of hybrid vehicles in the country, starting by the vehicles of the members of the government.

5.10 Sink protection

All countries should review their policies and implement the commitments set forth in Article 4 of the Convention, especially those relating to the protection of sinks and reservoirs, establishing measures to protect biodiversity, and populations. It is of fundamental importance for the credibility and good development of the Protocol that CO_2 reduction projects and initiatives do not lead to other serious environmental damage or create perverse incentives. In Cabo Verde, funding should be studied through the CDM and other appropriate mechanisms for programs to reduce CO_2 emissions from some forest fires in Santo Antão and Fogo Island, and address their underlying causes.

In INDC, under the contribution of forests to reduce emissions, it is proposed to plant near 20,000 hectares by 2030:

- Plant 400 trees per hectare;
- Reach 360 tCO_2eq sequestrated per hectare, in a 30 period, corresponding to 7.2 $mtCO_2eq$ for 20.000 hectares 30 years later;

Reduce demand for firewood by:

- Eliminating 3 stone stove technology (still used by 35% of households) by improving low emission stoves.
- Reaching 100% access to the electrical grid (above 95%).

Seeking to improve overall forest management through investment in inventory and land registration systems, establishment of afforestation / reforestation priorities, and preparation of sustainable land management plans and long-term forest management plans associated with performance based inputs

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CHAPTER V – OTHER INFORMATION ON THE IMPLEMENTATION OF UNFCCC

- AOSIS non-paper for ADP Worksteam2
- Boletim Informativo Mudanças Climáticas 2013
- Cabeólica Relatório Sustentabilidade 2016
- Cabo Verde 50% Renovável – Um Caminho até 2020
- Cabo Verde e o Sistema das Nações Unidas - Plano de Trabalho Anual UNDAF 2017
- Cabo Verde no Contexto Desenvolvimento Sustentado – Relatório à Conferencia Rio + 20
- Centro Internacional de Investigação Científica e Desenvolvimento Tecnológicos de Cabo Verde, dedicado aos biocombustíveis
- Energia Renovável Desenvolvimento Sustentável
- Estratégia de Desenvolvimento Baixo Carbono Resiliente
- Estratégia Desenvolvimento Protecção Social
- Estratégia e Plano de Acção Nacional para a Biodiversidade (EPANB)
- Fórum Transformação Cabo Verde 2030
- Integração da Adaptação às Mudanças Climáticas no Processo de Desenvolvimento
- Intended Nationally Determined Contribution of Cabo Verde (INDC)
- NAMAs no sector da Energia/eficiência energética e no sector de resíduos
- Plano de Acção Florestal Nacional (PAFN)

- Plano de Acção Nacional de Eficiência Energética
- Plano de Acção Nacional de Luta Contra a Desertificação (PAN-LCD)
- Plano de Acção para a Gestão Integrada dos Recursos Hídricos (PAGIRH)
- Plano Estratégico do Instituto Nacional Meteorologia e Geofísica 2012 - 2016
- Plano Estratégico do Desenvolvimento Agrícola (PEDA)
- Plano Estratégico Nacional de Água e Saneamento
- Plano Estratégico de Desenvolvimento Sustentado Cabo Verde 2017 – 2022
- Plano Nacional de acção para a energia renovável (2015/2020/2030)
- Plano Nacional de Investimento Agrícola (PNIA)
- Primeira e Segunda Comunicação Nacional sobre as Mudanças Climáticas
- Primeiro Plano de Acção Nacional para o Ambiente (PANA I)
- Programa do Governo da IX Legislatura 2016 – 2021
- Segundo Plano de Acção Nacional para o Ambiente (PANA II)
- UNDP Climate Change Country Profiles - Cabo Verde

SYMBOLS

AFOLU - Agriculture, Forestry, and Other Land Use
CH_4 – methane
CO - carbon monoxide;
CO_2 - carbon dioxide
CO_2eq - carbon dioxide equivalent;
CORINAIR - CORE INVENTORY AIR EMISSIONS;
GEE – Greenhouse gases;
Gg - Giga Gram (1000 t);
GWP - Global Warming Potential
HFCs - hydrofluorocarbons
IE – Included in another category
IPCC - Intergovernmental Panel on Climate Change
IPPU - Industrial Processes and Product Use
N_2O - nitrous oxide
NE – Not estimated
NO – Inexistent;
NO_X – Nitrogen oxide;
NMVOC – Non-Methane Volatile Organic Compounds
EAP – Economically Active population;
SAR - Second Assessment Report
NF_3 – Nitrogen trifluoride;
SF_6 - Sulphur hexafluoride;
t – Tons;
Tep – Tons equivalent of oil;
TJ - Tera Joule;

ACCRONYMS

CBD- Convention on Biological Diversity
DNA - National Directorate for the Environment

IUCN - International Union for Conservation of Nature
INIDA - National Institute of Agricultural Research and Development
INDC – Intended Nationally Determined Contribution
MAHOT - Ministry of Environment Housing and Spatial Planning
UNFCCC - United Nations Framework Convention on Climate Change
CCVA - Vulnerability and Adaptation to Climate Change Study in Cabo Verde
PEDAS - Strategic Plan for Sustainable Development
ODS - The 2030 Agenda for Sustainable Development
ANAS - National Water and Sanitation Agency
CAS - Water and Sanitation Code
ESG - Social and Gender Strategy
WWTP - Wastewater Treatment Plant
FASA - Water and Sanitation Fund
GHG - Greenhouse Gases
INMG - National Institute of Meteorology and Geophysics
INE - National Institute of Statistics
IMC - Continuous Multi-Objective Survey
IPCC - Intergovernmental Panel on Climate Change
CC - Climate Change
NAPA National Program of Action for Adaptation to Climate Change
NITA - Technical Assistance to National Institutions
ODS - Sustainable Development Objective
UN - United Nations
PAGIRH - Integrated Water Resources Management Action Plan
PDAS - Water and Sanitation Master Plan
PLENAS - National Strategic Plan for Water and Sanitation
PNAEE - National Action Plan for Energy Efficiency
PNAER - National Plan of Action for Renewable Energy

ANNEX I – NATIONAL CIRCUMSTANCES

Table 1 - International Legal/environmental tools Ratified by Cabo Verde

Tool	Place/Completion date	Signature/approval
United Nations Convention to Combat Desertification	Paris, 17 June 1994	Resolution 98 / IV / 95 of 8 March 1994
United Nations Framework Convention on Climate Change	New York, 9 May 1992	Resolution No. 72 / IV / 94, of 20 October
United Nations Convention on Biological Diversity	Rio de Janeiro, June 5, 1992	Resolution 73 / IV / 94 of 20 October
Basel Convention on the Control of Transboundary Movements	Basel, 22 March 1989	Resolution No 74 / IV / 94 of 20 October
United Nations Convention on the Protection of the Ozone Layer	Vienna, 22 March 1985	Decree No. 6/97 of 31 March
United Nations Convention on the Law of the Sea	Montego Bay, Jamaica, 1982	Law No. 17 / II / 87, of 3 August
Convention on the Minimum Conditions for Access to Fishery Resources (Subregional Fisheries Commission)	Amended in Praia, 1993	Resolution 38 / V / 96 of 30 December
Civil liability for losses due to oil pollution	New York, 1958	Decree No. 2/97 of 10 February
Persistent Organic Pollutants (POPs) (POPs)	Stockholm, May 2001	Decree No. 16/2005 of 19 December
RAMSAR Convention on Wetlands of International Importance	Ramsar, 1971	Decree No. 4/2004 of 18 November
International Trade in Endangered Species of Wild Fauna and Flora	Washington, 1973	Decree No. 1/2005 of March 21
United Nations Convention on the Conservation of Migratory Species of Wild Animals	Bonn, 1979	Decree 13/2005 of 5 December
Convention on the Control of Hazardous and Obsolete Pesticides	Rotterdam, 1998	Decree No. 17/2005 of 28 December

ANNEX II – GHG INVENTORY

1. Energy Balance 2005

Cabo Verde Energy Balance 2005 (Tep)	Wind	Firewood	Diesel Oil	Fueloil	Jet A1	Petroleum	Gasoline	Buthane	Electricity	Coal	Total
Production	555	31 833									**31 148**
Imports			109 622	55 809	91 101	1 115	7 231	11 458			**276 336**
Stock variation											**0**
Exports			23 305	22 435	56 555						**102 295**
Gross domestic supply	**555**	**30 593**	**86 317**	**33 374**	**34 546**	**1 115**	**7 231**	**11 458**	**0**	**0**	**205 189**
Transformation - Thermal			-22 212	-33 059					20 301		**-34 970**
Transformation - wind + solar	-555								352		**-203**
Transformation – Coal plants		-1860								620	**0**
Losses									-4 670	-175	**-4 845**
Total transformation	**-555**	**-620**	**-22 212**	**-33 059**	**0**	**0**	**0**	**0**	**15 983**	**445**	**-40 018**
Energy final consumption	0	**29 973**	**64 105**	**315**	**34 546**	**1 115**	**7 231**	**11 458**	**15 983**	**445**	**165 171**
Transports			**54 884**		**34 546**		**7 231**				**96 661**
Transports			49 511				7 231				**56 742**
Road					34 546						**34 546**
Air			5 373								**5 373**
Disalination									1 054		**1 054**
Industry			8 111	315					3 262		**11 688**
Residential		29 021				1115		7 448	7 900	59	**45 076**
Trade, Services and Pub Adm		952	1 110					4 010	3 767	386	**10 226**

2. Energy Balance 2010

Cabo Verde Energy Balance 2010 (Tep)	Wind	Firewood	Diesel oil	Fueloil	Jet A1	Petroleum	Gasoline	Buthane	Electricity	Coal	Wind	Total
Production	171	181	31 703									**30 784**
Imports				110 224	67 697	63 288	648	7 548	11 526			**260 931**
Stock variation												**0**
Exports				29 663	14 059	46 458						**90 181**
Gross domestic supply	**171**	**181**	**30 431**	**80 561**	**53 638**	**16 830**	**648**	**7 548**	**11 526**	**0**	**0**	**201 534**
Transformation - thermal				-21 533	-52 726					30 332		**-43 927**
Transformation - wind + solar	-171	-181								352		**0**
Transformation – coal plants			-1908								636	**0**
Losses										-7 156	-180	**-9 282**
Total de transformation	**-171**	**-181**	**-636**	**-21 533**	**-52 726**	**0**	**0**	**0**	**0**	**21 581**	**456**	**-53 210**
Energy final consumption	0	**0**	**29 795**	**59 028**	**912**	**16 830**	**648**	**7 548**	**11 526**	**21 581**	**456**	**148 324**
Transports				**46 193**		**16 830**		**7 548**				**70 571**
Road				42 071				7 548				**49 618**
Air						16 830						**16 830**
Maritime				4 123								**4 123**
Disalination										1 787		**1 787**
Industry				10 527	912					5 272		**16 711**
Residential			28 850				648		6 202	10 265	60	**46 025**
Trade, Services and Pub Adm.			946	2 309					5 324	6 204	395	**15 179**

Assumptions made for calculation of energy balances:

- All wind and solar power energy was assigned to electricity generation
- All fuel Imports was consumed internally;
- No stock of product;
- No imports of coal;
- All oil is consumed in residential sector;

- There are no losses in electricity generation with RE sources; and
- All gasoline is consumed in the transport sector

To calculate CO_2 emissions, the equivalence factor Global Warming Potential (GWP) over 100 years of the Second Assessment Report (SAR) of IPPC (1995) presented in the table below:

3. Table – Type of gases and Global Warming Potential over 100 years

Gases	Símbolo	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFC-23	11.700
	HFC-125	2.800
	HFC-134a	1.300
	HFC-143a	3.800
	HFC-152a 140	140

4. Data on Emission factors

The following values were used for emission factors to calculate GHG emission estimates in the energy sector, available at the IPCC 2006 in kg/TJ.

Table - Emission factors in Maritime transport subsector and by type of gases

Maritime Transports	CO_2	CH_4	N_2O
Diesel oil	74100	7	2
Fuel oil	77400	7	2

Table - Emission factors in Air transport subsector and by type of gases

Aviação	CO_2	CH_4	N_2O
Jet A1	71500	0,5	2

Table - Emission factors in Road transport subsector and by type of gases

Road Transp	CO_2	CH_4	N_2O
Gasoline	69300	33	3,2
Diesel oil	74100	3,9	3,9

Table –Emission factors in Residential subsector and by type of gases

Residential	CO_2	CH_4	N_2O
Buthane	63100	5	0,1
Kerosene	71900	10	0,6

Table - Emission factors in Industry subsector and by type of gases

Industry	CO_2	CH_4	N_2O
Diesel oil	74100	3	0,6
Fuel	77400	3	0,6

Table - Emission factors in Road transport subsector and by type of gases

Trade	CO_2	CH_4	N_2O
Diesel oil	74100	10	0,6
Buthane	63100	5	0,1

Table – Emission factors in Biomass subsector and by type of gases

Biomass	CO_2	CH_4	N_2O
Coal	112000	200	1
Firewood	112000	300	4

Conversion factors

In the inventory, the following conversion factors were established, as defined in Resolution no. 100/2015, which sets out the Renewable Energy Stock Plan for fuel, firewood and coal conversion from tons to tep. Density values were provided by the Direction of Energy Service, institution responsible for this sector.

Table- Conversion factor of the energy unit

Electricity	Density		Conversion factor			
			0,011628	**GWh/Tep**	**86**	**Tep/GWh**
Fuels						
Buthane	0,58	Ton/m^3	1,05	Tep/Ton	12.209	MWh/Ton
Gasoline	0,75	Ton/m^3	1,03	Tep/Ton	11.977	MWh/Ton
Kerosene	0,80	Ton/m^3	1,01	Tep/Ton	11.744	MWh/Ton
Jet Fuel	0,80	Ton/m^3	1,02	Tep/Ton	11.860	MWh/Ton
Diesel oil	0,86	Ton/m^3	1,00	Tep/Ton	11.682	MWh/Ton
Fuel	0,96	Ton/m^3	0,94	Tep/Ton	10.930	MWh/Ton
Firewood	--	Ton/m^3	0,33	Tep/Ton	3.837	MWh/Ton
Coal	--	Ton/m^3	0,71	Tep/Ton	8.256	MWh/Ton
Waste	--	Ton/m^3	0,25	Tep/Ton	2.907	MWh/Ton

To convert tep consumptions into TJ the following conversion was used:

1 tep = 0,0418608TJ

5. GHG Sector Estimates in Cabo Verde in 2005

Inventory Year: 2005

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	297,403	4,504	0,193	0,761	NO	NO	NO	NO	4,088	36,661	3,680	NE
1 - Energy	533,874	0,414	0,019	NO	NO	NO	NO	NO	3,337	11,395	1,761	NE
1.A - Fuel Combustion Activities	533,874	0,414	0,019	NO	NO	NO	NO	NO	3,337	11,395	1,761	NE
1.A.1 - Energy Industries	176,011	0,009	0,002						0,471	0,113	0,015	NE
1.A.2 - Manufacturing Industries and Construction	26,180	0,001	0,0002						0,071	0,004	0,002	NE
1.A.3 - Transport	294,618	0,020	0,012						2,611	4,864	0,986	NE
1.A.4 - Other Sectors	37,064	0,383	0,005						0,185	6,415	0,758	NE
1.A.5 - Non-Specified	NE	NE	NE						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	NE	NE	NE						NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE						NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	0,594	NO	NO	0,761	NO	NO	NO	NO	NO	NO	1,919	0
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.1 - Cement production	NO								NO	NO	NO	NO
2.A.2 - Lime production	NO								NO	NO	NO	NO
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	0	0	0,00080	0

Inventory Year: 2005

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)					
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO							NO	NO	NO	NO
2.B.9 - Fluorochemical Production									NO	NO	NO	NO
2.B.10 - Other (Please specify)	NE	NE	NE						NO	NO	0,00080	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO							NO	NO	NO	NO
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	0,594	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.D.1 - Lubricant Use	0,594								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NO								NO	NO	NO	NO
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO

Inventory Year: 2005

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	0,761	NE	NO	NO	NO	0	0	0,5498	0
2.F.1 - Refrigeration and Air Conditioning				0,761				NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO				NO	NO	NO	0,0099	NO
2.F.3 - Fire Protection				NE	NE			NO	NO	NO	NE	NO
2.F.4 - Aerosols				NE				NO	NO	NO	NE	NO
2.F.5 - Solvents				NO	NO			NO	NO	NO	0,5399	NO
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO		NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO		NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO						NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	1,368	NO
2.H.1 - Pulp and Paper Industry	NO	NO							NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NE	NE							NO	NO	1,368	NO
2.H.3 - Other (please specify)	NE	NE	NE						NO	NO	NE	NO
3 - Agriculture, Forestry, and Other Land Use	-237,292	2,853	0,154	NO	NO	NO	NO	NO	0,752	25,266	NE	NE
3.A - Livestock	NO	2,040	IE	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.A.1 - Enteric Fermentation		1,882							NO	NO	NO	NO
3.A.2 - Manure Management		0,1588	IE						NO	NO	NO	NO
3.B - Land	-237,380	0,0009	0,0001	NO	NO	NO	NO	NO	6E-04	0,021	NO	NO
3.B.1 - Forest land	-237,380	0,0009	0,0001						6E-04	0,021	NO	NO
3.B.2 - Cropland	NO								NO	NO	NO	NO
3.B.3 - Grassland	NO								NO	NO	NO	NO

Inventory Year: 2005

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.B.4 - Wetlands	NO		NO						NO	NO	NO	NO
3.B.5 - Settlements	NO								NO	NO	NO	NO
3.B.6 - Other Land	NE								NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	0,088	0,811	0,153	NO	NO	NO	NO	NO	0,751	25,245	NE	NO
3.C.1 - Emissions from biomass burning		0,811	0,021						0,751	25,245	NE	NO
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	0,088								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0,063						NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils			0,070						NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			NO						NO	NO	NO	NO
3.C.7 - Rice cultivations		NO							NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO								NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
4 - Waste	0,23	1,237	0,020	NO	NO	NO	NO	NO	NE	NE	NE	NO
4.A - Solid Waste Disposal	NE	0,6416	NE	NO	NO	NO	NO	NO	NE	NE	NE	NO
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	0,23	0,081	0,001	NO	NO	NO	NO	NO	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NO	0,514	0,0188	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Inventory Year: 2005

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Memo Items (5)												
International Bunkers	314,251	0,01	0,01	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	169,272	0,001	0,005						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	144,979	0,013	0,004						NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
Information Items												
CO2 from Biomass Combustion for Energy Production	151,332											

6. GHG Sector Estimates in Cabo Verde in 2010

Inventory Year: 2010

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	292,835	5,709	0,226	2,476	NO	NO	NO	NO	3,622	32,568	4,028	NE
1 - Energy	528,350	0,405	0,017	NO	NO	NO	NO	NO	2,981	11,045	1,671	NE
1.A - Fuel Combustion Activities	528,350	0,405	0,017	NO	NO	NO	NO	NO	2,981	11,045	1,671	NE
1.A.1 - Energy Industries	237,63	0,01	0,00						0,63	0,13	0,02	NE
1.A.2 - Manufacturing Industries and Construction	35,61	0,0014	0,0003						0,10	0,0048	0,0024	NE
1.A.3 - Transport	215,56	0,02	0,01						2,07	4,53	0,90	NE
1.A.4 - Other Sectors	39,56	0,37	0,01						0,19	6,38	0,75	NE
1.A.5 - Non-Specified	NE	NE	NE						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	NE	NE	NE						NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE						NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	0,89	NE	NE	2,48	NO	NO	NO	NO	NO	NO	2,357	0,00
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.1 - Cement production	NO								NO	NO	NO	NO
2.A.2 - Lime production	NO								NO	NO	NO	NO
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00082	NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO

Inventory Year: 2010

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO							NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	0,00082	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO							NO	NO	NO	NO
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	0,890	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.D.1 - Lubricant Use	0,890								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NO								NO	NO	NO	NO
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Inventory Year: 2010

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	2,48	NO	NO	NO	NO	0,00	0,00	0,65	0,00
2.F.1 - Refrigeration and Air Conditioning				2,476				NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO				NO	NO	NO	0,0108906	NO
2.F.3 - Fire Protection				NE	NE			NO	NO	NO	NE	NO
2.F.4 - Aerosols				NE				NO	NO	NO	NE	NO
2.F.5 - Solvents				NO	NO			NO	NO	NO	0,6372503	NO
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NE	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO		NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO		NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO						NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NE	NE	NE	NE	NE	NE	0,00	0,00	0,00	0,00	1,71	0,00
2.H.1 - Pulp and Paper Industry	NO	NO							NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NE	NE							NE	NE	1,71	NO
2.H.3 - Other (please specify)	NE	NE	NE						NE	NE		NO
3 - Agriculture, Forestry, and Other Land Use	-236,692	2,8996	0,1871	NO	NO	NO	NO	NO	0,64	21,52	NO	NO
3.A - Livestock	0,00	2,21	IE	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.A.1 - Enteric Fermentation		2,04							NO	NO	NO	NO
3.A.2 - Manure Management		0,17	IE						NO	NO	NO	NO
3.B - Land	-236,77	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NO
3.B.1 - Forest land	-236,77								NE	NE	NE	NO
3.B.2 - Cropland	NO								NO	NO	NO	NO
3.B.3 - Grassland	NO								NO	NO	NO	NO
3.B.4 - Wetlands	NO		NO						NO	NO	NO	NO
3.B.5 - Settlements	NO								NO	NO	NO	NO
3.B.6 - Other Land	NE								NE	NE	NE	NE

Inventory Year: 2010

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C - Aggregate sources and non-CO2 emissions sources on land	0,0824	0,6918	0,1871	NO	NO	NO	NO	NO	0,641	21,523	NE	NO
3.C.1 - Emissions from biomass burning		0,69	0,02						0,641	21,523	NE	NO
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	0,08								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0,08						NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils			0,08						NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO								NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
4 - Waste	0,2862	2,4046	0,0218	NO	NO	NO	NO	NO	NE	NE	NE	NO
4.A - Solid Waste Disposal	NE	0,84	NE	NO	NO	NO	NO	NO	NE	NE	NE	NO
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	0,29	0,11	0,0014	NO	NO	NO	NO	NO	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NE	1,46	0,0204	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	276,61	0,01	0,01	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	139,05	0,00	0,004						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	137,56	0,01	0,004						NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE

Inventory Year: 2010

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Information Items												
CO2 from Biomass Combustion for Energy Production	147,493											

7. GHG Sector Estimates in Cabo Verde in 2000

Inventory Year: 2000

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	58,573	3,891	0,202	0,127	NO	NO	NO	NO	2,608	30,943	1,177	NE
1 - Energy	287,879	0,410	0,012	NO	NO	NO	NO	NO	1,996	10,362	1,521	NE
1.A - Fuel Combustion Activities	287,879	0,410	0,012	NO	NO	NO	NO	NO	1,996	10,362	1,521	NE
1.A.1 - Energy Industries	97,218	0,004	0,001						0,262	0,030	0,007	NE
1.A.2 - Manufacturing Industries and Construction	21,015	0,002	0,0002						0,059	0,102	0,004	NE
1.A.3 - Transport	138,050	0,016	0,006						1,497	3,801	0,738	NE
1.A.4 - Other Sectors	31,596	0,388	0,005						0,178	6,429	0,772	NE
1.A.5 - Non-Specified	NE	NE	NE						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	NE	NE	NE						NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE						NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	0,3784	ÑE	NE	0,127	NO	NO	NO	NO	NO	0	1,17669	0
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.1 - Cement production	NO								NO	NO	NO	NO
2.A.2 - Lime production	NO								NO	NO	NO	NO
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	0

Inventory Year: 2000

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO							NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO							NO	NO	NO	NO
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	0,3784	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.D.1 - Lubricant Use	0,3784								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NO								NO	NO	NO	NO
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO

Inventory Year: 2000

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	0,13	NO	NO	NO	NO	NO	NO	0,0095	0
2.F.1 - Refrigeration and Air Conditioning				0,13				NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO				NO	NO	NO	0,0095	NO
2.F.3 - Fire Protection				NE	NE			NO	NO	NO	NE	NO
2.F.4 - Aerosols				NE				NO	NO	NO	NE	NO
2.F.5 - Solvents				NO	NO			NO	NO	NO	NE	NO
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO		NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO		NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO						NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	1,1672	0
2.H.1 - Pulp and Paper Industry	NO	NO							NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NE	NE							NO	NO	1,1672	NO
2.H.3 - Other (please specify)	NE	NE	0						NO	NO		NO
3 - Agriculture, Forestry, and Other Land Use	-229,8423	2,5312	0,1717	NO	NO	NO	NO	NO	0,6125	20,5807	NO	NO
3.A - Livestock	NO	1,8696	IE	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.A.1 - Enteric Fermentation		1,7222							NO	NO	NO	NO
3.A.2 - Manure Management		0,1474	IE						NO	NO	NO	NO
3.B - Land	-229,8700	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE

Inventory Year: 2000

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.B.1 - Forest land	-229,8700								NE	NE	NE	NE
3.B.2 - Cropland	NO								NO	NO	NO	NO
3.B.3 - Grassland	NO								NO	NO	NO	NO
3.B.4 - Wetlands	NO		NO						NO	NO	NO	NO
3.B.5 - Settlements	NO								NO	NO	NO	NO
3.B.6 - Other Land	NE								NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	0,0277	0,6615	0,1717	NO	NO	NO	NO	NO	0,6125	20,5807	NO	NO
3.C.1 - Emissions from biomass burning		0,6615	0,0172						0,6125	20,5807	NE	NO
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	0,0277								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0,0829						NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils			0,0716						NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			NO						NO	NO	NO	NO
3.C.7 - Rice cultivations		NO							NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO								NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
4 - Waste	0,1580	0,9499	0,0179	NO	NO	NO	NO	NO			NE	NO
4.A - Solid Waste Disposal	NE	0,5039	NO	NO	NO	NO	NO	NO	NO	NE	NE	NO
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	0,1580	0,0588	0,0008	NO	NO	NO	NO	NO	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NO	0,3871	0,0172	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Inventory Year: 2000

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	277,953	0,008	0,008	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	203,623	0,001	0,006						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	74,330	0,007	0,002						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
Information Items												
CO2 from Biomass Combustion for Energy Production	145,407											

8. GHG Sector Estimates in Cabo Verde in 1995

Inventory Year: 1995

	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
Categories	**Net CO_2 (1)(2)**	**CH_4**	**N_2O**	**HFCs**	**PFCs**	**SF_6**	**Other halogenated gases with CO_2 equivalent conversion factors (3)**	**Other halogenated gases without CO_2 equivalent conversion factors (4)**	**NO_x**	**CO**	**NMVOCs**	**SO_2**
Total National Emissions and Removals	23,458	3,978	0,189	NE	NO	NO	NO	NO	2,221	31,996	2,595	NE
1 - Energy	219,748	0,492	0,012	NO	NO	NO	NO	NO	1,600	11,119	1,555	NE
1.A - Fuel Combustion Activities	219,748	0,492	0,012	NO	NO	NO	NO	NO	1,600	11,119	1,555	NE
1.A.1 - Energy Industries	62,744	0,003	0,001						0,169	0,025	0,005	NE
1.A.2 - Manufacturing Industries and Construction	21,334	0,002	0,0002						0,061	0,125	0,004	NE
1.A.3 - Transport	107,987	0,013	0,005						1,170	3,105	0,602	NE
1.A.4 - Other Sectors	27,684	0,473	0,006						0,200	7,865	0,944	NE
1.A.5 - Non-Specified	NE	NE	NE						NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.B.1 - Solid Fuels	NO	NO	NO						NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	NE	NE	NE						NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE						NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO_2	NO								NO	NO	NO	NO
1.C.2 - Injection and Storage	NO								NO	NO	NO	NO
1.C.3 - Other	NO								NO	NO	NO	NO
2 - Industrial Processes and Product Use	0,353	NE	NE	NE	NO	NO	NO	NO	NO	NO	1,041	0,000
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.1 - Cement production	NO								NO	NO	NO	NO
2.A.2 - Lime production	NO								NO	NO	NO	NO
2.A.3 - Glass Production	NO								NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO								NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	NO
2.B.1 - Ammonia Production	NO								NO	NO	NO	NO

Inventory Year: 1995

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.B.2 - Nitric Acid Production			NO						NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO						NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO						NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO							NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO								NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO								NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO							NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.1 - Iron and Steel Production	NO	NO							NO	NO	NO	NO
2.C.2 - Ferroalloys Production	NO	NO							NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO			NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO		NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO								NO	NO	NO	NO
2.C.6 - Zinc Production	NO								NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	0,353	NE	NE	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	0,353								NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NO								NO	NO	NO	NO
2.D.3 - Solvent Use									NE	NE	NE	NE
2.D.4 - Other (please specify)	NE	NE	NE						NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO			NO	NO	NO	NO	NO

Inventory Year: 1995

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.E.4 - Heat Transfer Fluid					NO			NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO	0,009	NO
2.F.1 - Refrigeration and Air Conditioning				NE				NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO				NO	NO	NO	0,009	0,000
2.F.3 - Fire Protection				NE	NE			NO	NO	NO	0,000	0,000
2.F.4 - Aerosols				NE				NO	NO	NO	0,000	0,000
2.F.5 - Solvents				NO	NO			NO	NO	NO	0,000	0,000
2.F.6 - Other Applications (please specify)				NO	NO			NO	NO	NO	0,000	0,000
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO		NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO		NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO						NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NE	NE	NE	NO	NO	NO	NO	NO	NO	NO	1,032	NO
2.H.1 - Pulp and Paper Industry	NO	NO							NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NE	NE							NO	NO	1,032	0,000
2.H.3 - Other (please specify)	NE	NE	NE						NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-196,770	2,395	0,162	NO	NO	NO	NO	NO	0,621	20,876	NO	NO
3.A - Livestock	NO	1,724	IE	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.A.1 - Enteric Fermentation		1,586							NO	NO	NO	NO
3.A.2 - Manure Management		0,138	IE						NO	NO	NO	NO
3.B - Land	-196,770	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
3.B.1 - Forest land	-196,770								NE	NE	NE	NE
3.B.2 - Cropland	NO								NO	NO	NO	NO
3.B.3 - Grassland	NO								NO	NO	NO	NO

Inventory Year: 1995

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)			
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.B.4 - Wetlands	NO		NO						NO	NO	NO	NO
3.B.5 - Settlements	NE								NO	NO	NO	NO
3.B.6 - Other Land	NO								NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	NE	0,671	0,162	NO	NO	NO	NO	NO	0,621	20,876	0,000	0,000
3.C.1 - Emissions from biomass burning		0,671	0,017						0,621	20,876	0,000	0,000
3.C.2 - Liming	NO								NO	NO	NO	NO
3.C.3 - Urea application	NE								NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0,079						NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils			0,065						NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			NE						NO	NO	NO	NO
3.C.7 - Rice cultivations		NO							NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO						NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO								NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO						NO	NO	NO	NO
4 - Waste	0,126	1,091	0,016	NO	NO	NO	NO	NO			NE	NO
4.A - Solid Waste Disposal	NE	0,402	NE	NO	NO	NO	NO	NO	NO	NE	NE	NO
4.B - Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	0,126	0,047	0,001	NO	NO	NO	NO	NO	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	NE	0,642	0,015	NO	NO	NO	NO	NO	NO	NO	NO	NO
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Inventory Year: 1995

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Memo Items (5)												
International Bunkers	232,127	0,003	0,006	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers)	213,946	0,001	0,006						NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers)	18,181	0,002	0,000						NE	NE	NE	NE
1.A.5.c - Multilateral Operations	NE	NE	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
Information Items												
CO2 from Biomass Combustion for Energy Production	177,966											

9. Tables of Uncertainty

Base year for assessment of uncertainty in trend: 1995, Year T: 2010

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Inventory trend in national emissions for year t increase with respect to base year (% of base year)	Uncertainty introduced into the trend in total national emissions (%)
1 - Energy									
1.A.1 - Energy Industries - Liquid Fuels	CO2	62,744	237,627	5,000	5,000	7,071	2,153	378,727	5,578
1.A.1 - Energy Industries - Liquid Fuels	CH4	0,053	0,196	5,000	5,000	7,071	0,000	371,444	0,000
1.A.1 - Energy Industries - Liquid Fuels	N2O	0,156	0,578	5,000	5,000	7,071	0,000	371,444	0,000
1.A.1 - Energy Industries - Biomass	CO2	1,375	8,945	30,000	18,694	35,348	0,076	650,684	0,268
1.A.1 - Energy Industries - Biomass	CH4	0,008	0,050	30,000	245,455	247,281	0,000	650,684	0,000
1.A.1 - Energy Industries - Biomass	N2O	0,015	0,099	30,000	304,545	306,019	0,001	650,684	0,001
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CO2	21,334	35,608	5,000	5,000	7,071	0,048	166,908	0,106
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CH4	0,017	0,030	5,000	5,000	7,071	0,000	172,951	0,000
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	N2O	0,051	0,089	5,000	5,000	7,071	0,000	172,951	0,000
1.A.2 - Manufacturing Industries and Construction - Biomass	CO2	0,694	0,000	5,000	18,694	19,351	0,000	0,000	0,001
1.A.2 - Manufacturing Industries and Construction - Biomass	CH4	0,026	0,000	5,000	245,455	245,505	0,000	0,000	0,000
1.A.2 - Manufacturing Industries and Construction - Biomass	N2O	0,008	0,000	5,000	281,818	281,863	0,000	0,000	0,000
1.A.3.a - Civil Aviation - Liquid Fuels	CO2	230,737	189,424	7,071	7,071	10,000	0,834	82,095	2,923
1.A.3.a - Civil Aviation - Liquid Fuels	CH4	0,034	0,028	7,071	7,071	10,000	0,000	82,095	0,000
1.A.3.a - Civil Aviation - Liquid Fuels	N2O	2,001	1,643	7,071	7,071	10,000	0,000	82,095	0,000
1.A.3.b - Road Transportation - Liquid Fuels	CO2	74,881	152,396	5,000	5,000	7,071	0,885	203,516	2,007
1.A.3.b - Road Transportation - Liquid Fuels	CH4	0,244	0,363	5,000	5,000	7,071	0,000	148,706	0,000
1.A.3.b - Road Transportation - Liquid Fuels	N2O	1,185	2,443	5,000	5,000	7,071	0,000	206,057	0,001
1.A.3.b - Road Transportation	CO2	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
1.A.3.d - Water-borne Navigation - Liquid Fuels	CO2	34,495	150,352	7,071	7,071	10,000	0,728	435,859	2,087
1.A.3.d - Water-borne Navigation - Liquid Fuels	CH4	0,068	0,294	7,071	7,071	10,000	0,000	431,252	0,000
1.A.3.d - Water-borne Navigation - Liquid Fuels	N2O	0,288	1,242	7,071	7,071	10,000	0,000	431,252	0,000

Base year for assessment of uncertainty in trend: 1995, Year T: 2010

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Inventory trend in national emissions for year t increase with respect to base year (% of base year)	Uncertainty introduced into the trend in total national emissions (%)
1.A.4 - Other Sectors - Liquid Fuels	CO2	27,684	39,558	7,071	7,071	10,000	0,030	142,889	0,067
1.A.4 - Other Sectors - Liquid Fuels	CH4	0,052	0,077	7,071	7,071	10,000	0,000	146,346	0,000
1.A.4 - Other Sectors - Liquid Fuels	N2O	0,024	0,038	7,071	7,071	10,000	0,000	157,414	0,000
1.A.4 - Other Sectors - Biomass	CO2	175,897	138,547	42,426	26,438	49,989	17,511	78,766	64,097
1.A.4 - Other Sectors - Biomass	CH4	9,890	7,753	42,426	321,412	324,200	2,327	78,392	4,395
1.A.4 - Other Sectors - Biomass	N2O	1,946	1,516	42,426	421,050	423,182	0,153	77,924	0,287
2 - Industrial Processes and Product Use									
2.D - Non-Energy Products from Fuels and Solvent Use	CO2	0,353	0,890	14,142	5,000	15,000	0,000	251,867	0,000
3 - Agriculture, Forestry, and Other Land Use									
3.A.1 - Enteric Fermentation	CH4	33,311	42,885	36,742	12,247	38,730	0,114	128,741	0,308
3.A.2 - Manure Management	N2O	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
3.A.2 - Manure Management	CH4	2,891	3,479	39,686	13,229	41,833	0,001	120,314	0,002
3.C.1 - Emissions from biomass burning	CH4	14,092	14,528	15,000	5,000	15,811	0,040	103,097	0,160
3.C.1 - Emissions from biomass burning	N2O	5,393	5,560	15,000	0,000	15,000	0,005	103,097	0,023
3.C.2 - Liming	CO2	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
3.C.3 - Urea application	CO2	0,000	0,082	15,000	5,000	15,811	0,000	0,000	0,000
3.C.4 - Direct N2O Emissions from managed soils	N2O	24,564	26,149	15,000	5,000	15,811	0,130	106,454	0,517
3.C.5 - Indirect N2O Emissions from managed soils	N2O	20,249	26,283	15,000	5,000	15,811	0,132	129,801	0,519
3.C.6 - Indirect N2O Emissions from manure management	N2O	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
3.C.7 - Rice cultivations	CH4	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
3.D.1 - Harvested Wood Products	CO2	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
4 - Waste									
4.A - Solid Waste Disposal	CH4	8,444	17,669	0,000	0,000	0,000	0,000	209,239	0,000
4.B - Biological Treatment of Solid Waste	CH4	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000
4.B - Biological Treatment of Solid Waste	N2O	0,000	0,000	0,000	0,000	0,000	0,000	100,000	0,000

Base year for assessment of uncertainty in trend: 1995, Year T: 2010

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Inventory trend in national emissions for year t increase with respect to base year (% of base year)	Uncertainty introduced into the trend in total national emissions (%)
4.C - Incineration and Open Burning of Waste	CO2	0,126	0,286	15,000	5,000	15,811	0,000	226,633	0,000
4.C - Incineration and Open Burning of Waste	CH4	0,988	2,238	15,000	6,000	16,155	0,001	226,633	0,004
4.C - Incineration and Open Burning of Waste	N2O	0,192	0,435	15,000	6,000	16,155	0,000	226,633	0,000
4.D - Wastewater Treatment and Discharge	CH4	13,485	27,049	15,000	6,000	16,155	0,146	200,584	0,552
4.D - Wastewater Treatment and Discharge	N2O	4,635	6,322	15,000	5,000	15,811	0,008	136,387	0,030
5 - Other									
Total									
		Sum(C): 774,632	Sum(D): 1145,228				Sum(H): 25,323		Sum(M): 83,934
							Uncertainty in total inventory: 5,032		Trend uncertainty: 9,162

10. Energy Balance

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Energy Balance: 2000 Unit: tep	Wind energy	Firewood	Total primary energy	Buthane (GLP)	Gasoline	Diesel	Jet-A1	Fuel oil	Petroleum	Electricity	Charcoal	Total secondary energy	Total
Production	1,769	31.805,73	**33,575**									**0**	33,575
Imports			**0**	10,5	7,46	82,541	75,429	13,487	1,283			**190,7**	190,7
Exports			**0**			23,963	68,032	3,981				**95,976**	95,976
Gross domestic supply	1,769	31,806	**33,575**	10,5	7,46	58,578	7,397	9,506	1,283	0		**94,724**	128,299
Transformation - Thermal			**0**			-27,297		-3,872		11,089		**-20,08**	-20,08
Transformation - wind + solar	-1,769		**-1,769**							1,769		**1,769**	0
Transformation – Coal plants		-239,58	**-240**								156	**156**	-83
Losses			**0**							-2,875		**-2,875**	-2,875
Total transformation	-1,769	-240	**-2,009**	0	0	-27,297	0	-3,872	0	9,983	156	**-21,03**	-23,038
Net domestic supply	0	31,566	**31,566**	10,5	7,46	31,281	7,397	5,634	1,283	9,983	156	**73,694**	105,26
Final consumption	0	31,566	**31,566**	10,5	7,46	31,281	7,397	5,634	1,283	9,983	156	**73,694**	105,26
Energy industries			**0**							349		**349**	349
Manufacture and Construction industries	0	948	948	0	0	890	0	5.634	0	1.868	121	8.513	9.461
Water production			**0**					5,634		1,858		**7,492**	7,492
Other		948,09	**948**			890				10,00	120,80	**1,021**	1,969
Transports	0	0	0	0	7,46	30,391	7,397	0	0	0	0	45,248	45,248
Road transport			**0**		7,46	23.603,00						**31,063**	31,063
Sea transport			**0**			6.788,00						**6,788**	6,788
Air transport			**0**				7,397					**7,397**	7,397
Residential		30.618,06	**30,618**	9.486,00					1,283	4,393	35,53	**15,198**	45,816

Energy Balance: 2000 Unit: tep	Wind energy	Firewood	Total primary energy	Buthane (GLP)	Gasoline	Diesel	Jet-A1	Fuel oil	Petroleum	Electricity	Charcoal	Total secondary energy	Total
Commercial - Tourism			**0**	1.014,00						943		**1,957**	1,957
Outher Sectors			**0**							2,43		**2,43**	2,43

Source: National Inventory of GHG Emissions, 2010

Energy Balance: 1995 Unit: tep	Wind energy	Firewood	Total primary energy	Buthane (GLP)	Gasoline	Diesel	Jet-A1	Fuel oil	Petroleum	Electricity	Charcoal	Total secondary energy	Total
Production	2,304	38.927,63	**41,232**									**0**	41,232
Imports			**0**	8,579	6,258	44,183	77,091	11,805	1,669			**149,585**	149,585
Exports			**0**			5,243	71,481	592				**77,316**	77,316
Gross domestic supply	2,304	38,928	**41,232**	8,579	6,258	38,94	5,61	11,213	1,669	0		**72,269**	113,501
Transformation - Thermal			**0**			-14,703		-5,289		4,878		**-15,114**	-15,114
Transformation - wind + solar	-2,304		**-2,304**							2,304		**2,304**	0
Transformation – Coal plants		-293,23	**-293**								191	**191**	-102
Losses			**0**									**0**	0
Total transformation	-2,304	-293	**-2,597**	0	0	-14,703	0	-5,289	0	7,182	191	**-12,619**	-15,216
Net domestic supply	0	38,634	**38,634**	8,579	6,258	24,237	5,61	5,924	1,669	7,182	191	**59,65**	98,285
Final consumption	0	38,634	**38,634**	8,579	6,258	24,237	5,61	5,924	1,669	7,182	191	**59,65**	98,285
Energy industries			**0**							251		**251**	251
Manufacture and Construction industries	0	1.160	1.160	0	0	690	0	5.924	0	1.344	148	8.105	9.266
Water production			**0**					5,924		1,337		**7,261**	7,261

Energy Balance: 1995 **Unit: tep**	**Wind energy**	**Firewood**	**Total primary energy**	**Buthane (GLP)**	**Gasoline**	**Diesel**	**Jet-A1**	**Fuel oil**	**Petroleum**	**Electricity**	**Charcoal**	**Total secondary energy**	**Total**
Other		1.160,39	**1,16**			690				7,19	147,85	**845**	2,005
Transports	0	0	0	0	6,258	23,547	5,61	0	0	0	0	35,415	35,415
Road transport			**0**		6,258	18.287,97						**24,546**	24,546
Sea transport			**0**			5.259,45						**5,259**	5,259
Air transport			**0**				5,61					**5,61**	5,61
Residential		37.474,02	**37,474**	7.750,51					1,669	3,16	43,49	**12,623**	50,097
Commercial - Tourism			**0**	828,49						678		**1,507**	1,507
Outher Sectors			**0**							1,748		**1,748**	1,748

ANNEX III – ABILITY TO REDUCE GHG EMISSIONS

1. Energy: Assumptions of using LEAP software

1.1 Efficient public lighting measures – 3 000 units

The main assumptions used to calculate the emission savings under this measure are:

- Cost of LED lamp: 162 US$
- Cost of sodium lamp: 75 US$
- LED lamp useful life: 50 000 hours
- sodium lamp useful life: 24 000 hours
- Lamp use: 8 hours/da

1.2 Transport measures – Electric automobiles – 500

The main assumptions used to calculate emission savings under this measure are:

• Annual distance traveled 15 000 km
• Investment per vehicle (electric and gasoline): US $ 20,000
• Battery: 40 kWh
• Electric vehicle consumption: 7.8 kWh / km
• Gasoline vehicle consumption: 10 km / l (or 10 liters per 100 km)

This measure considers installing a AQS system with 71m^2, with a 9000-liter reservoir, in 5 services such as hotels, hospitals, public buildings and industry. The data mentioned in the GACMO are obtained from the "*Use of Renewable Energies and Energy Conservation - PART D, PHARE Programme, Investment Options in the Energy Sect*or" report (2003). Updating the main figures with information known from the country it is calculated (GACMO) that this measure saves 27.24 GWh per year in electricity.

1.3 Installation of solar hot water systems in services (hospitals) – 5 units

The main assumptions used to calculate emission savings under this measure are:

- Reference technology: Electric boiler:
- Water use: 9000 liters/day
- Temperature of the water supplied: 28ºC
- Investment in technology: 220 US $/m^2
- System´s annual energy output: 881kWh/m^2
- Electricity used (boiler): 325 GWh/year

No detailed information was found on industrial AQS projects to enhance the data used. However, information from "*Solar Water Heating Systems for Industrial Applications. A Tata BP Solar Initiative, "by Tata BP Solar India Ltd, and Ooshaksaraei et al. (2010)*

"*Large scale solar hot water heating systems for green hospital*" is consistent with the data used.

1.4 Energy transformation measures

The main assumptions used to calculate emission savings under this measure are:

- In wind power production:
  - Investment: 2 750 US$/kW
  - Capacity factor: 2 200 hours (approxim. 25%)
- In solar power production:
  - Investment: 3 000 US$/kW
  - Capacity factor: 2 920 hours (approxim. 33%)
  - Nr. of hours of sunshine: 8 hours
- In transmission network quality improvements:
  - Losses in improved network: 8%
  - Cost of loss reduction: 0,73 M US$/GWh*

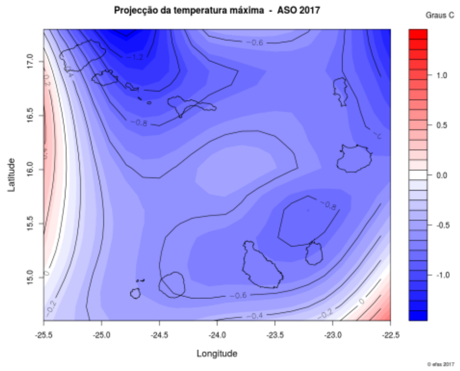
2. Cabo Verde Energy Sector Indicators

Indicator	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Final energy intensity (final energy consumption /GDP/kWh/1.000 ECV	19,83	17,91	14,79	12,48	12,20	12,49	12,34	11,83	11,32	10,93
Final energy consumption per inhabitant (kWh / inhabitant / year)	4120	4132	3776	3477	3390	3504	3651	3516	3396	3268
Consommation annuelle d'énergie (kWh / habitant / year)	399	418	432	438	451	542	491	519	563	556
Electrical intensity (final electricity consumption / GDP kWh /1.000 ECV)	1,92	1,81	1,69	1,57	1,62	1,93	1,66	1,75	1,87	1,86
Firewood / per capita consumption (kg / person / year)	195	193	190	187	185	183	185	186	188	186

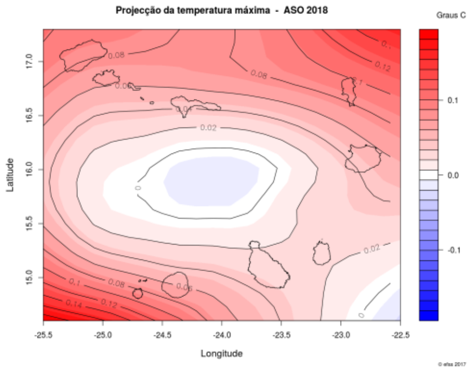
ANNEX IV – CLIMATE CHANGE VULNERABILITY, ADAPTATION and IMPACTS

1. CLIMATE PARAMETERS –Spatial Projections of Maximum, Average and Minimum Temperatures for 2017, 2018, 2019, 2020, 2021, 2022 e 2023

1.1 Projections of maximum temperature (ASO)



a)



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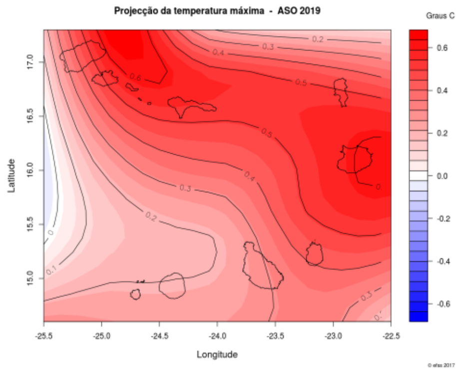

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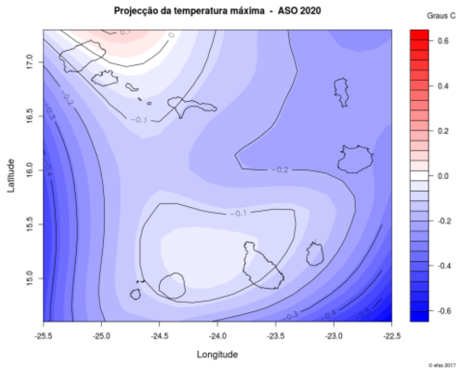

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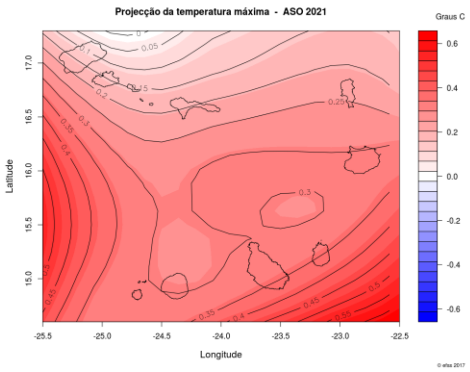
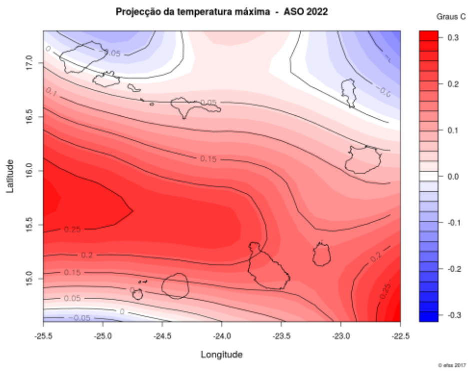


e)



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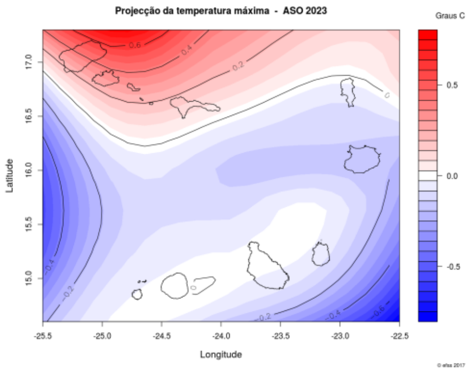

g)

Figure 65: a), b), c), d), e), f) and g) – Projection maps of maximum temperature spatial variability during August, September and October (ASO), for the 2017-2023 period.

Note that the years 2019, 2020, 2021 and 2022 show maximum temperatures slightly above average.

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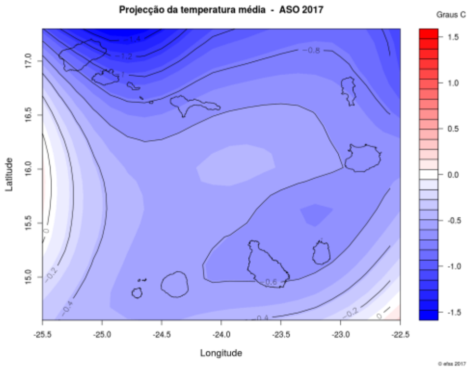
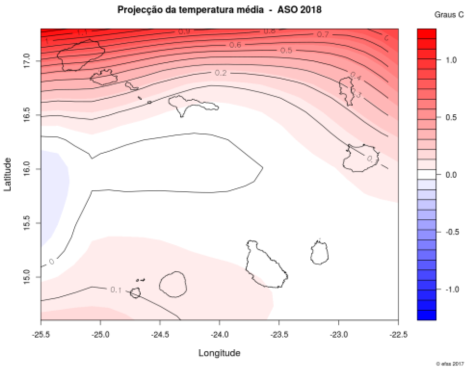
1.2 Projections of average temperature (ASO)



a)



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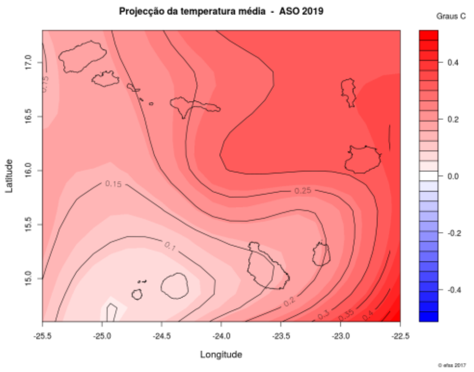

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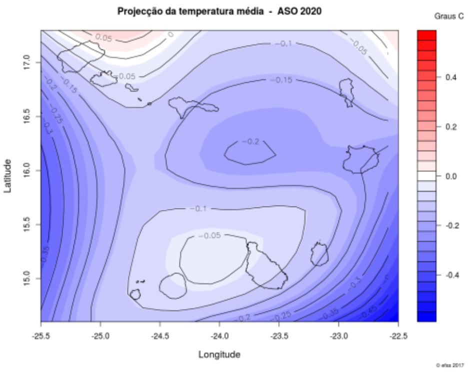

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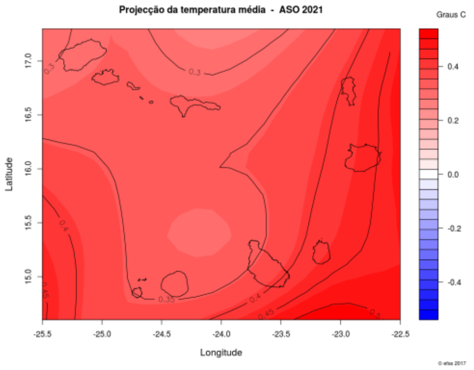

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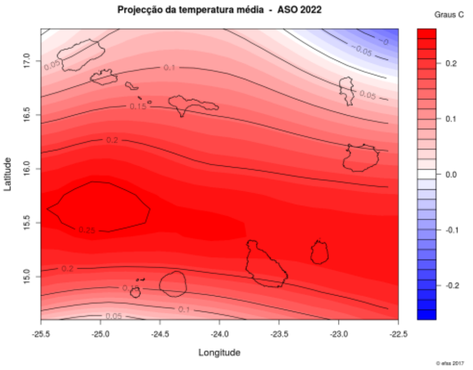

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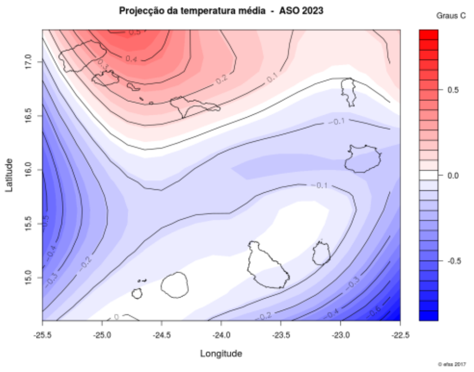
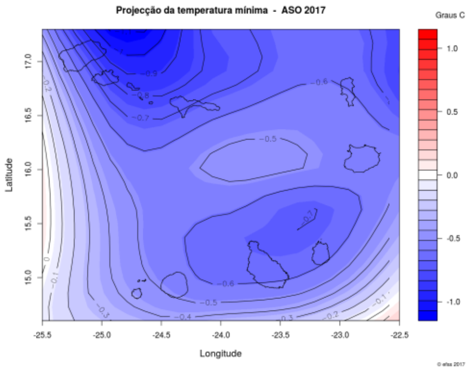


g)

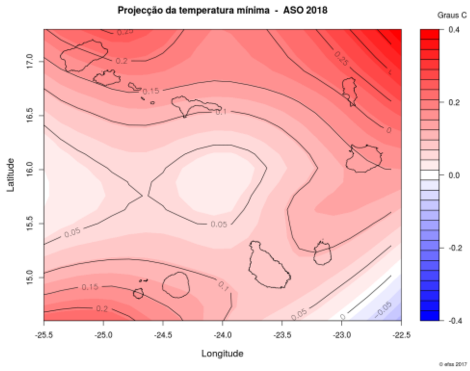
Figure 66: a), b), c), d), e), f) and g) – Projection maps of average temperature spatial variability during August, September and October (ASO), for the 2017-2023 period.

Note there is a slight cooling in 2017 and 2020 throughout the country and in the south in 2021. The remaining years present low positive anomalies.

1.3 Minimum temperature (ASO)



a)



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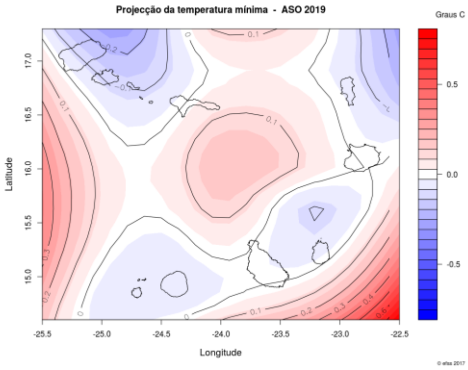

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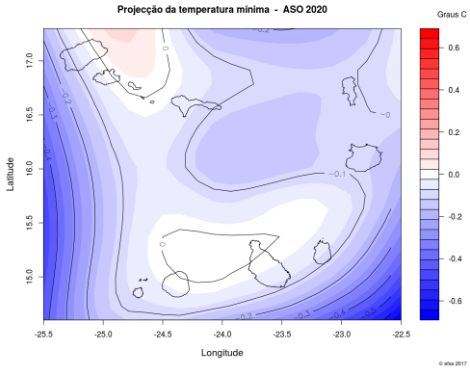

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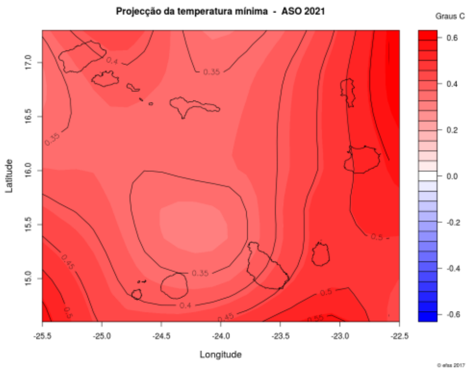

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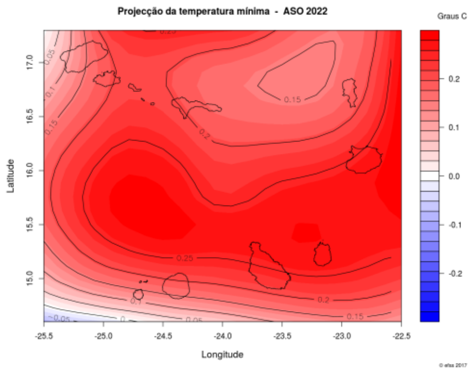

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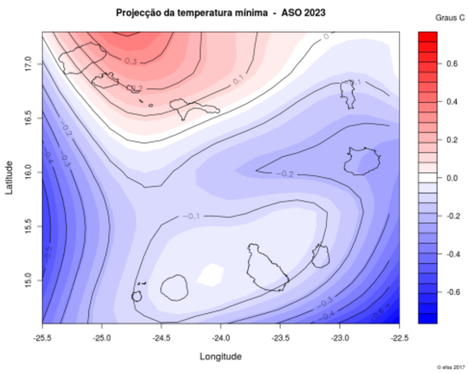
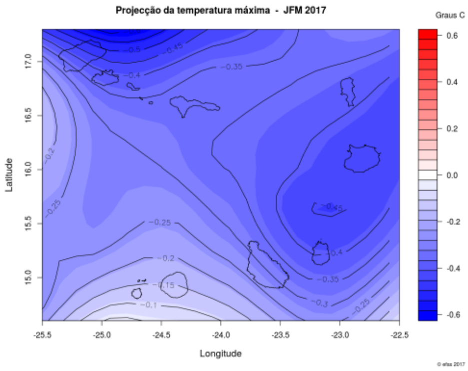


g)

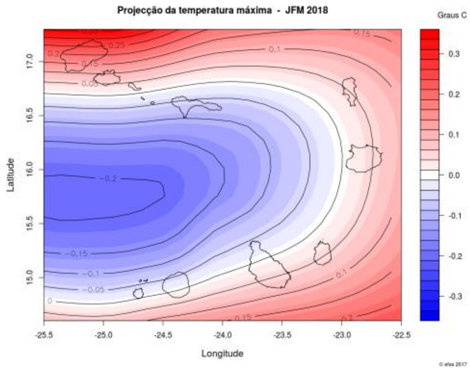
Figure 67: a), b), c), d), e), f) e g) - Projection maps of minimum temperature spatial variability during January, February and March (JFM), for the 2017-2023 period.

Note that 2018, 2020 and 2021 are the hottest years, with positive anomalies between 0,3 and 0,6ºC. The remaining years present negative anomalies.

1.4 Maximum temperature (JFM)



a)



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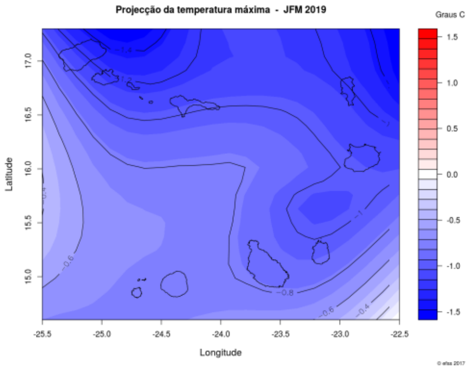

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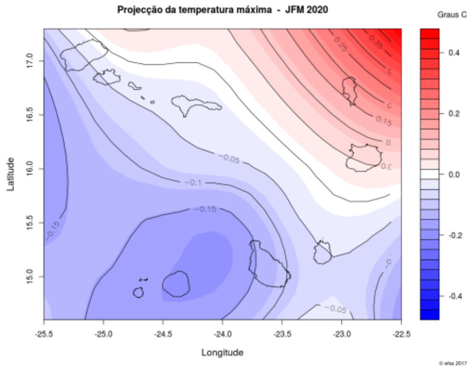

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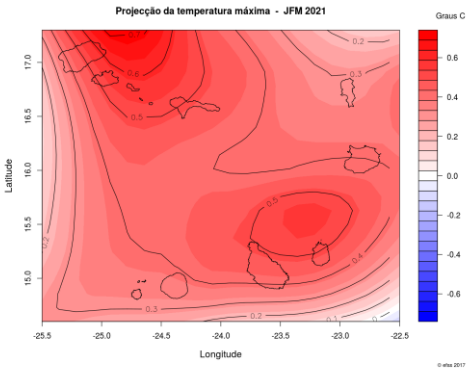

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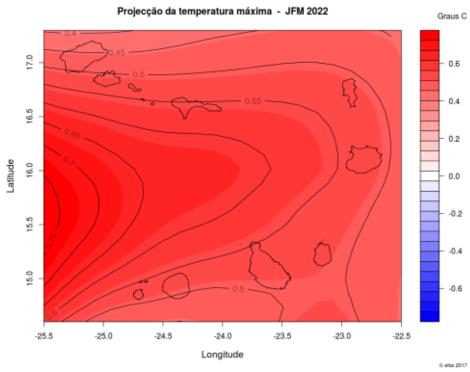

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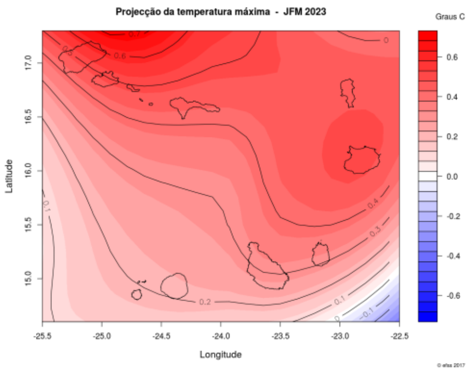
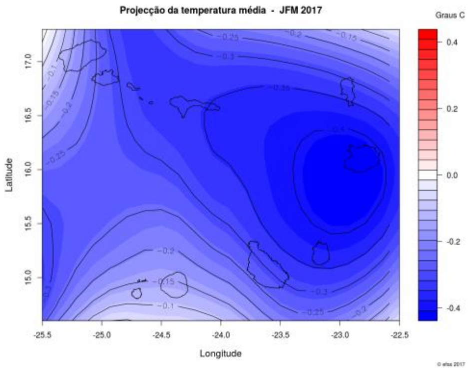


g)

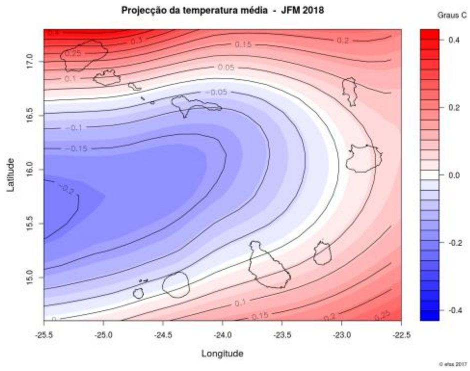
Figure 68: a), b), c), d), e), f) e g) - Projection maps of maximum temperature spatial variability during January, February and March (JFM), for the 2017-2023 period.

Note that 2017, 2010 and 2020 present temperatures slightly below the average, while the remaining years present a slight warming.

1.5 Average temperature (JFM)



a)



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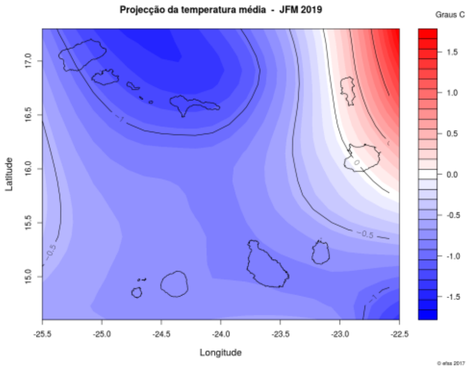

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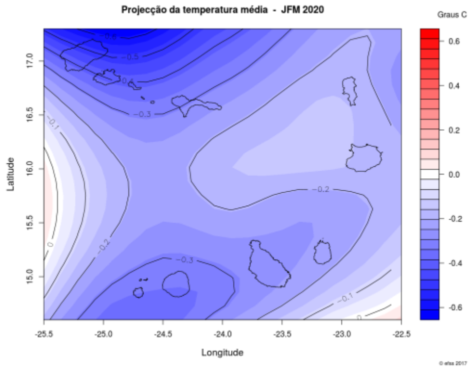
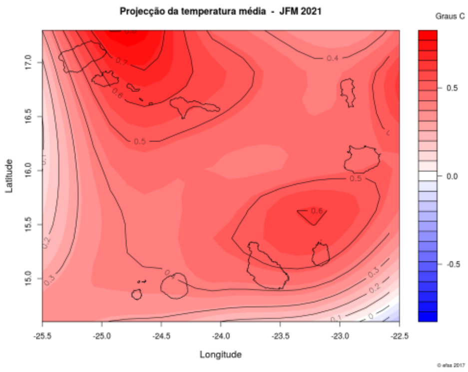


d)



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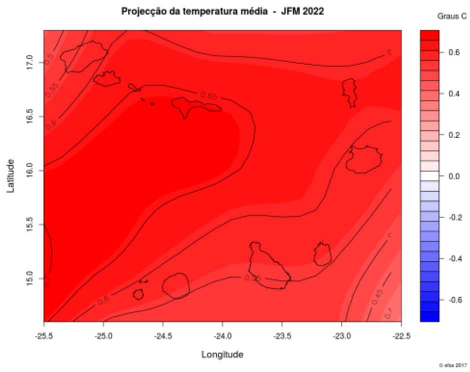
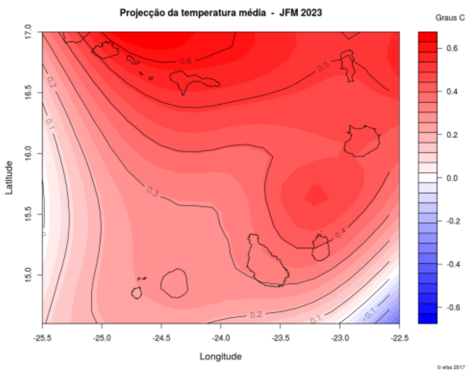


f)

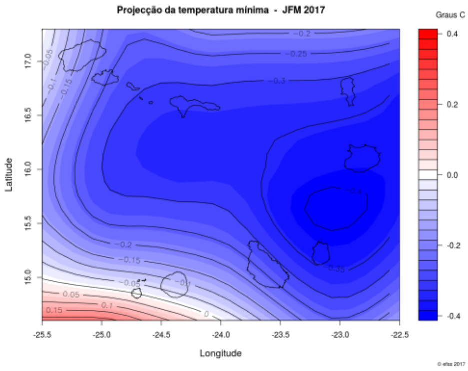


g)

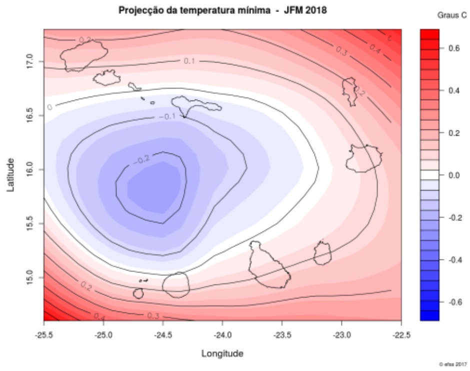
Figure 69: a), b), c), d), e), f) e g) - Projection maps of average temperature spatial variability during , September and October (ASO), for the 2017-2023 period.

Note there´s is a slight cooling in 2017, 2019 and 2020. The remaining years present low positive anomalies.

1.6 Minimum temperature (JFM)



a)



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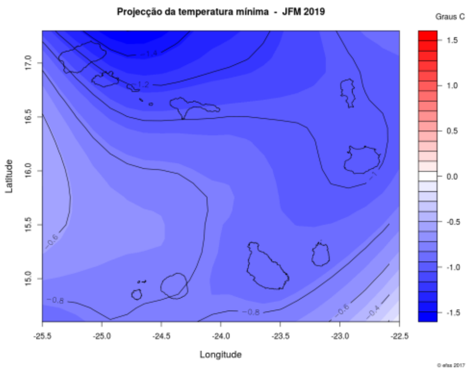
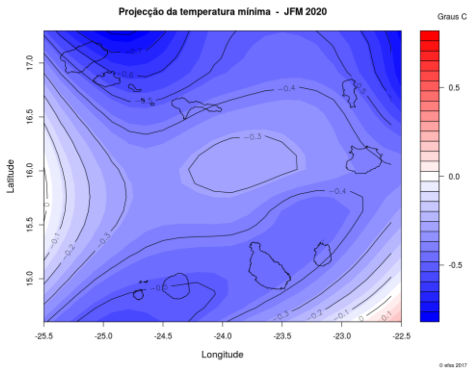


c)



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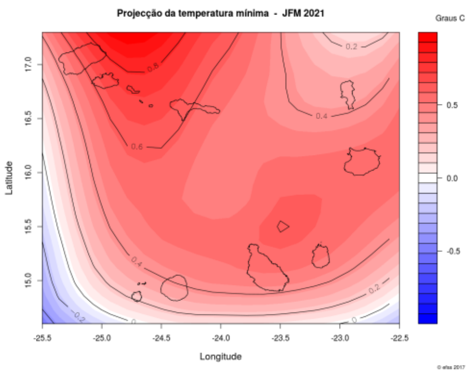
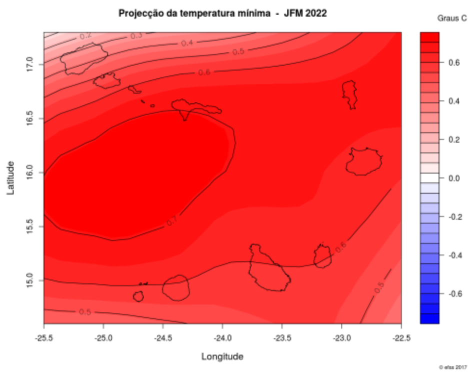


e)



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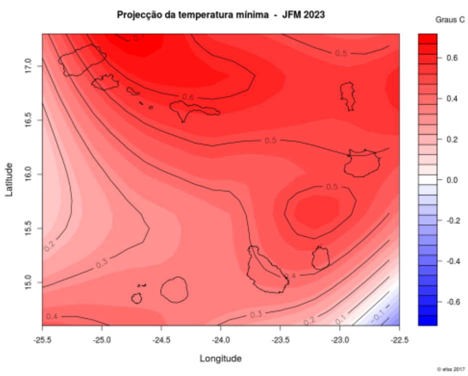

g)

Figure 70: a), b), c), d), e), f) e g) - Projection maps of minimum temperature spatial variability during January, February and March (JFM), for the 2017-2023 period.

Note that 2017, 2019 and 2020 are the coldest years.

2. VULNERABILITIES, ADAPTATION and IMPACTS

1. WATER RESSOURCES

1.1 Summary of potential climate change impacts on the sector

Climatic phenomenon	Impact on Water Resources	Probability of occurrence
Rise in temperature and variation in rainfall pattern	✓ Increase in water vapor content in the atmosphere; ✓ Change in rainfall patterns; ✓ Changes in soil moisture and surface water runoff; ✓ Reduction in surface runoff; ✓ Over-exploitation of wells and holes, often provoking salt water intrusion which is a serious problem due to droughts and excessive pumping of groundwater; ✓ Loss of lives; ✓ Prolonged drought; ✓ Flood risks ✓ Over-exploitation of aquifers; ✓ Decreased rainfall; ✓ Weak recharge of aquifers; ✓ Acceleration of desertification; ✓ Advances and/ or indentation of wetlands; ✓ Variations in hydrographic network patterns and retention capacity of aquifers; ✓ Siltation of streams; ✓ Decline in agricultural production in areas depending exclusively on rainwater; ✓ Rural exodus and consequent illegal construction in flood risk areas and geologically unstable areas; ✓ Population growth, unplanned urban expansion, mismatch between growth and deployment of water supply and sanitation infrastructure	**Likely**
Rising Sea level	✓ Soil and water salt intrusion; ✓ Flooding of lower coastal areas; ✓ Water pollution; ✓ Reduction in quality water availability for various uses; ✓ Reduced food security; ✓ Degradation of water quality; ✓ Extreme weather events; ✓ Floods and damage to infrastructure; ✓ Variations in bioclimatic limits; ✓ Change in CO_2 concentrations that will influence the dissolution processes of carbonates, increasing karsification; ✓ Changes in organic carbon concentrations in soil; ✓ Infiltration properties of aquifers.	**Likely**

1.2 Water Resources in Cabo Verde – Adaptation Measures

Sector	Adaptation Measures
Water Resources	- Increase population resilience through Information, Education and Communication (IEC) campaigns in water and sanitation sector; - Enforce laws and regulations on water resources established in the Water and Sanitation Code; - Implement, follow up and evaluate the Water and Sanitation Master Plans of each island; - Reduce consumption and streamline uses; - Implement more efficient irrigation systems; - Improve access to safe drinking water and basic sanitation; - Introduce energy-efficient pumps in water pumping and sewage system; - Improved wastewater treatment and reuse; - Efficient water use in production processes; - Reduced pollution loads; - Increase and improve water mobilization, distribution and storage infrastructure, and groundwater recharge; - Protection of watersheds through reinforced soil and water conservation techniques; - Improve access to technologies and decision-making forums on climate issues and efficient water resources use; - Improve and control water quality; - Modernize the network for qualitative and quantitative water monitoring; - Increased use of renewable energy sources by the public and private sectors; - Promote the fight against poverty and for equitable social development; - Accelerate rural development; - Promote effective waste management systems that protect water resources and fragile ecosystems and strengthen their resilience to climate change impacts; - Integrate CC mitigation and adaptation components into decision-making and planning; - Create a corroborative research and training network on issues related to climate change in Cabo Verde; - Strengthen human, technical and institutional capacities in climate change field. - Promote research in any areas related to global climate change.

2. AGRICULTURE

2.1 Limitations/constraints in agricultural production

Nature	**Production Systems**	
	Rain-fed	**Irrigated**
Technological (farming practices)	– Weeding with hoe – Monoculture of maize and beans (absence of crop rotation) – Species and varieties not adapted to agro-climatic conditions – Weak crop diversification – Non-use of agricultural inputs such as chemical or organic fertilizers – No maintenance of soil and water conservation structures – Collection and/or burning of crop waste – Weak integration of agriculture / livestock – Poor agro-sylvopastoral integration – Intensive soil use	– Inadequate use of production factors: fertilizers, water, pesticides, seeds – Low efficiency in water use (waste) – Poor crop rotation – Weak crop diversification – Poor use of organic matter – Over-exploitation of irrigation water sources – Predominance of conventional watering (flooding) – Infestation of bio-aggressors – Intensive soil use – Poor crop protection models – Absence/poor post-harvest, processing and agricultural product conservation techniques – Poor quality and conservation of associated products – Weak integration of agriculture/livestock
Socioeconomic and cultural	– Low rainfed based productivity – Low household income – Subsistence agriculture – Poor labor availability – High labor cost – Weak involvement of young people in rainfed agriculture – Poverty and food insecurity in rural areas – Rural exodus – Poor adoption of improved farming practices – Land conflicts: land use	– Low productivity of irrigated crops – Small plots – Low household income – High labor cost – Weak investment in new technologies – Poor level of education and technical ability – Poor appreciation of agricultural products – Difficulty in marketing agricultural products – Inadequate / non-existent agricultural credit arrangements

Nature	Production Systems	
	Rain-fed	Irrigated
	system that hampers investment	
Soil and climatic (natural resources)	– Limitation of expansion of arable land – High rates of water erosion (soil loss) – High rates of surface runoff – Lack of plant cover – Low fertility; – Soil degradation – Cultivation of steep slopes – Poor, erratic and poorly distributed rainfall in space and time – Strong and hot winds	– Expansion limit of irrigated area – Poor availability of water for irrigation – Poor water quality – Degradation of soil fertility – Low organic matter content – Salt intrusion – High evapotranspiration rate – High temperatures
Political-institutional	– Inadequate agricultural policies – Poor training and low level of education of producers – Weak public investment in rainfed agriculture – Poor rural extension service – Deficient research on rainfed production systems	– Resistance of farmers to follow technical guidelines – Insufficient dissemination of new production technologies to producers – Poor research-extension coordination – Poor research in the field of post-harvest, processing and of agricultural product preservation techniques – □ Poor rural extension service

2.2 Policy and action tools integrating climate change in Cabo Verde and related prioritization extent in agriculture

Tool/Measure	Description	CC prioritization in agriculture
Government Program of the IX Legislature (2016-2021)	The Government intends that Cabo Verdean agriculture, as an income generating, prosperity and social recognition sector, respects and protects the environment and evolves from a family farming to a modern and competitive agriculture.	+++
Strategic Plan for Sustainable Development (PEDS) **(2017-2021)**	PEDS is a planning tool describing the country´s macroeconomic, structural and social policies together with sector programs that the Government intends to implement in the country over a 5-year period. It aims to promote a sustainable development of Cabo Verde based on a new economic growth model and focused on improving the quality of life of people. Agriculture is in line with the objective of ensuring economic sustainability, aligning with the Sustainable Development Goals and international commitments such as Paris commitment on climate change and SAMOA commitment on small island states.	++
Low Carbon Strategy (2016)	Under the "Feasibility Study of Low Carbon Development Options" it is intended to provide Cabo Verde with the necessary skills to design, implement, measure, report and verify a low greenhouse gas strategy that is resilient to climate change impacts. In the study agriculture appears as a sector with low energy consumption and low GHG emissions.	++
National Strategy for Food Security (ENSA)	ENSA is an instrument ensuring availability and stability of food supply in central and peripheral markets. It seeks to guarantee sustainable improvement of access conditions to food and basic services in urban and rural environments by 2015, focusing on the most vulnerable people and areas.	++

Tool/Measure	Description	CC prioritization in agriculture
National Strategic Plan for Water and Sanitation - "PLENAS **-2015"**	The plan provides strategic guidance to the different levels of governance, advocating the expansion of water supply for different uses. This objective is aligned with measures to enhance the resource use, reduce losses and promote rainwater harvesting and water reuse.	++
Promotion of Rural Social Economic Opportunities – Climate" (POSER-C, **2016)**	POSER-C aims to increase local incomes, employment, climate change resilience and well-being of the poor in the program areas. The project responds to government priorities in terms of adapting agro-sylvo-pastoral systems to CC effects and improving water resource management.	++++
Building Climate Change Adaptation and Resilience Capacity in the Water Sector"	This project, implemented with UNDP and GEF support, aims to systematically respond to climate disruptions by developing adaptation policies and measures to better manage climate vulnerability and to demonstrate the investments made. The objective is to increase resilience and improve adaptability to address the additional risks posed by climate change in the Cabo Verde water sector, benefiting agriculture.	++++
Second National Action Plan for the Environment (PANA II: 2004-2014)	PANA II is an instrument aimed at providing the country with a strategy that would allow it to promote rational use of natural resources and the sustainable management of economic activities. The tool is an example of a decentralized planning process that provides strategic guidance to address key environmental and social issues in Cabo Verde. NAPA integrates an action plan for the agricultural sector, prioritizing integrated interventions based on research and adoption of agricultural practices and more profitable technologies for rural populations	++++
Santiago Water Supply Project	Funded by the Japanese International Cooperation Agency (JICA), the project aims to meet water demand in several communities on the island of Santiago and includes wells construction and promotion of efficiency in water use and distribution including for agriculture.	++

Tool/Measure	Description	CC prioritization in agriculture
National Program of Action for Adaptation to Climate Change– (NAPA 2008-2012**)**	NAPA sought to identify priority adaptation options according to urgent and immediate needs and concerns of the most vulnerable populations in the face of the adverse effects of climate change and variability. It focused its strategic intervention axes on water resources, agricultural and pastoral activities in coastal areas/tourism.	+++
Grow and Poverty Reduction Strategy - "DECRP I, II e III"	DECRP is a tool developed since 2004 and periodically reassessed with the objective of promoting food security, protecting the environment and inclusive economic growth, with opportunities for all, as a vital fact for reducing poverty and inequality. Cabo Verde has already developed and implemented 3 four-year planning cycles of DECRP. Agriculture is a key sector for achieving the national vision of building an inclusive, just and prosperous country for all.	+++
Agriculture Strategic Development Plan– "PEDA: 2005-2015" **and Action Plans for Agriculture Development– "PADA"**	PEDA establishes strategic guidelines for national agricultural development for the period, aiming at sustainable rural development, based on integrated and participatory valorization of natural resources and strengthening local human and socio-economic resources, according to agro-ecological areas and the river basins as a management unit. In addition, and following PEDA guidelines, the different PADs establish sector guidelines for the agricultural islands, regarding adaptation actions for agriculture.	+++
National Agricultural Investment Plan (PNIA, 2010-2015)	PNIA is an instrument within the ECOWAS Regional Agricultural Investment Program. Its creation was justified by the limited and severe degradation of natural resources in the subregion, and by the need to meet basic subsistence, industrialization and commercialization needs. The next PNIA, which is being developed, will incorporate a climate adaptation dimension, reflecting the strong political commitment to integrating climate into agricultural policies.	+++

Tool/Measure	Description	CC prioritization in agriculture
National Program of Action to Combat Desertification and Mitigate the Effects of Drought (PAN/LCD) **aligned with the UNCCD ten year strategy (MDR, 2015)**	PAN/LCD is a plan to combat desertification and mitigate the effects of drought as one of the dominant components of environmental policy in the country. Adopted in 1998 updated in 2015, the document provides a framework for sustainable land management, aligned with the UNCCD ten-year strategy (2008-2018). The 10-year strategy aims to ensure a common and consistent vision for UNCCD the implementation in the signatory countries to improve their efficiency. It is based on six pillars: increasing production capacity, combating poverty, strengthening democratic management, preserving the environment, participation and social responsibility.	++++
Intended Nationally Determined Contribution of Cabo Verde (INDC – 2015**)**	INDC (2015) was intended to contribute to the process of the 21st Conference of the Parties (COP 21) to the United Nations Convention on Climate Change. The document demonstrates Cabo Verde's continued commitment to sustainable, low-carbon and resilient climate policies and the country's contribution to global efforts to reduce emissions and limit the global average temperature increase of 2° C or 1.5° C above pre-industrial levels. In the agriculture sector, it prioritizes adaptability of agro-sylvo-pastoral production	+++
Strategic plan for the National Agricultural Research System and action plan (PE-SNIA 2017-2024**)**	PE-SNIA is a plan aiming at consolidating and harmonizing national agricultural research priorities with a view to sustainably improving productivity and agricultural markets in Cabo Verde. All research focuses are directly or indirectly linked to CC, including: preservation and sustainable management of soils and water resources; preservation and enhancement of biodiversity and genetic resources; resilience and adaptation to climate change for food and nutrition security; improvement of productivi*ty* and competitiveness of priority sectors; and management of agricultural technological know-how and innovations	++++
Integrated Financial	EIF-CV is a strategy developed in 2013 to	+++

Tool/Measure	Description	CC prioritization in agriculture
Strategy of Cabo Verde, 2013 (EIF-CV)	promote policies for sustainable land management, with the participation of the public and private sectors in order to combat desertification and promote poverty reduction and food security while preserving the country´s natural resources	
National Communication on Climate Change (I and **II** CNMC, **2010)**	The National Communication document describes Cabo Verde's reality in its sustainable development process, its vulnerability issues and possible adaptation, procedures related to GHG the emissions in the different sectors, emission scenarios; it proposes mitigation policies and measures, and assesses the technical and financial needs to develop and implement its National Mitigation Plan.	++++
Integrating Climate Change Risks and Opportunities into the National Development Process and the United Nations Programing (UNDP, 2010)	The UNDP has made CC a global institutional priority and has developed in Cabo Verde the project to train UN country teams and government decision makers to integrate climate change risks and opportunities into their development policy programming. UNDP has developed and implemented a tool entitled "Quality Standards for Integrating Adaptation to Climate Change into Development Programming."	++++
National Strategy and Action Plan on Biodiversity (2014-2030)	The strategy is a guiding document for nature and biodiversity conservation policy, serving as a reference for society and for private institutions and civil society. Its importance for agriculture stems from the fact that land biodiversity is an economically important natural resource supporting agricultural activities	++
White Paper on the Environment - LBEA **(2013)**	It is a document that summarizes the state of natural resource management (land, air, water and biodiversity) and the environment in Cabo Verde. It assesses how intervention agents (eg public sector, private sector, NGOs and civil society), in their interaction with the environment, have been making use of these resources. The LBEA should be updated every 3 years.	+++

2.3 Summary of Potential Climate Change Impacts on Agriculture in Cabo Verde

Climatic phenomenon	Impact on agriculture	Probability of occurrence
– **Days and nights warmer, low temperatures less frequently;** – **High temperatures very frequently;** – **Heat waves and hot periods more frequently.**	– Low crop productivity in already hot environments, impacting rainfed and irrigated systems; – Higher frequency of bio-aggressor infestation (pests, crop diseases and weeds) – Poor crop development due to thermal stress and high evapotranspiration rates; – Loss of water by soil surface evaporation – Increased risk of unintentional fires	Almost certain
Heavy/torrential rains more frequently	– Physical damage to crops – Increased soil erosion and runoffs resulting in soil degradation; – Increased soil leaching; – Loss of soil fertility – Impossibility to cultivate land due to floods; – Loss of agricultural land and land productive capacity; – Sedimentation of soil and water conservation structures, such as large dams and retention dams. *Note: Depleted soils cause increased erosion and reduced productivity*.	Very likely
– **Decreased rainfall and spatiotemporal irregularity:** – **Occurrence of frequent drought** – **Increased areas affected by drought**	– Lower productivity of rainfed and irrigated crops; – Loss of crops; – Rainfed agriculture increasingly uncertain; – Large animal losses; – Reduced wet periods and increased dry period; – Decreased water availability for irrigation; – Increased crop water requirements; – Over-exploitation of the water table;	Very likely

Climatic phenomenon	Impact on agriculture	Probability of occurrence
	– Increased arid and semi-arid areas with damage to wet and sub-humid areas; – Loss of agricultural biodiversity and biomass; – Increased desertification; – Abandonment of agricultural land and increased rural exodus. – Livelihoods increasingly difficult, leading to migration and abandonment of rural communities – Increased food insecurity and dependence on imports of food	
Increased intensity of tropical cyclones with occurrence of: - Strong winds - Flooding	– Physical damage to crops – Extraction of trees – Destruction/damage to agricultural infrastructure: agricultural fields, greenhouses, wells, holes, among others.	Likely
Increase in average sea level and frequency of tides	– Increased soil salinity in coastal areas and downstream of river basins; – Salt water intrusion; – Invasion of salt water into basins; and groundwater; – Salinization of wells and holes; – Increased intensity of coastal erosion; – Destruction of port infrastructure	Likely

2.4 Strategies and Measures for Mitigation and/or Adaptation to Climate Change

Priority strategic axes	Adaptation and/or Mitigation Measures
1. **Adaptation of integrated and sustainable agricultural systems**	– Reinforcement and promotion of **agriculture and livestock integration:** o Mixed production is an agricultural system in which a farmer applies different farming practices together, such as multiple crops and livestock production. For example, association of grain legumes can provide grains for human consumption, forage for animals and nitrogen for soil; while the animals provide manure for organic soil fertilization. o With this, farmers can make the most of the available space to select plants and crop structuring that make best use of light, moisture and soil nutrients. o Other examples of mixed animal systems include chicken and fish breeding where poultry waste serves as fish feed. - Increased adaptive capacity of agro-sylvopastoral production systems to ensure and improve national food production. o Agroforestry and sylvo-pastoral systems simultaneously help protect farmers against climate variability and change and reduce greenhouse gases from the atmosphere because of their high potential for carbon sequestration. o It is an integrated approach to the production of trees, shrubs and herbaceous crops and agricultural and livestock crops in the same space. Crops can be grown together, at the same time, in rotation, or in separate plots when materials of one are used for the benefit of the other. o These systems take advantage of trees for multiple uses: keeping the soil in place; increasing fertility through nitrogen fixation, or bringing minerals from the soil depth to deposit them through falling leaves; and providing shade, building material, food and

Priority strategic axes	Adaptation and/or Mitigation Measures
	energy to humans and animals. – Promotion of short-cycle grain crops (eg lentils, dried beans, chickpeas), and perennial legumes such as congo beans (Cajanus cajan) as environmentally resilient crops that provide highly nutritious foods and nutrients critical to biological ecosystems. The legumes keep a healthy soil, either as part of combination, cover crops or crop rotation. – Promotion/intensification of vegetable and fruit species cultivation in humid zones, by using compensation irrigation. This measure has already been applied in some localities and should be strengthened and reproduced. – Promotion of organic and/or organic farming as a privileged niche. ○ Organic agriculture is a production system that sustains healthy soils, ecosystems and people. It is based on ecological processes, biodiversity and cycles adapted to local conditions, rather than using adverse impact inputs (IFOAM 2009). Organic agriculture combines tradition, shared innovation and science to benefit the environment promoting fair relations and a good quality of life for all involved. – Introduction and promotion of precision agriculture techniques for small-scale agriculture based on technology, planning and management. AP is an integrated information and technology management system based on the concept according to which time and space variability influences crop yields. It aims at more focused management of agricultural production system as a whole. It is represented by these three points that converge in quality results: revolution of management; information technology and value added to production.

Priority strategic axes	Adaptation and/or Mitigation Measures
2. Integrated management and sustainable use of water	– Promotion of alternative water sources for, focusing on: o Rainwater and runoff water harvesting for irrigation, using community tanks, dams, catch dams, road and roof water, fog water; o Treatment and reuse of wastewater in irrigation ✓ ***Improved efficiency of irrigation systems*** focusing on waste reduction ✓ Expansion of more efficient irrigation practices such as drip irrigation; ✓ Demand and irrigation water storage management; ✓ Improvement of well, hole, spring and gallery water mobilization; ✓ Irrigation water quality monitoring to avoid soil degradation and loss of crop productivity.
3. Adequate management of agricultural information	✓ Promotion of knowledge management based on experience sharing and dissemination of information between information producers and users; ✓ Enhanced capacity of stakeholders to use appropriate tools, manage knowledge and technological innovations to ensure information production and dissemination; ✓ Development and dissemination of a good practice guide for adaptation of agriculture to climate change; ✓ Dissemination and ownership of improved production techniques, including: more efficient small-scale irrigation; soil conservation procedures for rural producers; ✓ Establishment of a national soil information system, using modern methods and digital mapping tools. The system a) will allow sustainable management of the land, b) facilitate the inventory, management and conservation of soil and water resources; c) efficient monitoring of land degradation processes;

Priority strategic axes	Adaptation and/or Mitigation Measures
	d) support decision-making in agriculture and the environment.
4. Improved governance, capacity building and awareness in climate change related issues	✓ Improved strategies associated with agro-climatic zoning and stratification of crops; ✓ Improved data collection and modeling capability associated with water and soil management ✓ Strengthened institutional capacity to impose restrictions on land zoning, including the application of impediments to agricultural constructions in risk areas. ✓ Improved data and knowledge to assess impacts, vulnerability and adaptation to MC, as well as costs and benefits, through innovative, user-friendly tools and methods. ✓ Improved institutional, political and financial capacities to adapt and integrate agriculture into national adaptation plans. ✓ Prioritization of actions for disaster risk reduction and management that meet climate change adaptation activities. ✓ Holding of workshops to introduce varieties of more appropriate crops and species to climatic conditions; ✓ Strengthening implementation of the global land partnership as a point of convergence in pursuing healthy soils through the adoption of the sustainable management guide for soils (FAO 2016). ✓ Development of erosion and desertification risk maps, ✓ Flood risk analysis with zoning and flood mitigation actions, ✓ Use of land use models to make agriculture more efficient and less destructive to the environment. ✓ Planning for variability and climate change, including: ✓ A national system for climate monitoring and early warning for farmers, ✓ Seasonal and interannual rainfall forecast; and ✓ A weather-indexed agricultural insurance ✓ Financial incentives and regulations to improve land management, maintain soil carbon content,

Priority strategic axes	Adaptation and/or Mitigation Measures
	efficient fertilizer use and irrigation.
5. Political-institutional Adaptation	✓ Building of national and local capacity to implement integrated and innovative approaches to sustainable and participatory natural resource and biodiversity management, measures to mitigate and adapt to CC and disaster risk. ✓ Reinforcement of adaptive research with regard to: ✓ species and varieties adapted to water stress, heat and pests and diseases; ✓ protected cultivation techniques adapted to the climatic and socio-economic conditions of the country; ✓ improved drip irrigation efficiency. ✓ Promotion of development, transfer and dissemination of appropriate technologies and practices to address climate change in the country as a small SIDS; ✓ Promotion of tools and incentives for climate-smart land, water and biodiversity management; ✓ Improvement of agricultural extension services for adequate technical assistance to farmers, including reinforcement of the rural radios and promotion of school camps for farmers; ✓ Establishment of land use plans and corresponding implementation strategies; ✓ Agricultural funding and microfinance ✓ Payment for ecosystem services provided ✓ Strategic seed reserves

3. BIODIVERSITY

1. Summary of potential climate change impacts on Cabo Verde Biodiversity

Climatic phenomenon	Impact on biodiversity	Probability of occurrence
	• Increased risk of extinction of endangered species • Coral leaching • Increased insect populations (some disease vectors that can be considered a pest for agriculture) • Change in the age of sexual maturity, spawning timing, incubation time, growth and survival of certain fish species • Reduced endemic terrestrial reptiles due to reduction in foraging time and fertility rate • Change in the proportion sea turtles • Decreased sea turtle nesting success on beaches with very high temperatures • Change in prey availability in the marine environment, favoring the distribution of predatory species with direct impact on economically important fish, mammals and turtles. • Change in distribution area of bird species • Changes in distribution intervals of marine mammal species and migration pattern • Changes in migration patterns and spatial distribution of large pelagic fish, such as tuna fish, leading to decreased abundance in the national seas • Changes in the arrival of migratory bird species in wintering sites	
Torrential rains with occurrence of storms	• Damage to coastal ecosystems • Flooding of bird nests on the ground • Destruction of habitat of vulnerable species of birds and reptiles • Destruction of nests of species such as cane bird, red heron, seabirds, sea turtles • Abundance and distribution of prey due to changes in rainfall patterns associated with decreased salinity	**Very likely**
	• Reduced populations and area of distribution of plant	

Climatic phenomenon	Impact on biodiversity	Probability of occurrence
Occurrence of prolonged drought	species, particularly endemic and endangered species that have limited distribution on more humid sites • Change in the nesting cycle of endemic and endangered birds such as red heron, cane bird and shallow calandra • Reduction of bird populations and 1/3 in length of stay in nests in natives, particularly endemics • Reduced wetlands (habitats), wintering sites of most of migratory bird species that arrive in the archipelago	**Very likely**

2. Adaptation measures to mitigate potential climate change impacts on Cabo Verde Biodiversity

Strategic axes	Adaptation measures
Direct management to reduce climate change impacts	• Measures to manage and preserve the most sensitive and vulnerable ecosystems such as mountains, dune systems, wetlands and coastal ecosystems so that species of these sites increase their ability to withstand climate change • Regulation and legislation enforcement on biodiversity conservation, including the law on the protection of endangered flora and fauna (DR no. 7/2002), the law establishing fish stock protection, the law on conservation of turtles • More rigorous implementation of the legal regime of aggregate extraction. • Management of areas invaded by invasive species such as Lantana chamber and Furcrea foetida, which is competing with native vegetation, is fundamental • Control or eradication of cats in areas of importance to nesting birds • Reducing pressures on biodiversity by avoiding the uncontrolled extraction of native plants for uses such as firewood, pasture or even natural medicine • Need to introduce issues related to climate change

	in environmental management documents, particularly protected areas
Promote dispersion of species	• Inclusion of representative of threatened plant species in botanic gardens • Reinforcement of ex situ conservation practices in the same natural climatic conditions (botanical gardens and seed banks of wild species). • Increase of green areas with native species; • Translocation of endemic species of Cabo Verde Alauda razeae to other islands (Santa Luzia) as a measure to increase its population and possibility of survival under adverse conditions
	• Restoration of sensitive species habitats • Inclusion of coral and terrestrial reptile habitats in the protected area network • Minimize degradation of man-threatened habitats
Promote conditions for the normal functioning of ecosystems	• Functions of biodiversity and terrestrial and marine ecosystems are interlinked, eg seabirds play an important role in sea primary productivity
Optimizing biodiversity related sector responses to climate change	• Changes in land use management • Create new forests by native species planting • Reconcile biodiversity needs and energy production • Develop adaptation strategies in different sectors considering the implications for biodiversity at an early stage of planning and seek solutions that are ideal or at least aimed at avoiding negative impacts • Develop more scientific studies relating biodiversity to climate issues taking into account the scenarios for the region/country • Strengthen environmental awareness, particularly on the importance of biodiversity values and necessary measures for its conservation and sustainable use

Continued reduction of pressures not linked to climate change	• Creation of new protected areas, consider regions of sensitive species, namely terrestrial reptiles and birds, and corals • Protection measures for nesting beaches of sea turtles • Reduction of anthropogenic impacts • Integration of biodiversity conservation into other key sector development • Include climate change in protected area and conservation management plans • Improved monitoring of anthropic pressures on species to contribute to mitigating climate change impacts on species

4. FISHERIES

1. Possible Climate Change Impacts

Changes	Negative Impacts on Fisheries
Rising water temperatures	Age of sexual maturity Synchronization of spawning Incubation Time Growth and survival of certain species/decreased abundance of certain species (eg tuna, mackerel etc. ...) Appearance of certain species at certain times of the year/disappearance of other species s
Rising sea levels	Increasing coastal erosion Difference in tidal patterns Flooding and degradation of coastal habitats
Scarce, irregular and intense rains	Abundance and distribution of species Habitat degradation Coastal erosion Destruction of beaches
High winds	Changes in seasonal coastal outcrops Decrease in fishing effort
Changes in ocean currents	Changes migrations of marine species (eg tuna, saw and mackerel Appearance of invasive species Disappearance of certain species Disturbance in the reproduction system
Increase in drought periods	Poor fertilization of coastal areas Availability of nutrients
Ocean Acidification	Coral Bleaching Change of habitat in crustaceans Decreased minimum oxygen zone Disappearance of large pelagics

2. Fisheries Adaptation mesaures

1. **Improve prevention through not only a precautionary approach, but also an ecosystem approach;**
2. Use the field surveys for surveys/endogenous crossing of knowledge with scientific knowledge;
3. **Focus on a national integrated coastal area management strategy;**
4. Increase the adaptability of fishing communities and national activities to climate impacts,
5. **Promote scientific research by raising capacity of research institutes technically and financially;**
6. **Implementation of fisheries management policies and sustainable practices;**
7. Integration of climate change into national development policies, plans and projects
8. **Sensitization of local populations on the impacts of climate change on fisheries.**

5. TOURISM

1. Summary of Adaptation Measure types implemented in Cabo Verde

<table>
<tr><th rowspan="2">Types of adAptation</th><th colspan="2">STRATEGY</th></tr>
<tr><th>Tourism operators</th><th>Government and communities</th></tr>
<tr><td>Technical</td><td>Use rainwater
Use of clean energy;
Environment friendly building structure design</td><td>Construction of reservoirs
Restructuring of water tariffs
Promote standard measures for clean energy use</td></tr>
<tr><td>MANAGEMENT</td><td>Water management and conservation plans
Reduce activities in low seasons
Diversification of products and markets
Diversification in commercial and regional operations;
Redirect customers to less-affected destinations
Develop an warning plan in case of occurrence</td><td>Impact management plans
Sector incentives or subsidies (eg energy)
Implementation of coastal management plans
Drought contingency plan
Public Infrastructure Monitoring Plan
Identification of natural monuments and places of scientific interest for protection purposes - Protected areas
Orderly and organized occupation of the coastline
Construction of longitudinal protection barriers or bridges along the coast to protect infrastructure at risk
Develop a warning plan in case of occurrence
Promote planning and monitoring of tourism activity
Small activities and measures to convert people using coastal resources for livelihoods</td></tr>
</table>

POLICIES	• Warranty insurance for cyclones and hurricanes • Comply with regulations (eg building code) • Enforcement of legislation	• Coastal Zone Surveillance • Adoption of international certification measures and standards for GHG reduction • Research on climate change, sustainability and ecosystems • Implementation of legislation on the extraction of aggregates in coastal areas • Legislation and conservation of biodiversity
EDUCATION	Water conservation education for employees and partners Training of citizens, partners on the risks of natural disasters	• Awareness building on water conservation • Campaigns on the dangers of ultraviolet radiation • Introduction of environmental and natural risk issues in school curricula at different levels of education, from primary to college
BEHAVIOR	• Participations and provision of data	• Climate Change Communication and Marketing Plan and recovery plan from extreme events (drought, cyclone, volcanic eruption and others)

Source: adapted WMO (2008)

6. ENERGY

1. Energy: Overview of all measures

Axis	Nr	Measures	Expected impact
1. Promotion of energy Efficiency of Appliances and Equipment	1.1	Energy Labeling and Standards for Equipment and Appliances	Definition of clear rules of energy efficiency for appliances and equipment; More efficient appliances; Families and businesses informed and sensitized to appliances and equipment energy efficiency
	1.2	Development of mechanisms to encourage the removal of inefficient devices and equipment	Improved sector planning; Shared vision of the future; Trust of consumers and investors. Definition of clear rules of energy efficiency for appliances and equipment; More efficient appliances; Families and companies informed and sensitized to the energy efficiency of appliances and equipment
	1.3	Regulation for Projects of Air Conditioning Installation Equipment	Conscious consumers of the benefits and gains of using efficient equipment; Elimination of inefficient equipment and device use; Removal of incandescent light lamp use by 2020 Availability of qualified and certified designers and installers; Substantial energy consumption reduction in air conditioning
	1.4	Regulation for Projects and Installation of Industrial Equipment	Availability of qualified and certified designers and installers Substantial energy consumption reduction in the Industry sector.
			Availability of a registry system for

Axis	Nr	Measures	Expected impact
	1.5	Creation log System for Equipment and Appliances entering the country	appliances and equipment typology in use in the country; Control of appliances and equipment entering the country.
2. Energy efficiency promotion in buildings		Development of a New Building Code System of Energy Certification and Comfort in Buildings Demonstration of Efficiency Solutions in Public Buildings	Improvement of thermal comfort in buildings; Reduction of energy consumption in air conditioning; Reduction of energy consumption in lighting; Improvement of construction quality and sustainability of buildings. Improvement of use conditions of buildings; Availability of information on energy performance of buildings; Reduction of energy consumption in buildings Reduction of energy consumption in selected buildings; Availability of practical examples of implementing energy efficiency measures.
3. Promotion of energy efficiency in intensive energy consumers		Law for Energy Efficiency of Intensive energy consumers Creation and Promotion of an Energy cost reduction seal	Improved consumer awareness of energy efficiency; Consumption reduction of the most relevant consumers. Encouraging energy consumption reduction; Availability of a green promotion mechanism

Axis	Nr	Measures	Expected impact
4. Promotion of energy efficiency in electricity distribution		Detailed study of the Operating Conditions of the Electricity Transmission and Distribution Network Modernization and Reinforcement of the Electricity Transmission and Distribution Network Development of a Network Management System Efficiency in public lighting Program to combat fraud and illegal connections	Detailed and in-depth knowledge of the Operating Conditions of the Electricity Transmission and Distribution Network; Availability of dynamic network models; Knowledge of distribution losses and underlying causes. Improved electricity transmission and distribution network; Reduction of technical losses; Reduction of commercial losses; Higher quality of electricity distributed Improved electricity transmission and distribution network; Reduction of losses; Better management of the energy flow in the network; Enhanced penetration of renewable energy sources in the network; Higher quality of electricity distributed. Improvement in provision of public lighting service; Improved access to public lighting; Loss reduction; Reduction of energy consumption in public lighting. Increased collection rate; Non-technical loss reduction

Axis	Nr	Measures	Expected impact
5. Promotion of efficiency in cooking		Establishment of a multisector implementation support team Definition of funding models Program to Promote Access to Modern Energy Forms for Cooking Monitoring and evaluation Improved biomass supply chain	Creation of a dialogue channel with the beneficiaries of the measures Creation of a multi-sector and multidisciplinary dialogue forum on access to energy for cooking; Availability of shared solutions and, therefore, with improved possibility of acceptance by families. Availability of sustainable funding solutions of access to energy for cooking Improving access to energy for cooking Availability of information on the implementation of access to energy for cooking; Possibility of process correction; Continued support for beneficiary families. Streamline forest exploitation; Strengthening of controls on firewood exploitation and trade; Identification and characterization of conflicts between competitive uses of forest resources and implementation of measures that encourage participatory forest management and the introduction of forest regulations.

Axis	Nr	Measures	Expected impact
6. Capacity building initiatives		Creation of a Post-Graduation and Specialization in Energy Creation of short term specialized training course Establishment of energy research centers	Availability of advanced training in energy, renewable energy and energy efficiency; Availability of specialists in various areas related to the energy sector and energy efficiency. Availability of information and expertise; Constant updating opportunity for energy professionals; More qualified professionals. Promotion of research and innovation; Availability of information and expertise to enable innovative solutions adapted to the country´s conditions, as well as knowledge exports.

Axis	Nr	Measures	Expected impact
7. Information and awareness raising initiatives		Establishment Energy Efficiency Day Integration of Renewable Energy and Energy Efficiency in School Manuals Integration of the Biomass Consumption, Health, Family and Gender Issues in School Manuals Creation and Periodic Broadcasting of Television Documentaries and Spots, Brochures, Posters and Other Communication Tools Design and Promotion of a Website with Information on Renewable Energy and Energy Efficiency	Sensitization of the population to Energy Efficiency; Dissemination of information on Energy Efficiency Teaching the benefits and processes of renewable energy and energy efficiency; Education on renewable energy and energy efficiency and its internalization in school age. Teaching problems related to firewood use; Teaching modern and safe forms of cooking; Population sensitized regarding health and gender issues in energy consumption. Population sensitized regarding renewable energy and energy efficiency; Informed population about the opportunities of renewable energy and energy efficiency. Availability of targeted information on renewable energy and energy efficiency; Population implements renewable energy and energy efficiency measures.

Axis	Nr	Measures	Expected impact
8. Transparency and support to decision-making		Energy information system Energy information assessment system Planning and prospection	Availability of detailed information on the energy sector, renewable energy and energy efficiency; Availability of official data on the energy sector, renewable energy and energy efficiency; Availability of a general and sector overview of the energy sector, renewable energy and energy efficiency. Availability of detailed and specific information on the energy sector, renewable energy and energy efficiency; Availability of sector and thematic overview on the energy sector, renewable energy and energy efficiency. Availability of up-to-date plans for the energy sector and energy efficiency; Availability of information on new technologies and new measures for the energy sector, renewable energy and energy efficiency; Availability of information on the path set for the energy sector, renewable energy and energy efficiency.

Source: PNAER/PNAEE, SE4ALL/ECREEE/DNEIC

ANNEX V – COUNTRY ORGANIZATION ON CLIMATE CHANGE

Table - Structure of Strategic Dimensions

Strategic dimension	Actions
Research & Innovation	Promote signing of cooperation protocols between national and international scientific institutions and the bodies involved in the implementation of the Strategy; Support the participation of Cabo Verdean researchers in national and international projects on climate change issues; Develop a national agenda for research, innovation and demonstration priorities in climate change field, including the development of a national thematic research program, including the definition, launch and evaluation of calls for proposals for research in this area; Promote linkage and participation of the stakeholders in international networks related to research and innovation in climate change field Promote internalization in knowledge and innovation progress of stakeholders with intervention in of climate change field.
Funding & Implementation	Promote the establishment of a single sub-regional agency for Climate Financial Resource Mobilization, based in Cabo Verde; Support in the preparation and submission of proposals for adaptation and mitigation projects to international donors;
	Establish a set of selection criteria for climate change projects requiring a bilateral partnership with the country's main development partners as a multi-country focused agency; Develop adequate accountability mechanisms, complying with international climate adaptation obligations ;

Strategic dimension	Actions
International Partnerships	Ensure the supervision of the Ministry of Foreign Affairs and the National Directorate for Planning through active participation and permanent dialogue in order to ensure consistency with cooperation policies and international commitments assumed by the country; Establish a cooperation platform with ECOWAS countries, focusing on adapting climate change effects, supporting the coordination of adaptation strategies at Member State level, fostering integrated intervention and streamlining current mechanisms for natural resource management in the subregion; Promote the establishment of a Regional Executive Secretariat (ECOWAS) to address of Climate Change issues; Streamline a national agenda of investment needs and priorities in climate change; Collaborate with international networks with a focus on adapting to climate change by promoting knowledge exchange and establishing project development partnerships; Participate in active cooperation policies in the field of climate change by promoting exchange of knowledge, technology and good practices with other regional and international entities and institutions; Support the accountability process of national cooperation activities in the field of climate change.

Strategic dimension	Actions
Integration of Climate Change in Sector Plans and Programs	Integrate climate change indicators into sectoral policies; Integrate indicators related to Climate Change into local planning tools (Municipal Master Plans, Urban Plans, Annual Activity Plans, Municipal Budget); Contribute to Thematic Area work; Identify impacts, vulnerabilities and measures in the field of climate change in your sector; Identify needs for capacity building and knowledge at the technical level; Establish capacity building institutions for locally elected representatives in the field of Climate Change; Promote sector studies, identify funding sources and monitoring mechanisms; Prepare activity plan and report; Promote the establishment of Regional Research and Development Center based in Cabo Verde, involving the main universities and research centers in ECOWAS countries;
Communication and Awareness Raising (National Platform for Climate Change)	Institute systematization and dissemination of scientific knowledge in climate change field through a permanent and regular forum for the exchange of knowledge in the field; Develop a National Communication Platform on climate change that centralizes information, progress, and stakeholder interaction in climate change in Cabo Verde, taking into account a possible link to similar platforms in other parts of the world; Provide the general public with the necessary climate information and decision support tools in the field of climate change in public and private sectors; Adopt communication plans to raise public awareness on climate change.