
# REPUBLIC OF NAMIBIA

# Third Biennial Update Report (BUR3) to the United Nations Framework Convention on Climate Change

**2018**


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# Foreword

On behalf of the Government of the Republic of Namibia, it is an honour and privilege for me to present Namibia's Third Biennial Update Report (BUR3) in fulfilment of its obligations as a Non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC) in accordance with the enhanced reporting requirements adopted at the 16th and 17th Conference of the Parties (COP).

Namibia ratified the UNFCCC in 1995 and thus became obligated to prepare and submit national communications. Namibia was also one of the first countries to ratify to the Paris Agreement in 2016. As a signatory to the Convention, Namibia has prepared and submitted three National Communications and two Biennial Update Reports (BURs), namely: The Initial National Communication (INC) in 2002; the Second National Communication (SNC) in 2011; the first BUR in 2014 (BUR1), the Third National Communication (TNC) in 2015 and the second Biennial Update Report (BUR2) in 2016. Furthermore, Namibia prepared and submitted its Nationally Determined Contributions (NDC) in 2015. Namibia is also currently busy with its Fourth National Communication (NC4) which will be submitted to the UNFCCC in 2019.

Namibia became the first Non-Annex I party to prepare and submit a Biennial Update Report at COP 20. It followed also by being the first country to submit its BUR2 in 2016 making it one of the countries who has been so far compliant in terms of enhanced reporting obligations. Namibia also submitted two stand-alone National Greenhous Gas Inventory (GHG) Reports (NIR) covering the period 2000 to 2012 in 2016. The BUR3 will provide on the national Greenhouse Gas (GHG) inventory for the period 1994 to 2014, mitigation actions and their effects, including the associated domestic Monitoring, Reporting and Verification (MRV), and needs and support received, and institutional arrangements. Namibia is one of the first countries to have gone through the first round of the International Consultation Analysis (ICA) process of its first BUR and also the second round on its BUR2.

At the national level, Namibia has made numerous strides to further engage itself to play its role in fighting climate change as outlined in the NDC. In 2014, the Cabinet of the Republic of Namibia approved the National Climate Change Strategy and Action Plan (NCCSAP). The NCCSAP, which is currently under implementation, aims at facilitating the realisation of the National Climate Change Policy (NCCP), which was passed in 2011. The strategy adopted in the document is cross-sectoral and will be implemented up to the year 2020 and it covers the thematic areas mitigation, adaptation and related cross cutting issues. The strategy is currently undergoing its mid-term review.

**Hon. Pohamba Shifeta**

**Minister of Environment and Tourism**

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- City councils and municipalities
- NamCor
- TransNamib Holdings Ltd
- Namibia Airports Company
- Petroleum products dealers
- Namport
- AGRA
- Electricity Control Board
- Meatco Namibia

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# Abbreviations and Acronyms

| Acronym | Definition |
|---|---|
| °C | degree Celsius |
| AD | Activity Data |
| AFOLU | Agriculture, Forest and Other Land Use |
| AIDS | Acquired Immune Deficiency Syndrome |
| ALU | Agriculture and Land Use National Greenhouse Gas Inventory Software |
| AR | Assessment Report |
| BAU | Business as usual |
| Bm | Biomass |
| BUR | Biennial Update Report |
| C | Carbon |
| CBS | Central Bureau of Statistics |
| CBO | Community Based Organisation |
| CCSAP | Climate Change Strategy and Action Plan |
| CCU | Climate Change Unit |
| CDC | Centre for Disease Control and Prevention |
| $CH_4$ | Methane |
| CNG | Compressed Natural Gas |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2$-eq | carbon dioxide equivalent |
| COP | Conference of Parties |
| CS | Country-specific |
| CSIR | Council for Scientific and Industrial Research |
| CSO | Civil Society Organisation |
| DE | Digestible Energy |
| DEA | Department of Environmental Affairs |
| DoF | Directorate of Forestry |
| DRFN | Desert Research Foundation Namibia |
| ECB | Electricity Control Board |
| EF | Emission Factor |
| EMEP | European Monitoring and Evaluation Program |
| ESKOM | Electricity Supply Commission |
| FANRPAN | Food, Agriculture and Natural Resources Policy Analysis Network |
| FAO | Food and Agricultural Organisation |
| FOLU | Forestry and Other Land Use |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| Gg | Gigagram |
| GHG | GreenHouse Gas |
| GPG | Good Practice Guidance |

| | |
|---|---|
| GRN | Government of the Republic of Namibia |
| GVM | Gross Vehicle Mass |
| GWH | Gigawatt Hour |
| GWP | Global Warming Potential |
| ha | Hectare |
| HFCs | hydrofluorocarbons |
| HIV | Human Immunodeficiency Virus |
| INC | Initial National Communication |
| INDC | Intended Nationally Determined Contribution |
| IPCC | Intergovernmental Panel on Climate Change |
| IPPU | Industrial Processes and Product Use |
| ITCZ | Inter-Tropical Convergence Zone |
| Iv | Biomass growth increment |
| IWRM | Integrated Water Resources Management |
| KCA | Key Category Analysis |
| km | kilometre |
| LPG | Liquefied Petroleum Gas. |
| m | metre |
| M&E | Monitoring and Evaluation |
| m/s | metre per second |
| mamsl | metre above mean sea level |
| MET | Ministry of Environment and Tourism |
| mm | millimeter |
| MoU | Memorandum of Understanding |
| MRV | Measuring, Reporting and Verification |
| MSW | Municipal Solid Waste |
| MW | MegaWatt |
| MWG | Mitigation Working Group |
| N$ | Namibian dollar |
| $N_2O$ | Nitrous oxide |
| NAFIN | National Alliance for Improved Nutrition |
| NAMA | Nationally Appropriate Mitigation Action |
| NAMPHIA | Namibia Population-based HIV Impact Assessment |
| NAMREP | Namibian Renewable Energy Programme |
| NAP | National Agricultural Policy |
| NATIS | A subdivision of the Transport Information and Regulatory Services of the Namibian Road Authority |
| NC | National Communication |
| NCCC | National Climate Change Committee |
| NDP | National Development Plan |
| NEEP | Namibia Energy Efficiency Programme |
| NEI | Namibia Energy Institute |
| NGO | Non-Governmental Organization |
| NHIES | Namibia Household Income & Expenditure Survey |

| | |
|---|---|
| NIDS | Namibia Inter-censal Demographic Survey |
| NIIP | National Inventory Improvement Plan |
| NIR | National Inventory Report |
| NIRP | National Integrated Resource Plan |
| NMVOC | Non-Methane Volatile Organic Compound |
| $NO_x$ | nitrogen oxides |
| NPC | National Planning Commission |
| NSA | Namibia Statistics Agency |
| NVDCP | National Vector-Born Disease Control Program |
| ODS | Ozone Depleting Substances |
| OGEMP | Off Grid Energy Master Plan |
| OPM | Office of the Prime Minister |
| PA | Paris Agreement |
| PFCs | Perfluorocarbons |
| QA | Quality Assurance |
| QC | Quality Control |
| REDD(+) | Reducing Emissions from Deforestation and Degradation |
| REEEI | Renewable Energy & Energy Efficiency Institute |
| SADC | Southern Africa Development Community |
| SAPP | South African Power Pool |
| $SF_6$ | sulphur hexafluoride |
| SME | Small and Medium Enterprises |
| SNC | Second National Communication |
| $SO_2$ | Sulphur dioxide |
| t | Tonne |
| TJ | Terajoule |
| TNC | Third national Communication |
| UN | United Nations |
| UNAM | University of Namibia |
| UNDP | United Nations Development Program |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNICEF | United Nations International Children's Emergency Fund |
| US-EPA | United States Environmental Protection Agency |
| USD | United States Dollar |
| WHO | World Health Organization |
| WMO | World Meteorological Organization |
| WTTC | World Travel & Tourism Council |
| ZESCO | Zambia Electricity Supply Corporation |

# Executive Summary

## ES 1. National Circumstances

### Introduction

Vision 2030, the document which guides Namibia's long-term development, aims at a high and sustained economic growth to create employment and move the country towards increased income equality. The current Fifth National Development Plan (NDP5), running over the period 2017/18 to 2021/22, translates this vision into strategies and plans for implementation. The objective of the vision is to have a prosperous and industrialized Namibia, developed by its human resources, enjoying peace, harmony and political stability. The NDP5 rests on four pillars, Economic Progression, Social Transformation, Environmental Sustainability and Good Governance. Climate Change is one out of two of the areas to be addressed under Environmental Sustainability.

### Convention Obligations

Namibia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 as a Non-Annex 1 Party, and as such, is obliged to report certain elements of information in accordance with Article 4, paragraph 1 of the Convention. Namibia also became a Party to the Paris Agreement fter its ratification in 2016. In order to meet its reporting obligations, Namibia has submitted two national communications (NCs); the initial national communication in 2002, the second national communication in 2011 and the third in 2015. In line with decision 2/CP.17, Namibia submitted its BUR1 in 2014, the BUR2 in 2016 and the present BUR3 will be submitted during the next COP meeting. As well, the INDC was presented in 2015.

### Institutional arrangements

The Cabinet of Namibia is the Government entity entrusted with the overall responsibility for the development of Policies, including those on Climate Change. The National Climate Change Committee (NCCC) oversees the implementation of the climate change policy, including the preparation of the reports for submission to the Convention and plays an advisory role to Government on climate change issues. It comprises representatives of the various ministries and other stakeholders such as the private sector and NGOs amongst others. MET, the official government agency acting as national focal point of the Convention, is responsible for coordinating and implementing climate change activities, including the preparation of both the National Communications and Biennial Update Reports to enable the country to meet its reporting obligations. This is done through the Climate Change Unit (CCU) established within the DEA. Being a formalized and multi-sectoral committee, the NCCC advises and guides the CCU for sector-specific and cross-sector implementation and coordination of climate change activities.

### Population profile

According to Namibia 2011 Population and Housing Census (Main Report) (NPHC, 2011), the total population of Namibia was estimated at 2,113,077 people. Woman outnumbered man with 1 091 165, compared to 1 021 912. The age composition of the Namibia population indicates that, 14 % of the population was under 5 years, 23 % between the ages of 5 and 14, 57 % between the ages of 15 – 59 years, and only 7 % is 60 years and above. In 2011, a total of 43 % of Namibia's population lived in urban areas, while 57 % of the population lived in rural areas. The intercensal population growth rate between 2001 and 2011 was 1.4 % compared to 2.6 % between 1991 –2001. The annual growth rate for urban areas was (5.0 %) which is much higher than the national rate. There was, however, a negative growth rate (- 0.1 %) in rural areas due to high migration to urban areas. (NPHC, 2011).

## Geographic profile

The Republic of Namibia is situated in the south-western region of the African continent and lies between latitude 17° and 29°S and longitude 11° and 26°E. The country covers a land area of 825,418 $km^2$ and has a coastline 1500 km long on the South Atlantic Ocean. Namibia shares borders with Angola in the North, Zambia in the north-east, Botswana in the east and South Africa in the south. Namibia consists of five geographical areas, namely, the central plateau, the Namib Desert, the Great Escarpment, the Bushveld and the Kalahari Desert.

Land cover and use is very diverse in Namibia. Apart from a substantial area being covered by the Namib Desert, there are vast expanses of Grasslands, itself sub-categorized into pure grassland, shrubland and savannahs. There are still forest areas sub-divided into Forestland and Woodland. The remainder of the territory is classified as Cropland, Wetlands and Settlement areas.

In spite of its very dry climate, Namibia holds a remarkable variety of species, habitats and ecosystems ranging from deserts to subtropical wetlands and savannas. Namibia is one of the very few countries in Africa with internationally-recognized "biodiversity hotspot". Namibia's most significant "biodiversity hotspot" is the Sperrgebiet, which is the restricted diamond mining area in the Succulent Karoo floral kingdom, shared with South Africa. The Succulent Karoo is the world's only arid hotspot. It constitutes a refuge for an exceptional level of succulent plant diversity, shaped by the winter rainfall and fog of the southern Namib Desert. A large portion of its plants is endemic (MET, 2001).

## Climate profile

Namibia is one of the biggest and driest countries in sub-Saharan Africa. It is characterized by high climatic variability in the form of persistent droughts, unpredictable and variable rainfall patterns, variability in temperatures and scarcity of water. Rainfall ranges from an average of 25 mm in the west to over 600 mm in the northeast. From a hydrological point of view, Namibia is an arid, water deficit country. High solar radiation, low humidity and high temperature lead to very high evaporation rates, which vary between 3800 mm per annum in the south to 2600 mm per annum in the north. Over most of the country, potential evaporation is at least five times greater than average rainfall. The lowest temperatures occur during the dry season months of June to August. Mean monthly minimum temperatures do not, on average, fall below 0°C

## Economic profile

According to the National Accounts compiled by NSA for 2015, the domestic economy has slowed down in 2015 recording a growth of 5.3 % in real value as compared to 6.5 % in 2014. This decline was mainly attributable to the primary industries that recorded a contraction of 3.2 %. Furthermore, the secondary and tertiary industries recorded growth rates of 8.3 % and 5.4 % compared to 9.5 % and 7.7 % in 2014, respectively. The main contributor to national GDP was the tertiary industries (58.3 %) followed by the primary industries with 18.7 % and the secondary industries with 15.8 % (NSA, Annual National Accounts-2015). GDP at current prices amounted to N$ 146 619 million in 2015 compared to N$ 139 500 million in 2014. At constant 2010 prices, the GDP was N$ 108 010million compared to N$ 102 578 million in 2014.

## Energy

The most dominant energy source in Namibia is liquid fuel which includes petrol and diesel and accounts for about 63 % of total net energy consumption which is mainly used in the transport sector, followed by electricity with 17 % net consumption, coal with 5 % and the remaining 15 % from other sources of energy such as solar, wood and wind energy among others.

Currently, Namibia's electricity demand stands at 597 MW, and grows at an annual energy consumption rate of 3 %. On the supply side, Namibia has currently only 3 major power generation stations, with an installed capacity of about 500 MW. The biggest one is the Ruacana Hydro Power station which generates about 332 MW of electricity, Van Eck Coal power station generates about 120 MW and the Paratus and Anixas diesel power stations at the coast with 24 MW and 22.5 MW respectively (Konrad *et al*., 2013). The local supply does not meet the demand. Currently, Namibia imports most of this difference from South Africa and other Southern Africa Development Community (SADC) member states.

The strategy aims at increasing the exploitation of local energy resources for electricity generation to reduce the country's dependence on foreign sources as well as for other purposes and also to increase the share of renewable energy in the future energy mix. Namibia intends to tap solar and wind energy resources in the future while concurrently exploiting efficiently the invasive bush as a biomass energy source since the latter is proving so detrimental to the livestock sector productivity and development.

## Transportation

Namibia's road network is regarded as one of the best on the continent with road construction and maintenance being at international standards. Namibia has a total road network of more than 64 189 km, including 5 477 km of tarred roads which link the country to the neighbouring countries Angola, Botswana, South Africa, Zambia and Zimbabwe.

The country has two ports handling imported and exported merchandise, and servicing the fishing industry. The only deep-sea harbour is Walvis Bay in the Erongo Region. The other harbour is Luderitz in the Karas Region. The Port of Walvis Bay receives approximately 3000 vessels each year and handles about 5 million tonnes of cargo.

The railway network comprises 2382 km of narrow gauge track with the main line running from the border with South Africa via Keetmanshoop to Windhoek, Okahandja, Swakopmund and Walvis Bay. Omaruru, Otjiwarongo, Otavi, Tsumeb and Grootfontein are connected to the northern branch of the railway network.

## Manufacturing industry

Namibia's manufacturing sector is inhibited by a small domestic market, dependence on imported goods, limited availability of local capital, widely dispersed population, small skilled labour force with high relative wage rates, and subsidized competition from South Africa. The manufacturing sector, a priority sector under the NDP4 contributed 10.0% to national GDP in 2014. This performance was supported mainly by the following six sub-sectors - Beverages, Other food products, Basic non-ferrous metals, Chemicals and related products, Grain Mill products, Diamond processing, Fabricated Metals which together accounted for 72% of the manufacturing share of GDP in 2014. It is to be noted, however, the total share of the manufacturing sector in GDP shrunk by 5.7% over the period 2007 to 2014

## Waste

Namibia, as a medium income country with a growing wealthy urban middle class and significant urban drift, is feeling the pressure of amounts of waste generated on its facilities throughout the country and more especially in the urban areas. Solid municipal waste in dumped in landfills or open dumps while almost all urban settlements are connected to reticulated waste water treatment systems. Management of the landfills and dumps are not at the highest standards and very often, the waste is burnt in the open dumps to reduce the volume or reduce health risks. The general trend for regular collection of

waste has been for an increase from 30.9% in 2001 to 36.1% in 2014 with roadside dumping decreasing from 14.7% to 9.7% during the same period. Namibia is projecting to add value to waste through conversion to energy which will also contribute to reducing GHG emissions.

## Agriculture and forestry

The share of Agriculture and Forestry in GDP has been gradually decreasing over the years and stood at 3.9% in 2014, down 2.3% from the 2005 level of 6.2% (NSA, Annual National Accounts 2014 and 2016). However, despite its modest contribution in the country's GDP, agriculture impacts directly on the livelihood of 70% of the population. The production of white maize, wheat, pearl millet and livestock including cattle, goat and sheep is divided in the intensive commercial production units and the extensive communal production system. The commercial sector though occupying 44% of land involves only 10% of population while the communal sector occupies 41% of the land and involves 60% of the population. Approximately 48% of Namibia's rural households depend on subsistence agriculture as their main source of income (NDP4). The majority of rural communities, particularly in the higher rainfall areas of the north, depend directly on forest resources for use as fuel wood, building materials, fodder, food and medicine. It is necessary to ensure the systematic management and sustainability of forest resources.

Forests play an important role in the livelihood of the Namibian. The majority of rural communities (particularly in the higher rainfall areas of the north) depend directly on forest resources for use as fuel wood, building materials, fodder, food and medicine. At the end of 2012, there were 32 registered community forests in Namibia. The use of all indigenous plant resources is regulated by the Directorate of Forestry (DoF) within the Ministry of Agriculture, Water Affairs and Forestry. Additionally, communal-area conservancies manage 158,247 $km^2$ which is about 19.2% of Namibia. This strategy has contributed significantly to reduce deforestation and forest degradation with increasing removals of GHGs from the atmosphere.

## Water Resources

Namibia is the driest country in Southern Africa. Water is a scarce resource and one of the major primary limiting factors to economic development in Namibia. The effects of climate change, rapid population growth, and rural exodus pose additional challenges and threaten people's livelihoods as well as the balance of the ecosystems. Namibia's rainfall is skewed, with the north-east getting more that the west and south-western parts of the country. Of the water that Namibia receives as precipitation, it is estimated that only 2% ends up as surface run-off and a mere 1% becomes available to recharge groundwater. The balance of 97% is lost through direct evaporation (83%) and evapotranspiration (14%). Rainfall often evaporates before it reaches the ground. Another source of moisture comes from fog in the cooler coastal regions where it is an extremely valuable source of moisture to desert animals and plants.

The primary sources of water supply are perennial rivers, surface and groundwater (alluvial) storage on ephemeral rivers, and groundwater aquifers in various parent rocks. Additionally, unconventional water sources have been adopted to augment the limited traditional sources. About 45% of Namibia's water comes from groundwater sources, 33% from the Border Rivers, mainly in the north, and about 22% from impoundments on ephemeral rivers (Christelis and Struckmeier, 2001).

## Fisheries

Namibia has one of the most productive fishing grounds in the world, primarily attributed to the Benguela Current. The up-welling caused by the current brings nutrient-rich waters up from the depths that stimulate the growth of microscopic marine organisms. These in turn support rich populations of

fish, which form the basis of the marine fisheries sector. As is the case in other up-welling systems, relatively few species dominate and their abundance can vary greatly in response to changing environmental conditions. Over 20 commercially important fish species are landed using various fishing methods. The off-shore commercial fishery represents the largest component of the fishing industry.

The sector is a substantial export earner, with over 85% of Namibia's fish output destined for international markets. It is to be noted, however, that the contribution of the fishery sector to national GDP has been shrinking since 2005, when it stood at 4.2%, to reach the level of 2.8% in 2014, that is, a reduction of 33.3% (NSA, Annual National Accounts 2014 and 2016)

### Tourism

Namibia's unique landscapes and biodiversity support a rapidly developing tourism sector. Over the years, supported by Namibia's unique landscapes and biodiversity, tourism has been developing into an important sector, contributing both directly and indirectly to national GDP. In 2014, a total of 1,32 million tourists visited Namibia which represents a 34.1% increase from arrivals recorded in 2010. Tourism also generates an important number of employments, often in rural areas where it is otherwise difficult to obtain a job. The sector also plays in important role in the reduction of poverty in rural area through employment and income injection, especially in conservancies. Being reliant on the wildlife and scenery potential of Namibia, the tourism industry is thus vulnerable to the adverse impacts that climate change may have on these resources.

### Health

Namibia's provision of health services is shared between the public and the private sector, the latter focusing on urban areas. The leading causes of disease burden (disability and premature mortality) in Namibia in 2013 (IHME, 2016) were: (i) HIV/AIDS, (ii) tuberculosis and (iii) lower respiratory infections. Between 1990 and 2004 life expectancy for males and females decreased by 9 and 12 years, respectively, mainly due to the HIV/AIDS epidemic, while between 2004 and 2013 the trend was reversed, life expectancy rising by 11 years for females but only by six years for males.

Infant and child mortality is comparatively low, but the maternal mortality ratio has increased, despite the fact that over 70% of births are delivered in hospitals. Malnutrition levels in children under the age of five years are as high as 38% in some regions.

## Priorities related to mitigation of climate change

The key sectors and areas identified for mitigation span over all development sectors of the economy and the four IPCC sectors. Emphasis is laid on those sectors and categories responsible for the highest emissions as well as sink potentials as per the key category analysis and development strategies of Namibia. However, other win-win situations such as mitigation in the waste sector which is expected to result in improvements in the health of the population has not been neglected despite its low contribution to national emissions. The main mitigation avenues are:

- Increasing the share of renewables in electricity generation;
- Increased energy efficiency and other DSM activities;
- Improved passenger and freight transport to reduce fossil fuel use;
- Reforestation and afforestation;
- Restoration of grasslands and rangelands;
- Promoting alternatives to reduce wood removals from forests and grasslands;
- Improved livestock husbandry practices;

- Enhancing soil carbon storage through improved agricultural practices;
- Conversion of solid waste to energy; and
- Improved solid and liquid waste management.

### Adaptation

Namibia, as one of the driest countries in sub-Saharan Africa, is dependent on development sectors highly sensitive to climate. Primary economic sectors which are natural resource based such as agriculture, fisheries and mining account for about one third of the total GDP. More than half of the population depends on subsistence agriculture and in drought years, food shortages are a major concern in rural areas. Namibia is therefore highly vulnerable to climate change. The predicted temperature rise and evaporation increase as well as higher rainfall variability will exacerbate the situation that Namibia is facing. The potential effects of these climatic changes could prove catastrophic to the communities, population and economy at large. Thus, adaptation is of prime importance to the country and is high on the government's agenda to guarantee the welfare of the people while reducing risks and building resilience. Adaptation is thus an obligation for the country to fulfil its role within the international context.

Broad avenues for adaptation to climate change are:

- Improving technical capacity at the national and sub-national levels to develop a greater understanding of climate change and its impacts;
- Developing and implementing appropriate responses and adaptation strategies to reduce the impacts of floods, low rainfall and high temperatures on people, crops, livestock, ecosystems, infrastructure and services;
- Implementing soil and water conservation policies and practices;
- Improving ecosystem management, protection and conservation; and
- Developing common goals and facilitating better integration of different policies and practices in vulnerable sectors.

## ES 2. GHG Inventory

### Introduction

Namibia has so far complied with the Convention and submitted five national GHG inventories as components of its first, second and third national communications and its first and second Biennial Update Reports. The last two inventories have been presented as stand-alone reports, the NIR1 and NIR2 that has also been submitted to the secretariat of the UNFCCC. These inventories have been compiled and submitted in line with Article 4.1 (a) of the Convention whereby each party has to develop, periodically update, publish and make available to the Conference of the Parties (COPs), in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. These inventories have been produced to the extent of the country's capabilities and using recommended methodologies of the IPCC which have been agreed upon by the Conference of the Parties. The NIR3, submitted also as a stand-alone report, supersedes previous inventories and provides for the latest and best emissions estimates of the country in light of available data and information.

### Coverage (Period and Scope)

Namibia has compiled inventories for the period 2001 to 2012 also, is updating this time series with inventories for the years 1994-2000, 2013 and 2014, and recalculating the inventories from 2001 to 2012 based on evidence for previous data being insufficiently accurate.

The emissions and removals of the country are being made available in a stand-alone national inventory report. The inventory covered the full territory of the country and the results are presented at the national level. It addressed all the IPCC sectors and categories subject to Activity Data (AD) availability. The latest IPCC 2006 Guidelines have been used to estimate emissions for the four sectors, namely, Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry, and Other Land Use (AFOLU) and Waste.

## Institutional Arrangements and GHG Inventory System

Capacity building continued with the preparation of inventories to further improve, implement and consolidate the GHG inventory management system being implemented. The process of preparation of GHG inventories remained a very laborious exercise as resources and human capacities continued to be limiting factors. Implementation of the different steps of the inventory cycle was staged over less than a year instead of a longer period to fit the availability of funds for the compilation of this inventory. Due to this time constraint, it is obvious that there still exist shortcomings in this inventory, but the country is committed to strive to raise the quality of future GHG inventories through further strengthening of the GHG inventory system and human capacities.

The Climate Change Unit (CCU) of the Ministry of Environment and Tourism has the responsibility for overlooking the production of reports to the Convention, including the GHG inventories in its capacity as National Focal Point of the Convention. The framework with all stakeholders agreeing to pursue the sharing of responsibilities for the compilation exercise as for the previous reports was maintained. Mapping of national institutions and organizations enabled the identification of additional stakeholders that would contribute in one way or the other for the inventory compilation. An international consultant was appointed to consolidate capacity building, follow and guide the team until the production of the final output, which is the NIR3. Capacity building of all inventory team members continued on the different steps of the inventory cycle as well as on data management, running the 2006 IPCC software, analysing the outputs and reporting to the Convention.

## Methods

### Guidelines and software

The present national GHG inventory has been prepared in accordance with the *IPCC 2006 Guidelines for National Greenhouse Gas Inventories* and using the IPCC 2006 software for the computation of emissions. The IPCC 2006 Guidelines has been supplemented with the European Monitoring and Evaluation Program/European Environment Agency (EMEP/EEA) air pollutant emission inventory guidebook for compiling estimates for nitrogen oxides ($NO_X$), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide ($SO_2$).

To facilitate derivation of national EFs and stock factors for improving estimates to be made at the Tier 2 level for the Livestock and Land sectors, Excel workbook was used. Thus, the inventory has been compiled using a mix of Tiers 1 and 2. This is good practice and improved the accuracy of the emission estimates and reduced the uncertainty level accordingly.

### Gases

The gases covered in this inventory are the direct gases carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$) and the indirect gases nitrogen oxides ($NO_X$), carbon monoxide (CO), non-methane organic volatile compounds (NMVOCs) and sulphur dioxide ($SO_2$). AD and important information required to allow on the choice of the EFs on the carbon fluorocarbons (CFCs), hydro-fluorocarbons (HFCs) and

perfluorocarbons (PFCs) were lacking and thus estimates of emissions have not been made for these gases. As well, sulphur hexafluoride (SF6) has not been estimated since AD were not available.

#### GWPs

Global Warming Potentials (GWP) as recommended by the IPCC have been used to convert GHGs other than $CO_2$ to the latter equivalent. Based on decision 17/CP.8, the values adopted were from the IPCC Second Assessment Report for the three direct GHGs, namely 1 for $CO_2$, 21 for $CH_4$ and 310 for $N_2O$.

### Activity Data

Country-specific AD pertaining to most of the socio-economic sectors collected at national level from numerous public and private sector institutions, organizations and companies, and archived by the NSA, provided the basis for the compilation of the inventory. Additional and/or missing data, required to meet the level of disaggregation for higher than the Tier 1 level, were sourced from both public and private institutions by the inventory team members and coordinators through direct contacts. Data gaps were filled through personal contacts and/or from results of surveys, scientific studies and by statistical modelling. Expert knowledge was resorted to as the last option. For the Land sector, a mix of remote sensing technology, scientific publications and studies, international databases, forest inventories and surveys provided the activity data for making the estimates.

### Emission Factors

Country emission factors were derived for the Tier 2 estimation of GHGs for some animal classes for enteric fermentation and for the Land sector where stock factors have been derived to suit national circumstances. This is Good Practice towards enhancing the quality of the inventory and especially as these activity areas were major emitters on the basis of previous inventory results. Additionally, default IPCC EFs for the remaining source categories were screened for their appropriateness before adoption, on the basis of the situations under which they have been developed and the extent to which these were representative of national ones.

### Recalculations

The inventory for the years covered in the previous time series 2000 to 2012 was recalculated to bring them in line with the years 2013 and 2014 as well as with the period 1994 to 1999 being added. This provide for a longer time series for better consistency in the inventory report. This is essential as there have been changes in the methodologies with the upgrading of the IPCC software to the latest version 2.54 that was released in 2017. The scope of the inventory has also been widened to include some more categories in the IPPU sector.

### Inventory Estimates

#### Aggregated emissions

Namibia remained a net GHG sink over the period 1994 to 2014 as the Land category removals exceeded emissions from the other categories. The net removal of $CO_2$ increased by 20,484 Gg from 77,770 Gg to 98,254 Gg in 2014, representing an increase of 26.3% over these 21 years. During the same period, the country recorded an increase of 12.1% in emissions, 2,291 Gg $CO_2$-eq from 18,889 Gg $CO_2$-eq to 21,180 Gg $CO_2$-eq. The trend for the period 1994 to 2014 indicates that the total removals from the LAND category increased from 96,659 Gg $CO_2$-eq in 1994 to 119,434 (23.6%) Gg $CO_2$-eq in 2014 (Figure 1.1).

Per capita emissions of GHG decreased gradually from 11.9 tonnes $CO_2$-eq in 1994 to reach 9.9 tonnes in 2002; it then plateaued between 9.8 and 10.0 tonnes up to 2005 after which period it seesawed to reach 9.6 tonnes $CO_2$-eq in 2014. The GDP emission index decreased almost steadily from 100 in the year 1994 to 46.6 in 2014.

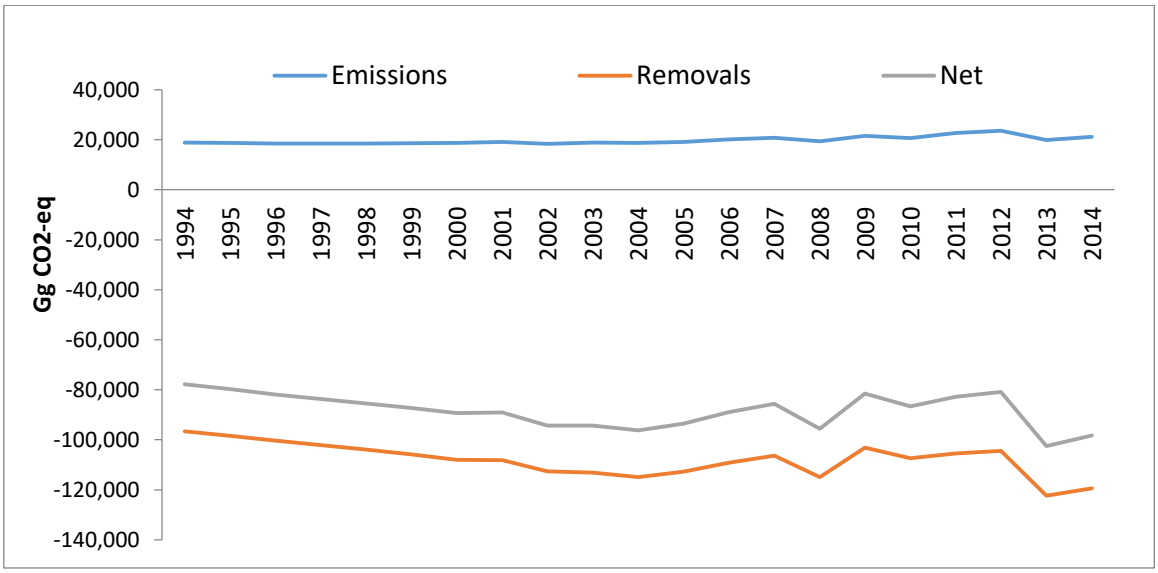



**Figure 1.1 - National emissions, removals and net removals (Gg $CO_2$-eq) (1994 – 2014)**

Total national emissions increased by 12.1% over these 21 years. The AFOLU sector remained the leading emitter throughout this period followed by Energy, for all years under review. Following the setting up of new industries, IPPU sector took over as the third emitter in lieu of the Waste sector as from the year 2003. Emissions from the AFOLU sector increased from 17,328 Gg $CO_2$-eq in 1994 to peak at 19,275 Gg $CO_2$-eq in 2012 and then regressed to 17,271 in 2014, representing a decrease of 0.3% from the 1994 level. The share of GHG emissions from the AFOLU sector out of total national emissions regressed from 91.7% in 1994 to 81.5% in 2014.

Energy emissions increased from 1,464 Gg $CO_2$-eq (7.8%) of national emissions in 1994 to 3,234 Gg $CO_2$-eq (15.3%) in 2014 as depicted in Table 1.1. During the period 1994 to 2014, the average annual increase of GHG emissions was by 6.0%.

The contribution of the IPPU sector in total national emissions increased from 22 Gg $CO_2$-eq in 1994 to 522 Gg $CO_2$-eq in 2014 (Table 1.1). The very sharp increase in GHG emissions in the IPPU sector is due to the commencement of the production of Zinc in 2003 and cement in 2011.

Waste emissions on the other hand varied over this period with the tendency being for a slight annual increase over time. Emissions from the waste sector doubled from the 1994 level of 75 Gg $CO_2$-eq to 153 Gg $CO_2$-eq in 2014.

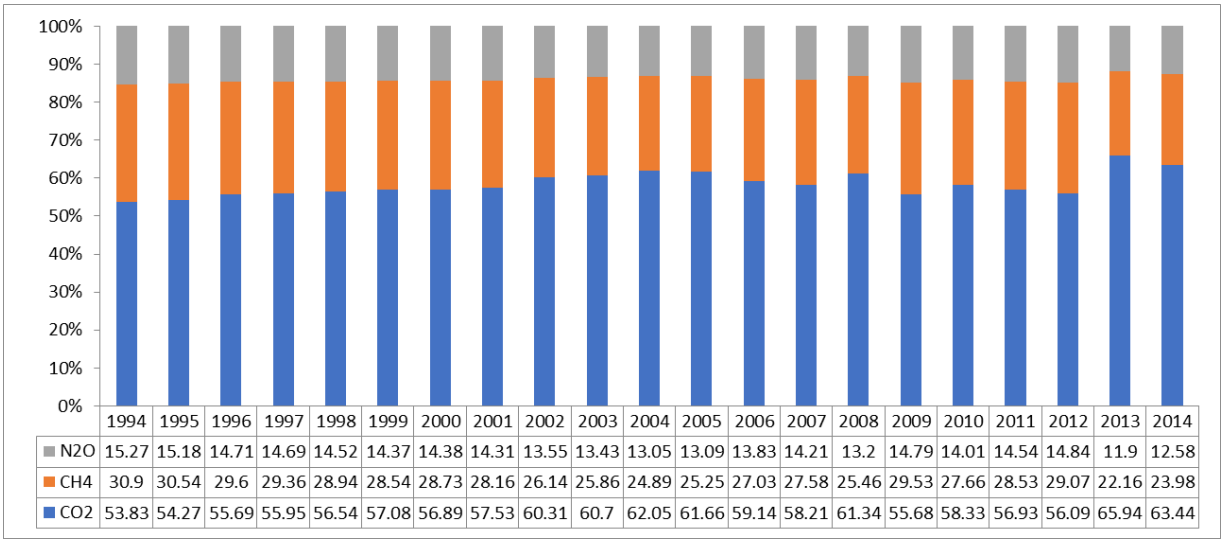
**Table 1.1 - National GHG emissions (Gg, $CO_2$-eq) by sector (1994 – 2014)**

| Year | Total emissions | Energy | IPPU | AFOLU | Waste |
|---|---|---|---|---|---|
| 1994 | 18,889 | 1,464 | 22 | 17,328 | 75 |
| 1995 | 18,752 | 1,473 | 23 | 17,183 | 72 |
| 1996 | 18,439 | 1,566 | 23 | 16,777 | 73 |
| 1997 | 18,442 | 1,617 | 24 | 16,726 | 76 |
| 1998 | 18,495 | 1,759 | 24 | 16,633 | 79 |
| 1999 | 18,553 | 1,893 | 25 | 16,551 | 83 |

| Year | Total emissions | Energy | IPPU | AFOLU | Waste |
|---|---|---|---|---|---|
| 2000 | 18,684 | 1,934 | 25 | 16,637 | 88 |
| 2001 | 19,157 | 2,116 | 25 | 16,927 | 90 |
| 2002 | 18,353 | 2,163 | 27 | 16,073 | 91 |
| 2003 | 18,842 | 2,454 | 110 | 16,176 | 101 |
| 2004 | 18,742 | 2,521 | 237 | 15,879 | 103 |
| 2005 | 19,135 | 2,671 | 260 | 16,094 | 110 |
| 2006 | 20,194 | 2,823 | 255 | 17,003 | 112 |
| 2007 | 20,725 | 2,907 | 293 | 17,415 | 109 |
| 2008 | 19,416 | 2,752 | 291 | 16,256 | 117 |
| 200, | 21,549 | 2,832 | 303 | 18,289 | 125 |
| 2010 | 20,720 | 2,923 | 301 | 17,365 | 131 |
| 2011 | 22,699 | 2,796 | 438 | 19,326 | 138 |
| 2012 | 23,542 | 3,003 | 515 | 19,875 | 149 |
| 2013 | 19,829 | 2,861 | 528 | 16,291 | 149 |
| 2014 | 21,180 | 3,234 | 522 | 17,271 | 153 |

### Emissions by gas

The share of emissions by gas did not change during the period 1994 to 2014. The main contributor to the national GHG emissions remained $CO_2$ followed by $CH_4$ and $N_2O$. However, the share of $CO_2$ increased while these of $CH_4$ and $N_2O$ regressed over the time series. In 2014, the share of the GHG emissions was as follows: 63.44% $CO_2$, 23.98% $CH_4$ and 12.58% $N_2O$. The trend of the aggregated emissions and removals by gas is given in Figure 1.2.




| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N2O | 15.27 | 15.18 | 14.71 | 14.69 | 14.52 | 14.37 | 14.38 | 14.31 | 13.55 | 13.43 | 13.05 | 13.09 | 13.83 | 14.21 | 13.2 | 14.79 | 14.01 | 14.54 | 14.84 | 11.9 | 12.58 |
| CH4 | 30.9 | 30.54 | 29.6 | 29.36 | 28.94 | 28.54 | 28.73 | 28.16 | 26.14 | 25.86 | 24.89 | 25.25 | 27.03 | 27.58 | 25.46 | 29.53 | 27.66 | 28.53 | 29.07 | 22.16 | 23.98 |
| CO2 | 53.83 | 54.27 | 55.69 | 55.95 | 56.54 | 57.08 | 56.89 | 57.53 | 60.31 | 60.7 | 62.05 | 61.66 | 59.14 | 58.21 | 61.34 | 55.68 | 58.33 | 56.93 | 56.09 | 65.94 | 63.44 |

**Figure 1.2 - Share of aggregated emissions (Gg $CO_2$-eq) by gas (1994 – 2014)**

Emissions of indirect GHGs (CO, $NO_x$ and NMVOC) and $SO_2$, have also been estimated and reported in the inventory. Emissions of $NO_x$ decreased from 48.4 Gg in the year 1994 to 38.2 Gg in 2014. Carbon monoxide emissions also regressed from 2198 Gg in 1994 to 939 Gg in 2014. Emissions of NMVOC increased from 15.9 Gg in 1994 to 24.5 Gg in 2014 whilst emissions of $SO_2$ varied between 1.9 Gg and 4.2 Gg during the same period.

## QA/QC

QC and QA procedures, as defined in the *IPCC 2006 Guidelines (IPCC, 2007)*, have been implemented during the preparation of the inventory. Whenever there were inconsistencies or possible transcription

errors, the responsible institution was queried, and the problem discussed and solved. QC was implemented through:

- Routine and consistent checks to ensure data integrity, reliability and completeness;
- Routine and consistent checks to identify errors and omissions;
- Accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emissions calculations; and
- Technical and scientific reviews of data used, methods adopted, and results obtained.

QA was undertaken by independent reviewers who were not involved with the preparation of the inventory, the main objectives being to:

- Confirm data quality and reliability from different sources wherever possible;
- Compare AD with those available on international websites such as FAO and IEA;
- Review the AD and EFs adopted within each source category as a first step; and
- Review and check the calculation steps in the software to ensure accuracy.

### Completeness

A source category analysis was conducted before the preparation of this inventory and it was updated by adding some new categories of the IPPU sector. Estimates of the HFCs and PFCs have not been included due to lack of disaggregated data, the information on them being as blends without the content of the different components.

### Uncertainty Analysis

For this Inventory, a Tier 1 uncertainty analysis of the aggregated figures as required by the IPCC 2006 Guidelines, Vol. 1 (IPCC, 2007) was performed. Based on the quality of the data and whether the EFs used were defaults or nationally derived, uncertainty levels were allocated for the two parameters and the combined uncertainty calculated. Uncertainty levels for the individual years of the period 1994 to 2014 varied from 26.0% to 29.1% while the trend assessment when adding one successive year on the base year 1994 for the years 1995 to 2014 ranged from 35.7% to 44.7%.

### Key Category Analysis

The Key Category Analysis also was performed using the tool available within the IPCC 2006 Software for both level and trend assessment. There are four key categories in the level assessment, three of these from the AFOLU sector, of which enteric fermentation from Agriculture, the other two from FOLU being Forest land Remaining Forest land and the last one is Road Transportation from the Energy sector. The results change quite drastically when considering the trend assessment covering the period 1994 to 2014. There are now ten key categories compared to the level assessment with four only. The four key categories under level assessment recur in the trend assessment also

### Archiving

All raw data, collected for the inventory, have been stored in the IPCC 2006 software data base after being processed and formatted for making estimates of emissions and removals. All documentation on the data processing and formatting have been kept in soft copies in the excel sheets with the summaries reported in the NIR. These versions will be managed in electronic format in at least three copies, two stored at the Ministry of Environment and Tourism and a third copy at the National Statistics Agency.

### Constraints, Gaps and Needs

Namibia, as a developing country, has its constraints and gaps that need to be addressed to improve the quality of the inventory for reporting to the Convention. Major problems encountered were related to

availability of AD, appropriateness of EFs, background information on technologies associated with production and national stock factors for the estimation exercise. Additionally, lack of resources - both technical and financial - coupled to insufficient capacity of national experts to take over the compilation of the full inventory remained a major issue of concern.

### National Inventory Improvement Plan (NIIP)

Based on the constraints and gaps and other challenges encountered during the preparation of the inventory, a list of the priority improvements has been identified. The main issues are listed below.

- Adequate and proper data capture, QC, validation, storage and retrieval mechanism need to be improved to facilitate the compilation of future inventories;
- Capacity building and strengthening of the existing institutional framework within a GHG inventory management system to provide improved coordinated action for a smooth implementation of the GHG inventory cycle for sustainable production of inventories;
- Development of emission factors (EFs) more representative of the national context;
- Improve the existing QA/QC system including a QA/QC plan in order to reduce uncertainty and improve inventory quality;
- Find the necessary resources to establish a GHG inventory unit within DEA to be responsible for inventory compilation and coordination;
- Institutionalize the archiving system;
- Pursue efforts for collecting the required AD for categories not covered in this exercise, namely the use of $SF_6$, use of $N_2O$ for medical purposes, incineration of medical waste and Ozone Depleting Substances;
- Conduct new forest inventories to confirm the new approach adopted for the Land sector;
- Produce new maps for 1990 to 2015 to refine land use change data over 5 years periods to replace the low quality maps available now which is proving inadequate;
- Refine data collection for determining country-specific (CS) weights for dairy cows, other cattle, sheep and goats;
- Develop the digestible energy (DE) factor for livestock as country-specific data is better than the default IPCC value to address this key category fully at Tier 2; and
- Add the missing years 1990 to 1993 to complete the full time series 1990 to at least 2015 in the next inventory compilation.

## ES 3. Mitigation actions and their effects

### Context

As a signatory Party to the Convention, Namibia invested in its implementation for nearly a decade now according to its capabilities. This is reflected in the progress recorded in reducing the emissions intensity per capita and per unit of GDP produced. Based on results presented in the NIR3, per capita emissions of GHG decreased gradually from 11.9 tonnes $CO_2$-eq in 1994 to reach 9.6 tonnes $CO_2$-eq in 2014 while the GDP emission index decreased steadily from 100 in the year 1994 to 46.6 in 2014. Namibia is committed to further progress in the decoupling of carbon emissions from economic growth to match the low carbon pathway embedded in its policies and strategies.

To meet this objective, Namibia established the NCCC in 2001 to drive implementation of mitigation actions. Cabinet approved the first NPCC in 2011 and the NCCAP in 2014 to enhance climate change mitigation activities. In line with the latest decisions of the COP, the country produced its INDC in 2015

which led to the PA to which Namibia is also a signatory Party. The outcomes of COP21 and Namibia's commitment, have created the necessary impetus for more structured and focused mitigation efforts. The country has reviewed its policies, strategies and regulations towards creating a favourable environment for mitigation in view of serious implementation of the NDC post 2020. New policies produced for the energy sector since 2016 to promote implementation of the PA are:

- National integrated resource plan for the electricity supply industry;
- National energy policy;
- National renewable energy policy; and
- National independent power producer (IPP) policy

## Mitigation actions implemented and planned

Based on information collected within the exercise for reporting in this BUR on mitigation activities implemented to-date, Namibia considers that it has achieved a fair part of its voluntary contribution as per the differentiated responsibilities embedded in the Convention. Furthermore, Namibia stresses on the fact that most of the actions are voluntary and that once the conditional funding starts to flow in, the full potential of mitigation can then be captured. In this vein, the country has already reviewed and updated existing policies and developed new ones to be in line with the PA. Detailed information on policies as well as planned and implemented actions, including those of the INDC are presented in the full report.

The number of actions on policies, plans and strategies is 11. Sector wise, Energy outnumbered the other three with 31 actions, followed by eight in AFOLU, three in Waste and one in IPPU. Out of these, 24 actions have been completed or implemented in the Energy sector and 7 in the AFOLU sector. A summary of the mitigation actions is presented in Table 1.2.

**Table 1.2 - Summary of mitigation actions**

| Type of action | No. of action | Completed or implemented | Planned |
|---|---|---|---|
| Policies, plans and strategies | 11 | 4 | 7 |
| Energy sector | 31 | 24 | 7 |
| IPPU sector | 1 | 0 | 1 |
| AFOLU sector | 8 | 7 | 1 |
| Waste sector | 3 | 0 | 3 |
| Total | 54 | 35 | 19 |

## Key mitigation actions

Namibia's INDC identified key mitigation actions funded by the Namibian government as being the Solar Revolving Fund, the commissioned hydro generation plant of Ruacana and other demand side management (DSM) measures. Few measures in the AFOLU section had been reported on previously. However, the AFOLU sector is a key category and among the highest emitters. Emissions come from the use of fuelwood, production of charcoal and wood removals for construction and other purposes, especially in the rural areas. Mitigation actions therefore target reductions in these sources. The livestock industry is also a major contributor through mainly enteric fermentation but offers restricted mitigation avenues on account of the extensive production system.

Actions in the AFOLU are mostly in their early stages of implementation. Key actions include:

- Using cattle feedlots to reducing methane emissions while creating; opportunities for local farmers and improving manure management;
- Reducing emissions from soil degradation;
- Afforestation and measures to reduce deforestation; and
- Restoring grassland.

The only information available on GHG reductions is based on potentials included in the INDC. There is no information on the GHG emission reduction achieved to date. The greatest potential for emission reductions is associated with a reduction in deforestation.

Mitigation actions in the energy sector focus on the shift from fossil fuels to renewable energy sources, improved energy efficiency through various DSM measures and reduced fossil fuel consumption through a series of measures in the road transportation sector. Actions in the energy sector include:

- Driving energy efficiency through providing audits (implementation of identified savings has not been measured), distributing free LED lightbulbs, and capacity building;
- Establishing commercial net metering (feeding back into the grid) which has facilitated private investment in rooftop solar PV;
- Establishing National Renewable Energy Policy, a Renewable Energy Feed in Tariff (REFIT) programme and a draft Independent Power Producer Framework to stimulate investments into renewable technologies. Under the REFIT, 14 IPPS, each generating 5 MW are expected to save in the region of 180 000 $tCO_2$-eq per year
- Currently developing a solar thermal technology roadmap and implementing a Concentrated Solar Power (CSP) technology transfer programme with the support of the GEF through UNDP;
- NamPower has conducted a feasibility to consider CSP implementation options (through or central receiver with storage) of between 50 and 200 MW;
- Part of the Southern African Solar Thermal Training and Demonstration Initiative (SOLTRAIN) and supported various Solar Water Heater demonstration projects (included in the SOLTRAIN initiative);
- Exploring projects to generate electricity from invader bush (biomass-to-electricity power station);
- Supporting the use of solar technologies in the residential sector;
- Developing a sustainable urban transport master plan for Windhoek including the mass transport, cars and freight pooling;
- Submission of a NAMA to the UNFCCC NAMA Registry to support A) Minigrids and B) Energy Zones (intended to contribute toward achieving the goal defined in the Off-Grid Energisation Master Plan); and
- Using biomass (from de-bushing) to generate electricity

Namibia is not a highly industrialized country and thus mitigation potential from the IPPU sector is limited. However, there exists a cement production unit with clinker production integrated. Namibia is focusing on opportunities related to clinker replacement with both extenders and substitute materials with hydraulic properties.

Namibia's has a small population (some 2.2 million) and therefore has limited potential to reduce GHG emissions from the waste sector. Actions targeted in this sector include waste to energy projects with multiple benefits. There are relatively fewer interventions to prevent GHG emissions associated with the

transport, handling, management and decomposition of waste streams. Namibia has developed emissions reduction projects in the waste sector under the Clean Development Mechanism (CDM). These relate to capturing landfill gas and biogas from waste water treatment works. Additionally, the large municipalities are exploring opportunities to generate electricity from Municipal Solid Waste (MSW).

## Barriers to mitigation and lessons learned

Namibia faces a number of challenges in planning and implementing mitigation actions: lack of financial support and capacity being the most significant of these. In addition, each IPCC sector faces different barriers and opportunities to mitigate GHG emissions.

**AFOLU:**

- Implementing mitigation actions in the AFOLU sector is challenging given a lack of data and complexities associated with multiple stakeholders at multiple scales.

**Energy**

- Namibia has significant renewable energy potential and has taken steps to direct investment and creating an enabling environment for private sector investment in renewables.
- Namibia's transport is dominated by the road component for both passengers and goods. Taking into consideration the extended geographic nature of the country with low population densities outside its urban areas, there is little prospect for the transport landscape to change in the short or medium term. There is no other means of transport which can replace the existing modes in the present context of the country's development and bring a significant change in its total energy demand profile and reduce its heavy reliance on imported fuel. In view of its rather small fleet of vehicles and therefore small volume of consumption of petroleum products, there is no economic incentive for these fuels to be replaced by alternative energy sources (TNC).

**IPPU**

- Use of extenders and other materials to replace GHG-intensive clinker is seen as a way of reducing the GHG intensity of cementitious products. The challenge is that the long term properties of these products is not known. This makes it difficult to find an appropriate "properties" metric to use as the denominator.
- There is a risk that a metric based only on clinker content could incentivise extending at the expense of quality. This could, in the longer term, require more cement which would have GHG emission implications. Alternatively cement companies could shift the non-hydraulic extender blending process from the downstream value chain to within its direct operational boundary. This would change the emissions profile of the country but would not impact emissions of the final products used (there is an argument that emissions could increase as centralised blending may not be optimal relative to decentralised needs).

**Waste**

- Limited waste is generated in Namibia (due to a small population). There are long distances between the municipalities making it expensive to transport waste. And there is a lack of waste characterization.
- Waste industries are not incentivised to reduce or prevent waste. Disposals costs (the gate fees) are not high enough to incentivise alternatives such as waste use in energy generation. Viable waste to energy projects require access to reliable and suitable feedstock which, given the current system, presents a potential barrier.
- Finally, administrative and technical capacity requirements tend to be quite high

## ES 4. Information on domestic Measurement Reporting and Verification

Prior to the publication of BUR1 Namibia did not have a system to track mitigation benefits in terms of emission reductions or sink enhancements as well as indirect returns within the wider context of sustainable development. However, efforts have been made to develop systems and build capacity domestically to sustainably assess and report mitigation actions within the framework of the UNFCCC. Progress has been made but there remain challenges relating to:

- Availability of data and resources required to gather and manage relevant data
- Capacity to undertake mitigation assessments; and
- Formalised roles and responsibilities to which institutions and individuals are held accountable

Given the outcomes of COP21, it is clear that a sustainable, capacitated system is required to meet the ongoing reporting requirements. Additionally, Namibia needs to generate evidence to inform domestic investment in mitigation, motivate for access to climate finance and other support and equip the country to engage more effectively around what represents a fair contribution to the global climate change mitigation effort.

### Overall coordination of MRV

Signatory Parties to the UNFCCC are obliged to submit Biennial Update Reports every 2 years to the COP and the latter should contain a chapter detailing the arrangements implemented by the country to domestically follow and track Emissions, Mitigation and Support received and needed to implement the Paris Agreement (PA) and the Convention. Namibia presented conceptual MRV systems in its BUR1 and BUR2, with the intent of implementing same. To-date, some progress has been recorded but this is still insufficient to meet the reporting requirements.

Based on the collection of data and other information for producing the last 3 GHG inventories and mitigation and needs chapters of the 3 BURs, it is evident that the present institutional arrangements for the MRV of Emissions (GHG inventory) are still weak and need strengthening while the MRV for Mitigation and Support are still in their infancies. Further work, brainstorming and consultation with stakeholders has led to the design of an improved MRV concept which will take on board objectively performing institutional arrangements to make the systems functional in the coming years, after appropriate capacity building. The proposed new concepts for the 3 MRV systems are presented in the BUR3, the intent being to meet the requirements of the PA.

Efforts have been deployed to develop the MRV systems and build capacity domestically to sustainably assess and report emissions, mitigation actions, including emissions reductions and support needed and received within the framework of the UNFCCC. Progress has been made but there remain challenges relating to:

- Systematic availability of all data required for the UNFCCC reports;
- Sufficiency of resources to implement the MRV components exhaustively;
- Adequate capacity to undertake mitigation assessments; and
- Formalised roles and responsibilities of institutions and individuals for accountability.

### Development and coordination of the MRV system

Namibia has in place a Monitoring and Evaluation (M&E) system to support its development agenda as laid out in the National Development Plan (NDP). Government implemented a continuous M&E process under the aegis of the National Planning Commission (NPC) for all socio-economic development engines,

with a view to track progress on the various goals and strategies earmarked in the NDP, including those of the Ministry of Environment and Tourism, which has the leading role on climate change. The initial MRV concept was based on this M&E model but has not met the reporting requirements for reporting of the UNFCCC. The existing systems have been reviewed and new proposals made, taking into consideration the present UNFCCC context which is more demanding in terms of outputs and indicators. It is now evident that the MRV system for reporting on climate change will need to be looked at with a different perspective and kept separate from the M&E system of the NPC.

### MRV of emissions

To date after outsourcing the compilation of the first three national GHG inventories, Namibia has been able to utilise active working groups to support the preparation of the three latest inventories, including three stand-alone NIRs, in collaboration with consultants to ensure capacity building of national experts. Institutional arrangements made initially have been constantly reviewed and improved.

The institutional arrangements put in place since Namibia started capacity development to prepare its inventory have been working at a lower level than expected to be considered as fully operational and sustainable. This is due to various reasons, the most important ones being the unavailability of the inventory compilers for the 4 IPCC sectors at the required time and within short spans of time to deliver. Another factor is the lack of official commitment of the different stakeholders with the current mechanism of requesting representation in committees rather than nomination for performing tasks related to the inventory compilation on an annual basis. It is proposed that the responsibility for compilation rests with the CCU supported by an external consultant while the other stakeholders either under the lead of a ministry or directly will contribute annual data sets according to an agreed Protocol or Memorandum of Understanding (MOU). It is worth highlighting that most of the data are already collected but not in an organized way to meet the stringent reporting requirements of the UNFCCC.

The MET is considering establishing a MOU with the NSA and it is recommendable that this be extended to all ministries, not only to serve the needs of reporting to the UNFCCC but also to other Conventions and national development at large. This would facilitate and improve data collection from the Ministries as the NSA has a legal framework to collect data. The challenge is that the NSA has capacity and staff turnover challenges which would need to be overcome if such a system is to be established.

The GHG inventory is the backbone to reporting as well as for planning and prioritizing mitigation actions and investments. It would be wise to further develop and strengthen the existing system to make it sustainable. Given that climate change is embedded within almost all the SDGs, it will surely mean the participation of most if not all Ministries, including the Agencies falling within their ambit. The best option is seen as each Ministry having a designated responsible Officer at a certain level, with an alternate, tasked to liaise with other colleagues to collect information on activities emitting GHGs or acting as sinks. This responsible Officer and/or his alternate is obligated to attend the NCCC meetings and also contribute in working groups of the CCU of MET on all issues pertinent to climate change. The responsible Officer and the alternate should both attend to meetings and working group sessions when they are available. Additional information can be requested by CCU as and when needed from the responsible Officer and other specific stakeholders.

### MRV of mitigation (including NAMAs)

Namibia continued to build and improve its system for measuring, reporting and verifying mitigation actions and their effects while tracking support received in implementing these. The institutional arrangements follow closely those described above for the GHG inventory, involving many of the same

institutions collaborating for the MRV of emissions but with somewhat different responsibilities for the MRV mitigation and support systems. The Mitigation Working Groups (MWG) established during the production of the BUR2, with representatives responsible for collecting and reporting data related to mitigation actions according to the IPCC sectors AFOLU, Energy, IPPU and Waste, functioned sparingly on account of limited capacity and the absence of well-developed procedures. The existing arrangements have to be reviewed and upgraded to be fully operational and to deliver for meeting reporting standards.

It is thus proposed to work out a system comprising only the stakeholders concerned with mitigation activities to track these under the responsibility of the reinforced CCU. This MRV system can be regularly revisited when preparing the UNFCCC reports to ensure it continues to meet its objectives. For making the apparent linkages on funding, the Ministry of Finance and National Planning Commission should be fully fledged members of the MRV mitigation and support systems. Ministries/Institution/Agencies implementing mitigation actions automatically joins the mitigation working group to provide data collected on the action

.

User-friendly templates have been designed during the preparation of the BUR2 for the collection of data and other information on mitigation actions, to the extent possible. However, these templates have not been used during the preparation of the BUR3 due to time constraints as the funding came late to allow for this exercise and the lack of the MRV mitigation system. Details of the range of information covered in the templates are provided below:

- **Mitigation action description**:
  Name of action, main objective, description, coverage (sector and gases) and type (policy, programme or project);
- **Implementation information**:
  Status (planned, ongoing, implemented), implementing agency and progress indicators;

.

- **Methodology**
  Methodology for estimating emissions reductions including assumptions

.

- **Effects**:
  Outcomes achieved, co-benefits (non-GHG impacts) and estimated GHG emission reductions

.

- **Costs and support**
  Cost of implementing and running action and support received

.

- **Other**:
  Barriers and opportunities for replication of mitigation action.

## MRV of Support

There is need to track support received for reporting to the COP and for implementing mitigation actions by the country. Namibia to-date does not have a functional system for this exercise. Information are disaggregated and may be obtained from different ministries and/or other institutions depending on the type of support received, though a fair amount of this information may be available with the ministry of Finance, NPC and MET. Since most of these are and will be project-based, it is recommendable that the MRV for support is not completely dissociated from the MRV mitigation component as already described. However, the operational framework will have to be different from the one proposed for MRV mitigation due to the different roles and responsibilities of various ministries.

Therefore, it is recommended that the responsibility be taken by the Ministry of Finance through NPC in close collaboration with the Environment Investment Fund and CCU of MET. The latter will have a crucial role as it will be the ministry to monitor implementation of mitigation actions being executed by other entities while being the lead ministry for executing projects for reporting to the Convention. As for NAMAs, user-friendly templates will have to be designed for tracking support received during the project cycle for reporting in the BURs. This should be done on an annual basis by NPC or EIF which will balance inflows and outflows of funds primarily and submit to MET for merging with capacity building and technological support received from its monitoring component. CCU of MET can then compile all this information for inclusion in the BUR.

The main ministries and institutions identified to be part of the MRV support are:

- MET with CCU responsible for follow-up of activities;
- Ministry of Finance through NPC;
- Ministry of Mines and Energy;
- Ministry of Agriculture Water Affairs and Forestry (Crops, Livestock and Forestry Divisions);
- Namibia Energy Institute (NEI) – Solar Revolving Fund (SRF) and Renewable Energy (RE) Divisions;
- NamPower;
- Central-North Regional Electricity Distributor (CENORED);
- Electricity Control Board (ECB);
- Green Building Council (GBC);
- Private sector through the Chamber of Commerce and Industry

The CCU of MET develops user-friendly templates that the Ministries and other organisations will complete once annually and send back for analysis, compilation of information and reporting. The information collected is handed over to NSA for databasing and archiving. The NSA sends back a copy of the quality-controlled data to CCU of MET for storage in a second archive. However, it is strongly recommended that this be agreed at the topmost managerial level for appropriate action. In case this does not work, then MET may have to resort to official MOUs and also look at appropriate legislations to be able to collect this information, especially when dealing with the private sector

## ES 5. Constraints and gaps, and related financial, technical and capacity needs, including a description of support needed and received

### Reporting

Namibia has made tangible progress in raising its reporting standards to the UNFCCC, shifting from total reliance on consultants to a mix of collaboration between consultants and national experts. The objective of the country is to become fully independent for reporting at the required standards to the Convention in the near to medium term. As it stands presently, there still exist challenges and constraints and gaps to reach a fully-fledged status. Capacity building of national experts was furthered during the preparation of the BUR3 report to enable them to overcome the constraints and gaps. This process will continue with the preparation of future reports, namely the NC4 and it is expected that constraint removal and filling of gaps will progress more rapidly in the medium and longer terms. To achieve this, national investments will continue, the institutional arrangements will be further enhanced but sustained support will be needed from the bilateral and multilateral partners, and donor institutions to hasten the process.

## Implementation

Namibia started implementing mitigation since more than a decade now. Mitigation is embedded in the national development plans as detailed in the national climate change policy. Various policies falling under the latter have been reviewed and updated ones produced in 2017 to cater for the latest COP decisions and the PA. However, implementation of mitigation actions faces multiple barriers and difficulties in various areas and the country stands to remove these challenges to move forward. Weaknesses exist at the institutional, organizational and individual levels, notwithstanding financial and technology transfer needs, especially at a time when the country has endured a drought over the past four years. There is an urgent need to improve the enabling environment for tackling climate change activities, with special emphasis on mitigation in the country. Many barriers have been removed in the recent years to speed up implementation of mitigation projects. Namibia has high expectations on the ratification of the PA. There is hope that the pledges will become reality soon and needs of non-Annex I Parties will be fulfilled to enable them start implementing the identified mitigation and adaptation projects.

## Technical and capacity building needs

The flow of technical and capacity building support has been below plans made as per the BUR1. Namibia has thus recorded slow progress on furthering technical capabilities and capacity building. Conscious of this situation, the country invested in capacity building of national experts for reporting to the Convention within the grant availed by the GEF. However, this is only marginal and for reporting only while enhancing of technical capabilities and capacity building for implementation of mitigation projects remain a void that should be filled urgently. An updated list of the technical and capacity building needs since the submission of the BUR2 is provided in the BUR3 report.

## Financial Needs

Substantial funding is required to enable Namibia to meet its reporting obligations and implement the Convention. Appropriate and timely funding is essential for meeting reporting requirements at the right standard. On the other way round, funding implementation of mitigation actions as provided for within the country's development strategy and agenda has been practically inexistent. Namibia, as a developing country, faces numerous difficult challenges to maintain the welfare of its population. As such, the country will not be able to allocate adequate funding to meet the climate change agenda, even if this is of prime importance to it. Efforts, including incentives to attract private investors, have been deployed to bring in the funds needed.

Reporting has become more stringent and frequent. This demands for more serious management and a sustainable system to be put in place. Human and other resources are already lacking, and it is a fact that countries need to have a fully-fledged team dedicated to data collection, QA/QC, and report preparation. Countries should also prepare themselves for verification amongst others to meet the standards, namely the transparency component as it stands today. While it is recognized that the international community is providing some support through the implementing agencies of the GEF, these amounts are not adequate and very often, problems arise in the timing of the release of the funds.

Implementation of the Convention is even a more gigantic task because of the significant amounts of funding required to develop and implement mitigation projects. Up to now, Namibia has not tapped much funding to support its mitigation strategy. Pledges by Annex I Parties is not yet a reality and

Namibia is suffering from the impacts of climate change, experiencing now a drought running in its fourth year.

### Technology Needs Assessment and Technology Transfer Needs

Mitigation of climate change rests on the adoption of the latest technologies and its smooth transfer that demands for appropriate and sufficient human and technical capacities in addition to funds. Namibia has never been able to conduct an exhaustive assessment of its technology needs and transfer for both mitigation and adaptation to climate change, notwithstanding the cross-cutting issues, due to lack of resources. This exercise has been done piecemeal within the framework of the preparation of its national communications, when identifying potential mitigation and adaptation measures. This delayed exhaustive assessment of technology needs by the country is preventing proper evaluation of vulnerability and adaptation to climate change as well as assessment of mitigation of climate change, and the associated cross-cutting issues. This partly explains the absence of national adaptation and mitigation strategies to inform the stakeholders and to develop proper implementation plans.

## ES 6. Information on the level of support received to enable the preparation and submission of biennial update reports

### Financial

The Global Environment Facility (GEF), through the UNDP country office, the implementing agency, provided funds to the tune of USD 352 000 to support Namibia prepare its Third Biennial Update Report (BUR3) for the fulfilment of its obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The government of the Republic of Namibia through its Ministry of Environment and Tourism (MET) Department of Environmental Affairs, Division of Multilateral Environmental Agreement (MEA) contributed USD 50,000 in kind to complement the funding required to complete the BUR3 project.

### Technical

Capacity building has been a recurrent feature of the previous two BUR projects and during the preparation of the BUR3, this exercise continued with funds from the GEF and through attendance to training meetings and workshops on the subject. This filled up the need for capacity building and some initiatives, directly or indirectly have partially addressed this lack of capacity.

# Introduction

Namibia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 as a Non-Annex 1 Party. In doing so, Namibia has to abide to the obligations of the Convention, namely reporting according to Article 4, paragraph 1 and to implement the Convention through development of policies and measures designed to mitigate and to adapt to climate change. The Global Environment Facility (GEF) provided funding through the United Nations Development Program (UNDP) country office for the production of Namibia's Initial National Communication (INC), Second National Communication (SNC), the Third National Communication (TNC) and the ongoing Fourth National Communication to the UNFCCC, which are requirements of the country to fulfil its obligations under the Convention. Over and above the three national communications that have been submitted previously to the UNFCCC, Namibia has also met its commitments, further to decisions of the Conference of Parties, in preparing and submitting its First and Second Biennial Reports (BUR1 and BUR2) and Intended Nationally Determined Contribution (INDC) according to the time schedules.

Namibia is committed to bring its contribution to the pooling of efforts of the international community for combating climate change. In this context, the country has put up in place the required institutional arrangements to produce national GHG inventory reports and tackle mitigation of climate change towards stabilizing greenhouse gases in the atmosphere at a the level not detrimental to the proper functioning of natural ecosystems as earmarked in Article 2 while investing on adaptation to climate change to build resilience of the population in the medium to longer term. These institutional arrangements that are still being refined and yet to become fully-fledged are more fully described later in this National Inventory Report.

The BUR3 project built on and continued the work done under the National Communications and Biennial Update reports of Namibia. The situation has not evolved significantly as the Namibian economy remains natural resource based and is extremely sensitive to climate change impacts. The direct effects of climate change on the various economic sectors have been seriously felt in recent years in thematic areas such as water, agriculture, fisheries, ecosystems, biodiversity, tourism, coastal zone, health and energy. These impacts stemmed from prolonged droughts and in turn affected the economy and resulted in lower than normal Gross Domestic Production (GDP). This situation is not expected to improve in the future but rather to worsen, given that the global temperature increase projected in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) is above the critical limit of $2^{o}C$ that will disrupt the proper functioning of natural ecosystems.

Namibia intends to maintain these efforts so as to fully transform its economic development to one with a low carbon footprint while consolidating investments to increase its resilience in light of the AR5 projections. However, resources are lacking to implement planned measures and steps. It is thus primordial that the international community arrives at a global agreement during COP 21 in Paris which provides for sustainable support in a timely manner to Non-Annex I Parties to enable them meet their obligations and commitments for successfully addressing the threat posed by climate change.

# 1 National Circumstances

## 1.1 Introduction

This section reviews Namibia's obligation to the United Nations Framework Convention on Climate Change, discusses the current institutional arrangement and future improvements needed to address the more demanding reporting requirements of UNFCCC and reports on the national circumstances of Namibia, emphasising on key sectors, development priorities and issues related to climate change.

## 1.2 Convention Obligations

Namibia is obliged to report certain elements of information in accordance with Article 4, paragraph 1 of the Convention after it ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 as a Non-Annex 1 Party. These elements include:

(a) A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHG) not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties (COP);

(b) A general description of steps taken or envisaged by the Party to implement the Convention; and

(c) Any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculations of global emission trends.

Namibia has met its reporting obligations up to now. The country has submitted three national communications (NCs) - the initial national communication in 2002, the second national communication in 2011 and the third national communication in 2015 with support from the Global Environmental Facility (GEF) through the United Nations Development Programme (UNDP) country office. The Cancun Agreements of COP 16 in 2011 stipulated that NC reports by non-Annex I Parties, including national GHG inventories, be enhanced to include information on mitigation actions and their effects as well as support received. It was also decided that developing country Parties, consistent with their capabilities and the level of support provided for reporting, should submit Biennial Update Reports (BURs). BURs, containing updates of national GHG inventories as an inventory report and information on mitigation actions or groups of actions, needs and support received and Institutional Arrangements are produced every two years, with the first one due in December 2014 as decided in COP 17. Namibia also met this obligation and submitted its BUR1 and BUR2 in 2014 and 2016 respectively. Reporting guidelines adopted during COP 17 for the preparation of BURs from Parties not included in Annex I to the Convention and contained in annex III of decision 2/CP.17 have been adopted for the preparation of this report.

The National Climate Change Committee (NCCC), chaired by the Ministry of Environment and Tourism (MET) and comprising a wide representation of stakeholders, provided the overall oversight and advisory role for the implementation of the BUR3 project. Coordination was done by the Climate Change Unit of the MET of the Directorate of Environmental Affairs (DEA), Division of Multilateral Environmental Agreements, which is responsible for overseeing the coordination of Climate Change issues in Namibia in its role as national focal point of these Conventions.

## 1.3 Long-term vision for Namibia

Prosperity, interpersonal harmony, peace and political stability are the over-arching targeted national goals underlying the development agenda spelt out in Namibia Vision 2030, the Policy Framework for Long-term National Development of the country. The operationalization of the broad and unifying vision of the policy framework is to be achieved through a number of National Development Plans which in turn provide specific, actualised development goals, as well as strategic directions for implementation.

One of the key mandates of the current Fifth National Development Plan (NDP5) is to expedite the implementation of Namibia's development strategy with respect to identified high-level national priorities, desired outcomes, and strategic initiatives. The four priority areas identified in the NDP5 are, Basic enablers, the Economy, the Environment and the Community.

The four pillars are:

- Economic progression;
- Social Transformation;
- Environmental Sustainability; and
- Good Governance.

It is worth noting the importance given to climate change in this NDP5 with the latter being clearly identified as an area for priority action.

The stated economic priorities of Namibia in the NDP5 are Logistics, Tourism, Manufacturing and Agriculture. Again, it is worth noting that the underlying economic sectors are vulnerable to climate change.

Though not expressed on its own, climate change stands high on the agenda of Namibia. The country is highly committed to implement the Convention to play its role as a signatory Party, by contributing in the international effort to curb down emissions and increase sinks of GHGs while investing in adaptation to climate change impacts. The potential for mitigation is clearly spelled out in the INDC of Namibia while more details on the country's efforts on adaptation can be obtained from the NC3.

## 1.4 Institutional Arrangements

The Cabinet of Namibia is the Government entity entrusted with the overall responsibility for the development of Policies, including those on Climate Change. The NCCC oversees the implementation of the climate change policy, including the preparation of the reports for submission to the Convention and plays an advisory role to Government on climate change issues. It comprises representatives of the various ministries and other stakeholders such as the private sector and NGOs amongst others. MET, the official government agency acting as national focal point of the Convention, is responsible for coordinating and implementing climate change activities, including the preparation of both the National Communications and Biennial Update Reports to enable the country to meet its reporting obligations. This is done through the Climate Change Unit (CCU) established within the DEA.

The NCCC was established in 1999 by MET to follow up on further obligations to the UNFCCC and establish an action plan which would enable the country to meet the said objectives. As a formalised and multi-sectoral committee, the NCCC provides the support required by the CCU by advising and guiding it for sector-specific and cross-sector implementation and coordination of climate change activities. The NCCC is chaired by MET and the deputy chair is the National Meteorological Service of the Ministry of Works and Transport. The NCCC reports to the Permanent Secretary of MET via the head of

the DEA. The NCCC has the powers to establish working groups and subcommittees as required for implementing and conducting specific climate change activities. Such working groups have been active and very useful for overseeing and providing guidance on the different thematic areas during the preparation of previous NCs and BURs. Given that climate change has a bearing on all socio-economic sectors, various Ministries, Organizations and Agencies actively address climate change related issues either solely or in collaboration with other stakeholders as required. The CCU within MET usually directly assists these different bodies with planning, development, implementation and coordination of the activities at the local, regional and national levels as required. Existing local and regional structures also collaborate and support the implementation of climate change activities.

These existing arrangements worked well for the preparation of the first and second NCs and the first BUR. Preparation of these national communications was on an *ad-hoc* basis and did not require a permanent set-up that would have proven too onerous for the country being given the scarcity of resources. Thus, reporting on the different thematic areas was outsourced and the CCU of MET catered for the whole process until the final report had been circulated, reviewed and approved by all stakeholders concerned for submission to the Cabinet for final clearance and submission to the COP. With the enhancement of the reporting requirements that came into force since the last few years and also the required higher standards of the NCs and detailed information required for the BURs, these past institutional arrangements have become outdated. The present situation demands for a permanent structure to enable the sustainable production of these reports while guaranteeing their quality. In addition, there is a need to develop and establish permanent systems for monitoring, reporting and verifying mitigation actions (MRV) and other activities related to the Convention so that Namibia may honour its MRV engagements on both the national and international fronts. Additionally, there will also be the need to keep track of the implementation of the INDC post 2020.

Conscious that the existing institutional arrangements were no longer appropriate and suitable under these new circumstances, MET embarked on a full exercise of reviewing the existing set-up towards developing and implementing new and more robust institutional arrangements for meeting the enhanced and more frequent reporting obligations, including the production of BURs.

One important decision was to shift from outsourcing the different elements of the Convention reports to having them produced in-house. The exercise started after the decision taken during COP 17 in 2012. While the NCCC and the CCU were kept in place, an institutional mapping was done by the latter, which kept the responsibility of coordinating the production of the reports, to identify all stakeholders who would have a role and contribution to bring in the production of better quality NCs, the BURs and development of the MRV system. A round of one on one institutional consultations to engage stakeholders was made and this was followed by formalization through official letters inviting nominations of representatives. Nominees were then called for a brainstorming session to present them the new needs for meeting reporting standards, to discuss implications for the institutions and agree on their role, contribution and responsibilities, namely for the major GHG inventory component. It became evident during these consultations that there existed a serious lack of capacity. The consensus was to make an attempt, with minimal outsourcing. Concurrently, this will serve for capacity building to enable the stakeholders assume their new responsibilities.

Within the planned institutional arrangements, there will be a sharing of responsibilities with the coordinating body taking on most of the planning, preparation, quality control, archiving, evaluation and validation and the other stakeholders concentrating on the preparation of the more technical components, including data collection and validation, performing technical tasks like compilation of the GHG inventory, producing draft reports and documenting these.

During the exercise of strengthening of the existing institutional arrangements, numerous and very daunting challenges cropped up. The most urgent ones were:

- Insufficient capacity of the coordinating body as well as lack of institutional and technical skills within the different thematic areas of the NC;
- To maintain a motivated permanent coordinating body and/or personnel;
- Staff scarcity / unavailability in collaborating institutions due to their already overloaded schedules and staff turn-over; and
- Lack of incentives and adequate funds to develop and maintain the system in place.

It was also evident that the development and implementation of robust institutional arrangements will take considerable time to become fully operational and run smoothly. It is anticipated that this will take two to three rounds of BURs and NCs. The new institutional arrangements are provided in detail in the MRV chapter of this report.

## 1.5 Geographical Characteristics


The Republic of Namibia is situated in the south-western region of the African continent and lies between latitude 17° and 29°S and longitude 11° and 26°E. The country covers a land area of 825,418 km$^2$ and has a coastline 1,500 km long on the South Atlantic Ocean. Namibia shares borders with Angola in the North, Zambia in the north-east, Botswana in the east and South Africa in the south.

Namibia consists of five geographical areas, namely, the central plateau, the Namib Desert, the Great Escarpment, the Bushveld and the Kalahari Desert

The physical geographic context of Namibia is determined by its position at the border of the continental shelf of the southern African subcontinent in the climatic sphere of influence of the Tropic of Capricorn and the cold Benguela Current. The land surface ascends from the Namib Desert to the mountains of the continental border range with peaks at 2,606 metres above mean sea level (mamsl). To the east and north the country then descends into the Kalahari Basin with a mean altitude of 1000 mamsl.

## 1.6 Climate

Namibia is one of the biggest and driest countries in sub-Saharan Africa. It is characterized by high climatic variability in the form of persistent droughts, unpredictable and variable rainfall patterns, variability in temperatures and scarcity of water. The climate of Namibia is a consequence of the country's location on the south-western side of the African continent, situated at the interface between different climate systems. The cold Benguela Current along the west coast and Namibia's position, straddling the sub-tropical high-pressure belt, determine the main features of the climate. The Benguela Current brings in cold water to its western shores. The climate of the northern part of the country is influenced by the Inter-Tropical Convergence Zone (ITCZ) and the Mid-Latitude High Pressure Zone, while the southern part of the country lies at the interface between the Mid-Latitude High Pressure Zone and the Temperate Zone. The different seasons experienced in Namibia are driven by the

northward and southward movements of these zones, in response to the apparent movement of the sun.

The cold water from the western shores (Benguela Current) is adverted from the south and is partly driven by a high-pressure system over the South Atlantic. The combination of cold water and high pressures leads to subsidence of cold dry air over much of the country which commonly suppresses rainfall. This situation is dominant during most of the year, except in summer when heating of the continent is greatest and the southerly position of the ITCZ draws moisture and rainfall from the tropics over northern and eastern Namibia. Therefore, the ITCZ and the Temperate Zone bring rainfall, while the Mid-Latitude High Pressure Zone brings drier conditions.

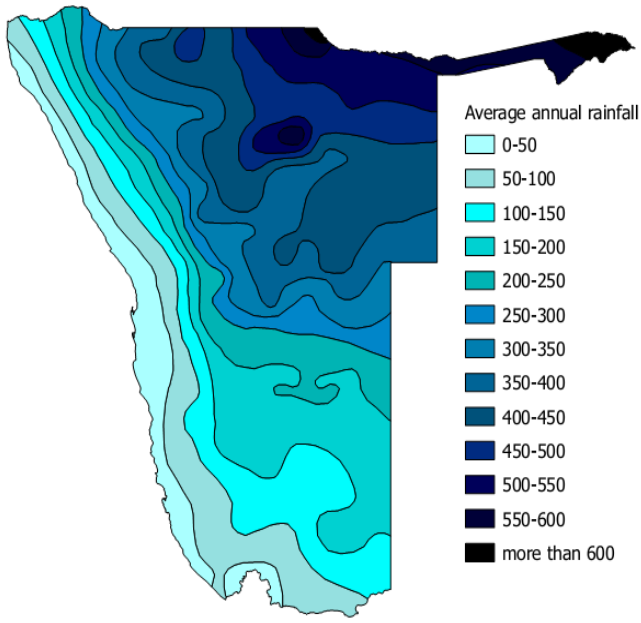



**Figure 1.1 - Distribution of average annual total rainfall in Namibia**

The movement of the ITCZ towards the south during the Namibian summer results in the rainfall season, normally starting in November and ending in April. In the far south, the Temperate Zone is moving northwards during the winter, resulting in the winter rains that occur in the far south-west of the country. Small variations in the timing of these movements result in the considerable differences in the weather experienced in Namibia from one year to another.

The mean annual rainfall ranges from just above 600 mm in the north-east to less than 25 mm in the south-west and west of the country (Figure 1.1). The rainfall isohyets generally follow a gradient from the north-east to the south-west. There are exceptions from this general pattern, e.g. the maize triangle of Tsumeb, Grootberg and Otavi receives more rainfall than would be expected in that geographic location. The reason for this is the undulating topography, which gives rise to orographic rainfall. On the other hand, the coastal zone receives almost no rainfall at all.

Most rain occurs in the summer months of November to April in the form of localized showers and thunderstorms. In the extreme south-west, winter rain and even snow can be expected between June and August. The inter-annual coefficient of variation of rainfall is very high, ranging from 25% in the north-east to >80% in the south-west. At some places in the southern parts of the country, winter rains account for up to 50% of annual rainfall. In the western part of the Namib Desert, coastal fog is an important source of water for the desert fauna and flora. Fog precipitation is five times greater than that of rain and is far more predictable.

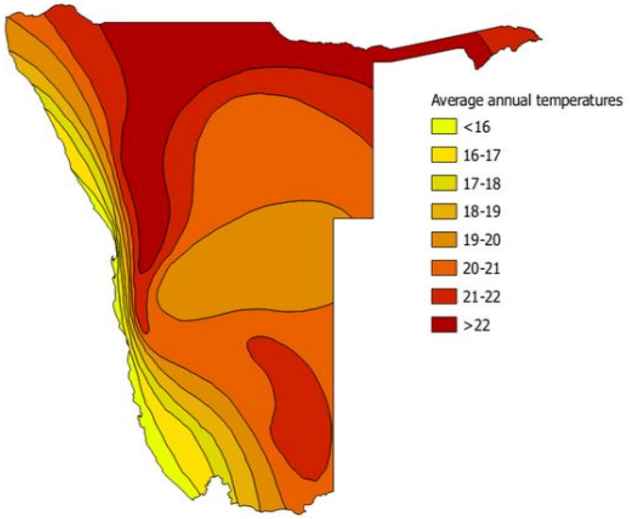



**Figure 1.2 - Average annual temperature in Namibia**

Namibia is characterized by high temperatures (Figure 1.2). Apart from the coastal zone, there is a marked seasonal temperature regime, with

the highest temperatures occurring just before the wet season in the wetter areas or during the wet season in the drier areas.

The lowest temperatures occur during the dry season months of June to August. Mean monthly minimum temperatures do not, on average, fall below 0°C. However, several climate stations in the central and southern parts of Namibia have recorded individual years with negative mean minimum monthly temperatures, and individual days of frost occur widely.

From a hydrological point of view, Namibia is an arid, water deficient country. High solar radiation, low humidity and high temperature lead to very high evaporation rates, which vary between 3,800 mm per annum in the south to 2,600 mm per annum in the north. Over most of the country, potential evaporation is at least five times greater than average rainfall. In those areas where rainfall is at a minimum, evaporation is at a maximum. Surface water sources such as dams are subjected to high evaporation rates.

Wind speeds are generally low in Namibia. Winds exceed a mean speed of 3 m/s only at the coast and exceed a mean speed of 2 m/s only at isolated climate stations inland, e.g. Keetmanshoop. These winds, and the occasional stronger gusts, do not cause any real problem apart from some wind erosion in the drier parts of the country during the driest part of the year. Away from the coast, relative humidity averages between 25% and 70%.

Despite its very dry climate, Namibia holds a remarkable variety of species, habitats and ecosystems ranging from deserts to subtropical wetlands and savannas. Namibia is one of the very few countries in Africa with internationally-recognized “biodiversity hotspot”. Namibia’s most significant “biodiversity hotspot” is the Sperrgebiet, which is the restricted diamond mining area in the Succulent Karoo floral kingdom, shared with South Africa. The Succulent Karoo is the world’s only arid hotspot. It constitutes a refuge for an exceptional level of succulent plant diversity, shaped by the winter rainfall and fog of the Southern Namib Desert. A large portion of its plants is endemic (MET, 2001) and climate change is a serious threat to this biodiversity.

## 1.7 Water Resources

Namibia is the driest country in Southern Africa. Water is a scarce resource and one of the major primary limiting factors to economic development in Namibia. The effects of climate change, rapid population growth, and rural exodus pose additional challenges and threaten people’s livelihoods as well as the balance of the ecosystems. Namibia’s rainfall is skewed, with the north-east getting more that the west and south-western parts of the country. Namibia’s international boundaries are marked by the Kunene River in the north-west, the Okavango River in the central north, the Zambezi and Kwando rivers in the north-east and the Orange River in the south. Perennial surface water resources are found only in these rivers which are all shared with neighbouring riparian states with an obligation for them to be managed according to the relevant rules of international water law.

Of the water that Namibia receives as precipitation, it is estimated that only 2% ends up as surface run-off and a mere 1% becomes available to recharge groundwater. The balance of 97% is lost through direct evaporation (83%) and evapotranspiration (14%). Rainfall often evaporates before it reaches the ground. Another source of moisture comes from fog in the cooler coastal regions where it is an extremely valuable source of moisture to desert animals and plants.

The primary sources of water supply are perennial rivers, surface and groundwater (alluvial) storage on ephemeral rivers, and groundwater aquifers in various parent rocks. Additionally, unconventional water

sources have been adopted to augment the limited traditional sources. About 45% of Namibia's water comes from groundwater sources, 33% from the Border Rivers, mainly in the north, and about 22% from impoundments on ephemeral rivers (Christelis and Struckmeier, 2001).

## 1.8 Agriculture and Forestry

The share of Agriculture and Forestry in GDP has been gradually decreasing over the years and stood at 3.9% in 2014, down 2.3% from the 2005 level of 6.2% (Figure 1.3) (NSA, Annual National Accounts 2014 and 2016). However, despite its modest contribution in the country's GDP, agriculture impacts directly on the livelihood of 70% of the population. The production of white maize, wheat, pearl millet and livestock including cattle, goat and sheep is divided in the intensive commercial production units and the extensive communal production system. The commercial sector though occupying 44% of land involves only 10% of population while the communal sector occupies 41% of the land and involves 60% of the population.

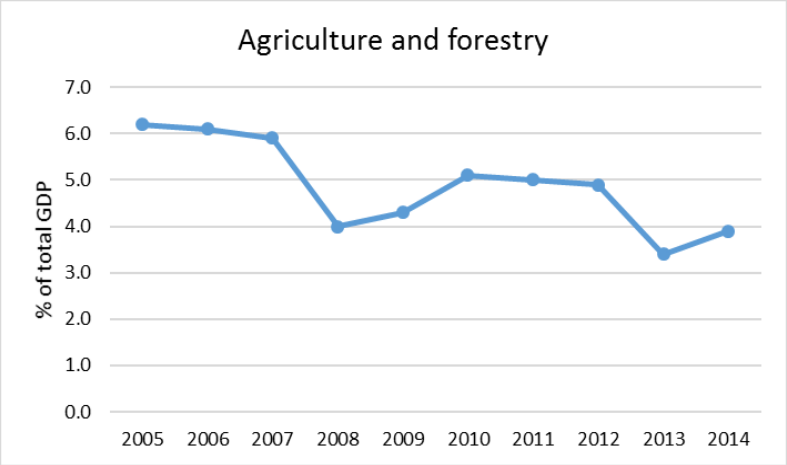



**Figure 1.3 - Contribution of agriculture and forestry to national GDP**

Approximately 48% of Namibia's rural households depend on subsistence agriculture as their main source of income (NDP4). The majority of rural communities, particularly in the higher rainfall areas of the north, depend directly on forest resources for use as fuel wood, building materials, fodder, food and medicine. It is necessary to ensure the systematic management and sustainability of forest resources.

The variability of climate, particularly rainfall, has a profound impact on the availability aspect of food security. The recent droughts at the start of this decade have highlighted this important feature of the Namibian society. A 2013 survey by the FAO has revealed that 330,000 people particularly in the poor north-western areas are food insecure and a further 447,000 moderately food insecure. This situation also puts pressure on forest resources.

### 1.8.1 Communal-area conservancies

Community conservation in Namibia covers over 159,755 $km^2$ which is about 52.2% of all communal land with about 172,000 residents. Of this area, communal-area conservancies manage 158,247 $km^2$ which is about 19.2% of Namibia. From 1991 to 2012, community conservation has contributed about N$ 2.9 billion to Namibia's net national income. During the year 2012 alone, community conservation generated over N$ 58.3 million for local communities. In the same year, community conservation facilitated 6,477 jobs and 55 conservancies had a total of 99 enterprises based on natural resources (NACSO, 2012). Community conservation also helps in building resilience to climate change.

### 1.8.2 Community forests

At the end of 2012, there were 32 registered community forests in Namibia. The use of all indigenous plant resources is regulated by the Directorate of Forestry (DoF) within the Ministry of Agriculture, Water Affairs and Forestry. The Forestry Act of 2001 and the Forestry Amendment Act of 2005 enable the registration of community forests through a written agreement between the Directorate and a

committee elected by a community with traditional rights over a defined area of land. The agreement is based on an approved management plan that outlines the use of resources. All residents of community forests have equal access to the forest and the use of its produce. Community forests have the right to control the use of all forest produce, as well as grazing, cropping and the building of infrastructure within the classified forest (NACSO, 2012). These enactments and the declaration of community forest contributed significantly in forest management, reducing forest degradation while optimizing the exploitation of forest resources by the communities.

## 1.9 Fisheries

Namibia has one of the most productive fishing grounds in the world, primarily attributed to the Benguela Current. The up-welling caused by the current brings nutrient-rich waters up from the depths that stimulate the growth of microscopic marine organisms. These in turn support rich populations of fish, which form the basis of the marine fisheries sector. As is the case in other up-welling systems, relatively few species dominate, and their abundance can vary greatly in response to changing environmental conditions. Over 20 commercially important fish species are landed using various fishing methods. The off-shore commercial fishery represents the largest component of the fishing industry. Small pelagic (open-water) species (pilchard, anchovy and juvenile mackerel) and lobster are fished along the shallower onshore waters on the continental shelf. Large pelagic species including adult mackerel, demersal (bottom dwelling) hake and other deep-sea species, such as monkfish, sole and crab, are fished in the waters further offshore.

Since independence in 1990, the fishing industry has grown to become one of the pillars of the Namibian economy. The commercial fishing and fish processing sectors significantly contribute to the economy in terms of employment, export earnings, and contribution to GDP. The sector is a substantial export earner, with over 85% of Namibia's fish output destined for international markets. It is to be noted, however, that the contribution of the fishery sector to national GDP has been shrinking since 2005, when it stood at 4.2%, to reach the level of 2.8% in 2014, that is, a reduction of 33.3% (Figure 1.4)(NSA, Annual National Accounts 2014 and 2016).

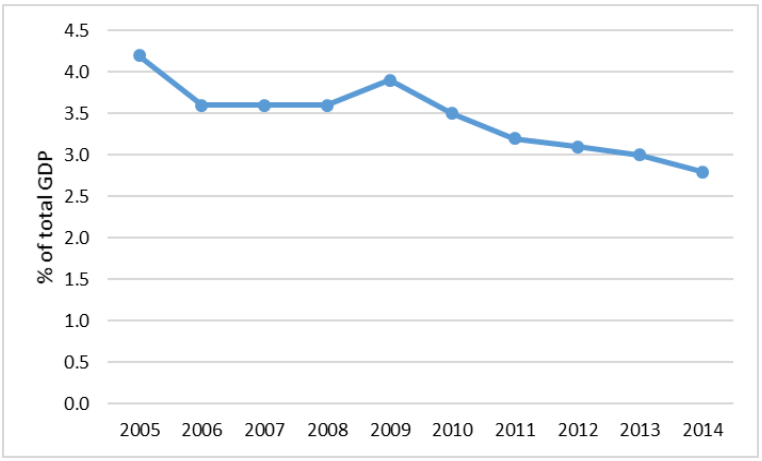



**Figure 1.4 - Contribution of fishing and fish processing on board to national GDP**

## 1.10 Mining

Namibia is known world-wide for producing gem quality rough diamonds, uranium oxide, special high-grade zinc and acid-grade fluorspar, as well as a producer of gold bullion, blister copper, lead concentrate, salt and dimension stone. Mining is one of the major contributors of Namibia's national

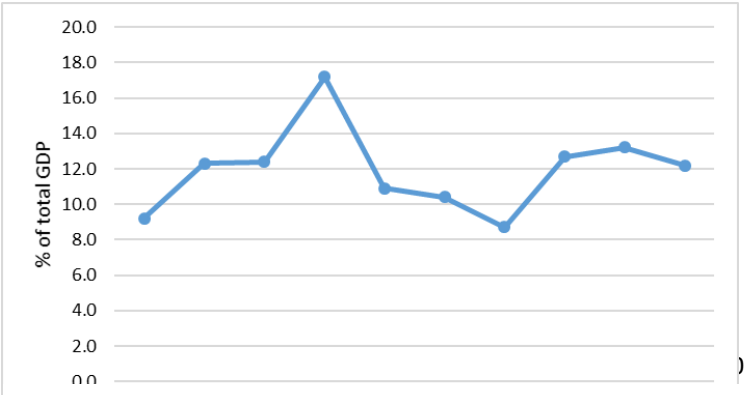



**Figure 1.5 - Contribution of mining and quarrying to national GDP**

economy with 12.2% of the country's Gross Domestic Product (GDP) in 2014 from 9.2% in 2005 (Figure 1.5) (NSA, Annual National Accounts 2014 and 2016).

## 1.11 Manufacturing

Namibia's manufacturing sector is inhibited by a small domestic market, dependence on imported goods, limited availability of local capital, widely dispersed population, small skilled labour force with high relative wage rates, and subsidized competition from South Africa. The manufacturing sector, a priority sector under the NDP4 contributed 10.0% to national GDP in 2014 (Figure 1.6). This performance was supported mainly by the following six sub-sectors[1] - Beverages, Other food products, Basic non-ferrous metals, Chemical and related products, Grain Mill products, Diamond processing, Fabricated Metals which together accounted for 72% of the manufacturing share of GDP in 2014. It is to be noted, however, the total share of the manufacturing sector in GDP shrunk by 5.7% over the period 2007 to 2014.

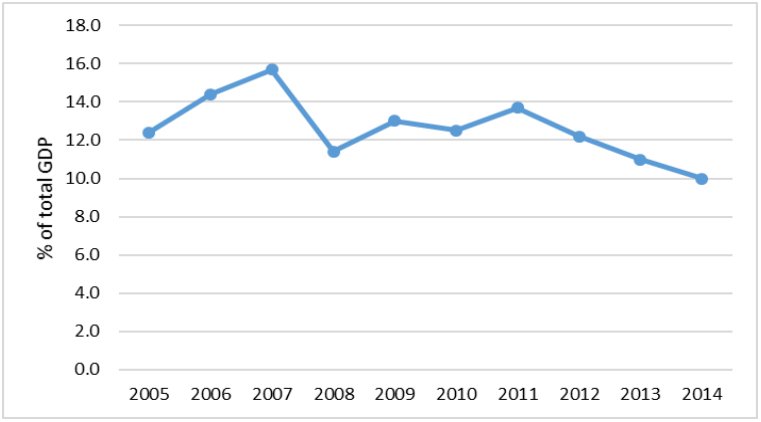



**Figure 1.6 - Contribution of manufacturing to national GDP**

## 1.12 Energy

The most dominant energy source in Namibia is liquid fuel which includes petrol and diesel and accounts for about 63 % of total net energy consumption which is mainly used in the transport sector, followed by electricity with 17 % net consumption, coal with 5 % and the remaining 15 % from other sources of energy such as solar, wood and wind energy among others. Namibia does not produce or export any fossil fuel though it is planned to exploit natural gas from the recently discovered Kudu gas reserve. Most of the fossil fuels are imported from South Africa.

Currently, Namibia's electricity demand stands at 597 MW, and grows at an annual energy consumption rate of 3 %. On the supply side, Namibia has currently only 3 major power generation stations, with an installed capacity of about 500 MW. The biggest one is the Ruacana Hydro Power station which generates about 332 MW of electricity, Van Eck Coal power station generates about 120 MW and the Paratus and Anixas diesel power stations at the coast with 24 MW and 22.5 MW respectively (Konrad *et al*., 2013). The local supply does not meet the demand. Currently, Namibia imports most of this difference from South Africa and other Southern Africa Development Community (SADC) member states. A special arrangement between the Namibian power utility NamPower and Eskom, the South African Power utility, enables Namibia to buy and utilize electricity from South Africa at affordable rates, with ZESCO in Zambia providing most of the remaining balance. NamPower also imports on a smaller

[1] Other sub-sectors include Non-metallic minerals products, Other manufacturing, Meat processing, Rubber and Plastics products, Wood and wood products, Textile and wearing apparel, Publishing and Printing, Leather and related products

scale from Zambia for supply to the Caprivi region and exports on a small scale to Angola and Botswana (Annual National Accounts, 2012).

Studies have shown that energy consumption is related to and also acts as a driver to economic growth and GDP production. This implies that increasing energy production of the country should be one of the high priority objectives on the economic developmental agenda, so that the development plan in place is not slowed by energy shortage. The policy is thus geared towards increasing the energy supply in Namibia through:

- Sustained and improved energy infrastructure;
- Expanded energy research and development;
- Increased energy efficiency awareness; and
- Increased investment in energy sector.

The strategy aims at increasing the exploitation of local energy resources for electricity generation to reduce the country's dependence on foreign sources as well as to increase the share of renewable energy in the future energy mix. Namibia intends to tap solar and wind energy resources in the future while concurrently exploiting efficiently the invasive bush as a biomass energy source since the latter is proving so detrimental to the livestock sector productivity and development.

## 1.13 Transport

Namibia's road network is regarded as one of the best on the continent with road construction and maintenance being at international standards. Namibia has a total road network of more than 64,189 km, including 5,477 km of tarred roads which link the country to the neighbouring countries Angola, Botswana, South Africa, Zambia and Zimbabwe. The management and maintenance of the national road network is the responsibility of the Roads Authority under the Roads Authority Act, 1999 (Act 18 of 1999).

The country has two ports which handle imported and exported goods and service the fishing industry. The only deep-sea harbour is Walvis Bay in the Erongo Region and the other harbour is Luderitz in the Karas Region. The Port of Walvis Bay receives approximately 3000 vessels each year and handles about 5 million tonnes of cargo.

Passenger transport is mainly carried out by minibuses and sedans and is increasing in intensity. For business people and tourists, air travel has become a more important means of transport to bridge the long distances. As of December 2013, Namibia had a total of 300,045 vehicles, representing an increase of 66,405 as compared with March 2007, when there was a total of 233,640. Out of the total number of vehicles 43.8% of them are light passenger motor vehicle (less than 12 persons), closely followed by light load vehicle (GVM 3500 kg or less), with 43.5%.

The railway network comprises 2382 km of narrow-gauge track with the main line running from the border with South Africa via Keetmanshoop to Windhoek, Okahandja, Swakopmund and Walvis Bay. Omaruru, Otjiwarongo, Otavi, Tsumeb and Grootfontein are connected to the northern branch of the railway network.

## 1.14 Tourism

Over the years, supported by Namibia's unique landscapes and biodiversity, tourism has been developing into an important sector, contributing both directly and indirectly to national GDP. In 2014, a total of 1,32 million tourists visited Namibia which represents a 34.1% increase from arrivals recorded in 2010 (Figure 1.7). According to the WTTC (2015), the direct contribution of Travel & Tourism to GDP in 2014 was N$ 3.8 billion (3.0% of GDP) while the direct and indirect impact of tourism amounted to N$ 18.4 billion (14.9% of GDP). This primarily reflects the economic activity generated by industries such as hotels, travel agents, airlines and other passenger transportation services (excluding commuter services) and also includes, for example, the activities of the restaurant and leisure industries directly supported by tourists. (WTTC, 2015, Travel and Tourism: Economic Impact 2015 (Namibia)).

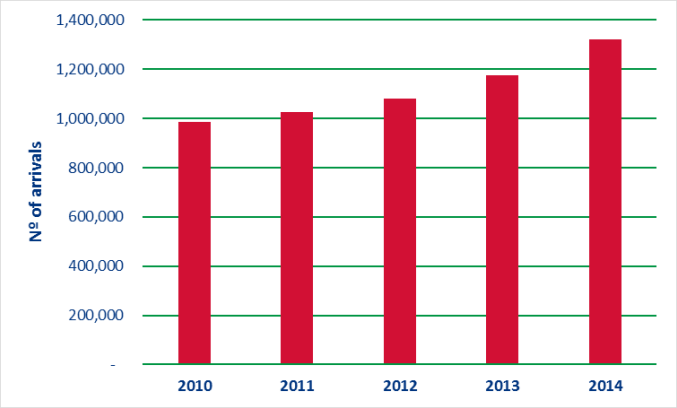



**Figure 1.7 - Number of Tourist Arrivals in Namibia**

Tourism also generates an important number of employments, often in rural areas where it is otherwise difficult to obtain a job. The sector also plays in important role in the reduction of poverty in rural area through employment and income injection, especially in conservancies.

Being reliant on the wildlife and scenery potential of Namibia, the tourism industry is thus vulnerable to the adverse impacts that climate change may have on these resources.

## 1.15 Waste

Namibia, as a medium income country with a growing wealthy urban middle class and significant urban drift, is feeling the pressure of amounts of waste generated on its facilities throughout the country and more especially in the urban areas. Solid municipal waste is dumped in landfills or open dumps while almost all urban settlements are connected to reticulated waste water treatment systems. Management of the landfills and dumps are not of the highest standards and very often, the waste is burnt in the open dumps to reduce the volume or reduce health risks. Additionally, in most areas there is no segregation of waste and no separate landfills or dumps implying that industrial waste is dumped along with municipal waste.

The evolution of household solid disposal for the period 2001 to 2014 is illustrated in Figure 1.8 and its salient facts are summarised below:

(i) The general trend for regular collection of waste has been for an increase from 30.9% in 2001 to 36.1% in 2014, with a peak of 37.2% in 2011.
(ii) The amount of waste which is collected in an irregular way decreased from 11.5% in 2001 to 4.8% in 2014.
(iii) Burning is the waste disposal practice which experienced the most important change, increasing from 18.0% in 2001 to 34.4% in 2014, peaking at 37.8% in 2011.
(iv) Roadside dumping decreased from 14.7% in 2001 to 9.7% in 2014.
(v) Disposal of waste in rubbish pits decreased from 20.3% in 2001 to 9.7% in 2014.

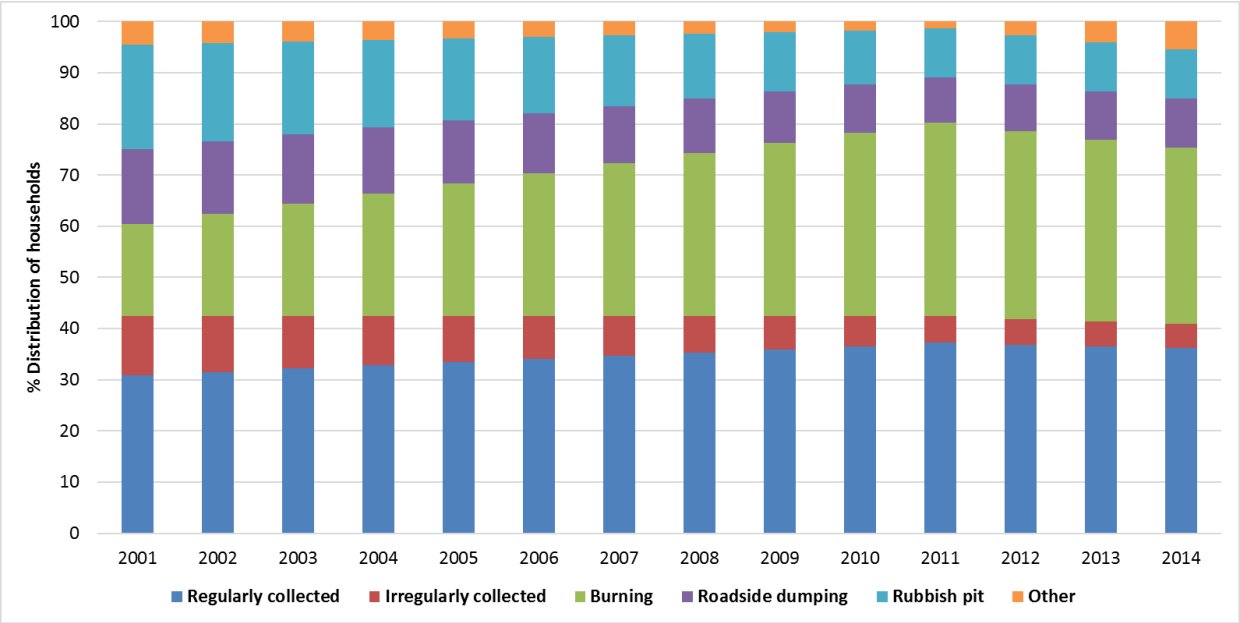



**Figure 1.8 - Percentage distribution of households by means of waste disposal (2001 – 2014)**[2]

## 1.16 Economic Indicators

Since 2010, Namibia has been recording stable GDP annual growth of above 5% and reached a GDP of N$ 138.763 billion in 2014 (US$ 1.786 billion). This was achieved through a stable annual growth varying between 5.1 and 6.4% after the harshest impact of the world financial crisis in 2009 (Figure 1.9).

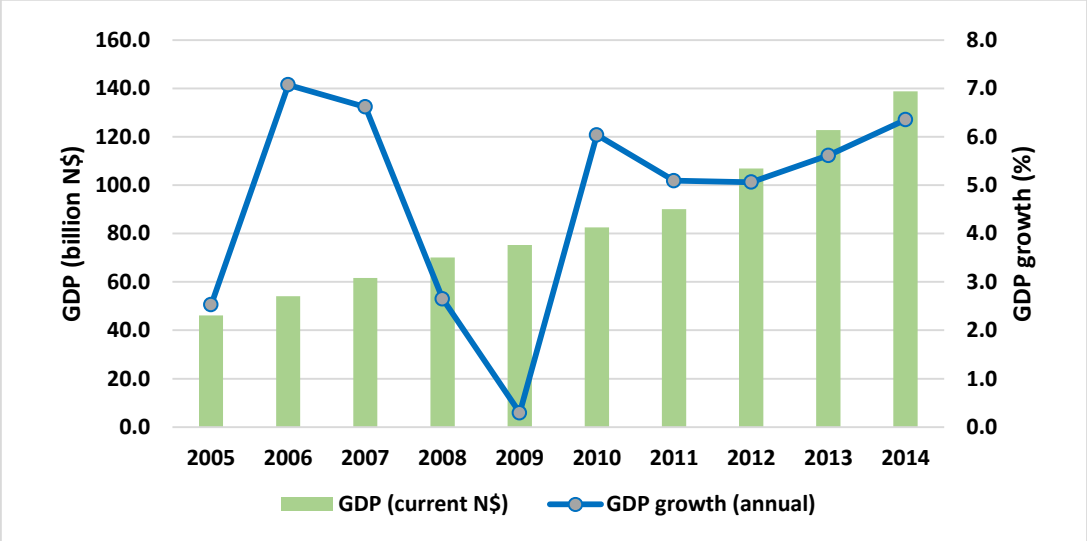



**Figure 1.9 - evolution of the GDP of Namibia as well as annual GDP growth for the period 2005 to 2014**

In 2014 Namibia recorded a GDP per capita of N$ 58,525 (US$ 5,393), classifying thus Namibia as a middle-income economy in 2014. However, with a GINI index of around 60 (2010 World Bank estimate),

[2] Namibia 2001 and 2011 Population and Housing Census Main Reports, Namibia Inter-censal Demographic Survey 2016 Report

Namibia remained among the ten countries with the world's highest inequality in the distribution of family income.

It was estimated that in 2010, around 29% of the population lived below the national poverty line. Furthermore, poverty is even more pronounced in the largely rural northern regions of Kavango, Oshikoto, Zambezi, Kunene and Ohangwena with more than one third of the population in these regions being poor (Republic of Namibia, 2015).

According to The Namibia Labour Force Survey 2014 Report (NSA, 2015) Namibia had an economically active labour force of 990,998 persons, among which 712,752 employed. Agriculture was by far the most important source of employment since it accounted for 31.4% of employed persons, the second sector being Whole sale and retail trade with 11.6% of employed persons.

According to the same report, unemployment stood at 28.1% (male=24.3%; female = 31.7%). It is to be noted that youth (15-34 years) unemployment was even higher, with 39.2% unemployed.

The Namibia Labour Force Survey 2014 Report also showed that 30.1% the employed population are in vulnerable employment. Most of the vulnerable workers are subsistence/communal farmers (47.6%) and other own account workers (32.0%), the remaining being unpaid family labour (20.2%). The persons in vulnerable employment are more at risk than others, because these people are unlikely to have formal work arrangements or access to benefits or social protection programmes, and they are more at risk to the effects of economic cycles (NSA, 2015).

## 1.17 Population

According to the Namibia Inter-censal Demographic Survey (NIDS) of 2016, the total population of Namibia was estimated at 2,324,388 people, a 10% increase compared with National Population and Housing census of 2011 which estimated the total population of Namibia at 2,113,077.

According to the NIDS 2016:

- Woman outnumbered man with 1,194,643, compared to 1,129,754.
- 14% of the population is under 5 years, 23% between the ages of 5 and 14, 57% between the ages of 15 - 59 years, and only 6% is 60 years and above.
- A total of 48% of Namibia's population lived in urban areas, while 52% of the population lived in rural areas. The urban population grew by 11.6% between 2011 and 2016, while the rural population decreased by 8.8% over the same period. This trend illustrates the high rates of rural-urban migration in Namibia.
- The population density is low at 2.8 people per square kilometre at national level. In the Khomas Region, where the nation's capital is situated, the population density stood at 11.8 persons per square kilometre and the most highly populated region was Ohangwena with 23.9 persons per square kilometre.

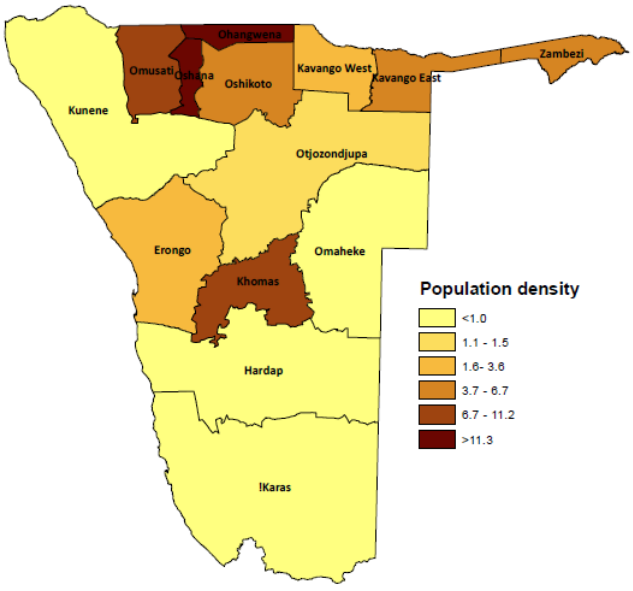



**Figure 1.10 - Map showing population density of Namibia**

- 54% of households are headed by males and 46% by females.

## 1.18 Health

Namibia's provision of health services is shared between the public and the private sector, the latter focusing on urban areas. The Ministry of Health and Social Services has prioritized the implementation of three health Millennium Development Goals, namely goals 4, 5, and 6: to reduce child mortality, improve maternal health, and combat HIV/AIDS, malaria and other diseases, respectively.

Statistics on life expectancy for males and females show two distinct phases: a phase of decline (from 1990 to 2004), and a phase of increase (from 2004 to 2013). Between 1990 and 2004 life expectancy for males and females decreased by 9 and 12 years, respectively, mainly due to the HIV/AIDS epidemic, while between 2004 and 2013 the trend was reversed, life expectancy rising by 11 years for females but only by six years for males. Life expectancy for males in 2013 was still below 1990 levels (IHME, 2016) (Figure 1.11).

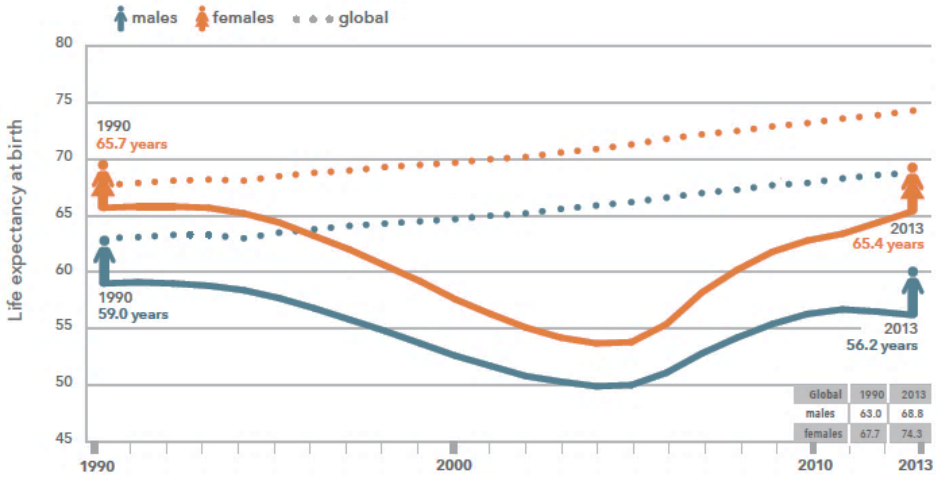



**Figure 1.11 - Life expectancy for males and females, Namibia, 1990–2013**

Source: IHME, 2016

The leading causes of disease burden (disability and premature mortality) in Namibia in 2013 (IHME, 2016) were: (i) HIV/AIDS, (ii) tuberculosis and (iii) lower respiratory infections.

Approximately 12% of the total Namibian population aged 15-49 is living with HIV/AIDS (CDC,2018). However, recent data show dramatic progress in Namibia toward HIV epidemic control. For example, results from the first Namibia Population-based HIV Impact Assessment (NAMPHIA) show that 77% of all HIV-positive adults have achieved viral load suppression, projected to surpass the Joint United Nations Programme on HIV/AIDS (UNAIDS) target of 73% by 2020 (CDC, 2018). Nonetheless, NAMPHIA results also suggest that women aged between 15 and 24 still have a far higher HIV incidence rate (0.99%) than same-aged young men (0.03%) in the country. This highlights the continued need for expanded primary HIV prevention in young women.

TB remains a serious concern in Namibia, which has one of the highest case notification rates in the world. The country now faces the new challenges caused by the emergence of multidrug-resistant TB and the growing problem of extensively drug-resistant TB which affect negatively the capacity for management of identified cases (WHO, 2016). It is to be noted that the very high incidence of tuberculosis in Namibia is fuelled by the HIV/AIDS epidemic, 38% of TB patients with known HIV-status being also HIV-positive in 2016 (CDC, 2018).

Malaria is one of the major health problems. However, year-on-year incidences of malaria are highly variable, and closely correlated with the prevailing temperature, rainfall and humidity. Malaria is endemic in parts of the north-central and north-eastern regions. In contrast, in north-western and parts of central Namibia, malaria transmission is seasonal and follows the onset of rains; these unstable occurrences increase the risk of malaria epidemics.

Infant and child mortality is comparatively low, but the maternal mortality ratio has increased, despite the fact that over 70% of births are delivered in hospitals. General life expectancy has not improved, partly because of the HIV/AIDS epidemic. Malnutrition levels in children under the age of five years are as high as 38% in some regions. The five leading causes of inpatient deaths (all age groups) are HIV/AIDS, diarrhoea, tuberculosis, pneumonia and malaria.

# 2 Greenhouse Gas Inventory

## 2.1. The inventory process

### 2.1.1 Overview

Under Article 4.1 (a) of the Convention, each party has to develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties. This inventory has been prepared to the extent of the country's capabilities and using recommended methodologies of the IPCC which have been agreed upon by the Conference of the Parties.

The process of preparation of the present inventory started late 2017. One year was allocated to implement and complete the different steps of the inventory cycle as depicted in Figure 2.1. Funding under the climate change programme of the Global Environment Facility through its implementing agency, the United Nations Development Programme (UNDP), provided the financial support for the preparation of this sixth national GHG inventory reported in the third national Inventory Report (NIR3).

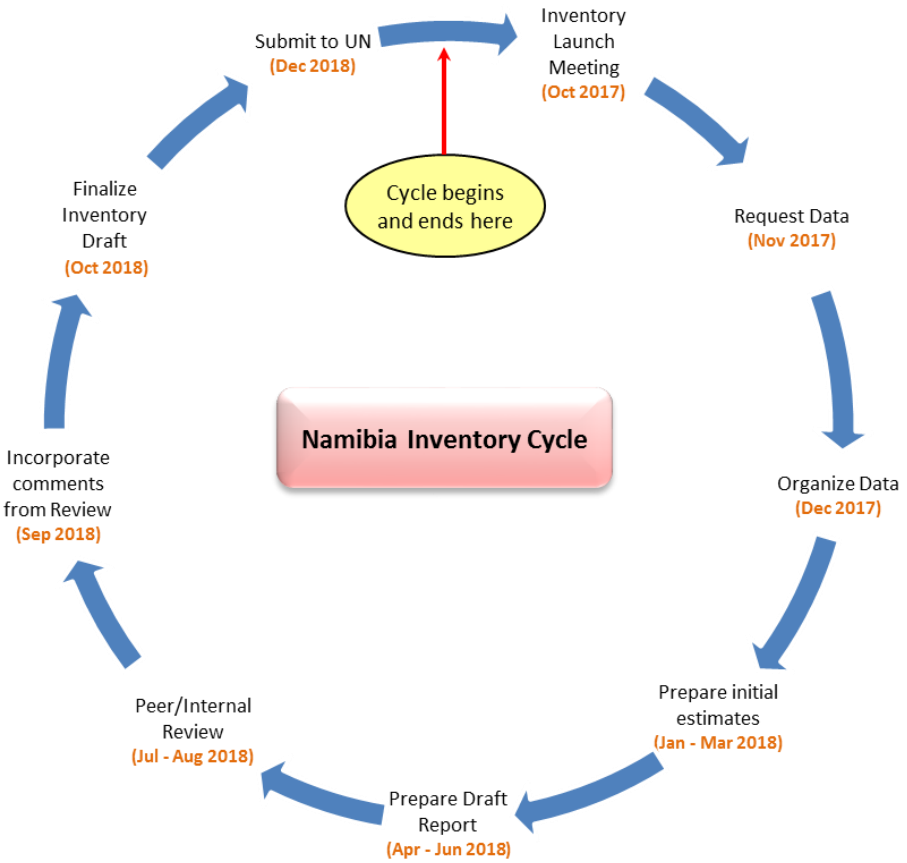



**Figure 2.1 - The inventory cycle of Namibia's BUR3 GHG inventory**

The Initial and Second National Communications of the Republic of Namibia to the United Nations Framework Convention on Climate Change included the National Inventory of greenhouse gases. for base years 1994 and 2000. These inventories were compiled using the *Revised 1996 IPCC Guidelines for*

*National Greenhouse Gas Inventories* (IPCC, 1997). These inventories have all been compiled using the sectoral bottom-up approach, Tier 1 level, and the GHG Inventory software. The reference approach has also been used for the Energy sector, to enable comparison of the two methods. The gases addressed were carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), oxides of nitrogen ($NO_x$), sulphur dioxide ($SO_2$), non-methane volatile organic compounds (NMVOCs) and the precursor carbon monoxide (CO). A third Inventory has been compiled using a mix of Tiers 1 and 2 for the first Biennial Report and submitted to the UNFCCC in 2014. The fourth and fifth inventories have been submitted as stand-alone national inventory reports. The IPCC 2006 Guidelines and software were used for compiling these inventories.

This sixth GHG inventory is presented as a stand-alone national inventory report as an accompanying document to the third Biennial Update Report. It provides data on GHG emissions by sources and removals by sinks for a full time series for the period 1994 to 2014. This inventory is exhaustive to the maximum, covering all source categories as far as possible, at the detailed level most appropriate for the country. Once again, a mix of Tiers 1 and 2 has been adopted.

### 2.1.2 Institutional arrangements and inventory preparation

From outsourcing its first and second inventories, Namibia started to institutionalise the compilation of its inventories with the one published in the BUR 1, with the support of an external consultant for capacity building, for enhanced transparency and meeting the higher requirements of reporting. This exercise continued with the inventories presented in the NIR2 to further improve, implement and consolidate the GHG inventory system being developed. The process of preparation of the present inventory and NIR3 by the GHG inventory team is still a very laborious exercise as resources and human capacities continued to be limiting factors. Furthermore, there has been numerous changes in the team following staff movements, promotions and resignations. Thus, there still exist shortcomings in this inventory but the country is committed to strive to further raise the quality of future GHG inventories through strengthening of the GHG inventory system.

The Climate Change Unit (CCU) of the Ministry of Environment and Tourism has the responsibility for overlooking the production of reports to the Convention, including the GHG inventories in its capacity as National Focal Point of the Convention. This unit is supported by one individual team for dealing with the four IPCC sectors under the guidance of the international consultant. Cross-cutting issues are attended for when the four teams meet during the capacity building workshops. The detailed institutional arrangements are reported under the MRV emissions section of the MRV chapter of this BUR3.

The inventory preparation started in January 2018 due to delays in the availability of funds. A work plan with timeframe and responsibilities was drawn for the preparation of the inventory using a mix of Tiers 1 and 2. AD were collected for the years 1994 to 1999, 2013 and 2014 to update the existing series and meet the timing requirement for the BUR 3. The collected AD were processed and sectoral experts of the inventory team computed emissions and performed recalculations as necessary under the supervision of the external consultant. This exercise took place during a three-day workshop with the external consultant providing the support for identifying improvement areas relative to data availability and quality, appropriateness of EFs, gaps and constraints. Drawbacks and shortcomings were addressed to maintain smooth implementation of the inventory cycle. The 2006 IPCC Guidelines *for National Greenhouse Gas Inventories* (IPCC, 2007) were used with the most appropriate IPCC default EFs. Default EFs were likewise assessed and these were derived or amended in some cases to reflect national

circumstances and conditions, the objective being to estimate emissions as accurately as possible. The results were reviewed during another three-day workshop which was attended by the full GHG inventory team. This exercise was very useful to enhance capacity of the national experts while serving for team building and also strengthening collaboration on cross-cutting issues. The different steps adopted for the preparation of the inventory were:

- Drawing up of work plan with timeline and deliverables;
- Allocation of tasks to sectoral experts;
- Collection, quality control and validation of activity data;
- Selection of Tier level within each category and sub-category;
- Selection of emission factors (EFs) and Derivation of local EFs wherever possible;
- Designing of appropriate MS Excel worksheets for detailed calculations;
- Computation of GHG emissions;
- Uncertainty analysis;
- Implementing QA/QC activities;
- Assessment of completeness;
- Recalculations;
- Trend analysis;
- Gaps, constraints, needs and improvements; and
- Report writing.

### 2.1.3 Key category analysis

Key Category Analysis gives the characteristics of the emission sources and sinks. According to the *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000), key categories are those which contribute 95% of the total annual emissions, when ranked from the largest to the smallest emitter. Alternatively, a key source is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs in terms of the absolute level of emissions, the trend in emissions, or both (IPCC, 2000). Thus, it is a good practice to identify key categories, as it helps prioritize efforts and improve the overall quality of the national inventory, notwithstanding guiding of mitigation pl, strategies and actions.

The Key Category Analysis was performed using the tool available within the IPCC 2006 Software for both level and trend assessment. The results for the level assessment for the year 2014 are presented in Table 2.1 and the trend assessment in Table 2.2.

There are four key categories in the level assessment, three of these from the AFOLU sector, of which enteric fermentation from Agriculture, the other two from FOLU being Forest land Remaining Forest land and the last one is Road Transportation from the Energy sector.

**Table 2.1 - Key Category Analysis for the year 2014 - Approach 1 - Level Assessment**

| A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|
| IPCC Category code | IPCC Category | GHG | "2012 Ex,t (Gg $CO_2$ Eq)" | "\|Ex,t\| (Gg $CO_2$ Eq)" | Lx,t | Cumulative Total of Column F |
| 3.B.1.a | Forest land Remaining Forest land | $CO_2$ | -118,470.9 | 118,470.9 | 0.843 | 0.843 |
| 3.B.3.b | Land Converted to Grassland | $CO_2$ | 9,755.9 | 9,755.9 | 0.069 | 0.912 |
| 3.A.1 | Enteric Fermentation | $CH_4$ | 3,650.3 | 3,650.3 | 0.026 | 0.938 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.A.3.b | Road Transportation | $CO_2$ | 2,456.4 | 2,456.6 | 0.017 | 0.955 |

The results change quite drastically when considering the trend assessment covering the period 1994 to 2014. There are now ten key categories compared to the level assessment with four only. The four key categories under level assessment recur in the trend assessment also.

**Table 2.2 - Key Category Analysis for the period 1994 - 2014 - Approach 1 - Trend Assessment**

| A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|
| **IPCC Category code** | **IPCC Category** | **GHG** | **1994 Year Estimate Ex0 (Gg $CO_2$ Eq)** | **2014Year Estimate Ext (Gg $CO_2$ Eq)** | **Trend Assessment (Txt)** | **% Contribution to Trend** | **Cumulative Total of Column G** |
| 3.B.3.b | Land Converted to Grassland | $CO_2$ | 8,671.9 | 9,755.9 | 0.029 | 0.261 | 0.261 |
| 1.A.3.b | Road Transportation | $CO_2$ | 734.6 | 2,456.6 | 0.017 | 0.148 | 0.409 |
| 3.A.1 | Enteric Fermentation | $CH_4$ | 2747.3 | 3,650.3 | 0.014 | 0.126 | 0.535 |
| 3.B.1.a | Forest land remaining Forest land | $CO_2$ | -95,039.3 | -118,470.9 | 0.014 | 0.124 | 0.659 |
| 3.B.1.b | Land converted to Forest land | $CO_2$ | -1,619.9 | -962.7 | 0.009 | 0.084 | 0.743 |
| 3.C.1 | Emissions from Biomass Burning | $CH_4$ | 2,944.9 | 1,176.2 | 0.009 | 0.076 | 0.819 |
| 3.C.4 | Direct Emissions from managed soils | $N_2O$ | 1,359.4 | 1,795.1 | 0.007 | 0.061 | 0.880 |
| 3.C.1 | Emissions from Biomass Burning | $N_2O$ | 1,289.7 | 512.8 | 0.004 | 0.034 | 0.914 |
| 2.A.1 | Cement Production | $CO_2$ | 0 | 303.1 | 0.003 | 0.024 | 0.938 |
| 2.C.6 | Zinc Production | $CO_2$ | 0 | 175.8 | 0.002 | 0.014 | 0.952 |

### 2.1.4 Methodological issues

This section gives an overview of the methodological approach adopted for all sectors and sub-sectors covered in this inventory report. These procedures are extensively detailed in the respective section covering the individual IPCC Key Source Categories.

Generally, the method adopted to compute emissions involved multiplying activity data (AD) by the relevant appropriate emission factor (EF), as shown below:

**Emissions (E) = Activity Data (AD) x Emission Factor (EF)**

All the methods and tools recommended by IPCC for the computation of emissions in an inventory have been used and followed to be in line with Good Practices.

As the IPCC 2006 Guidelines do not fully address compilations at the Tier 2 level, national emission factors and stock factors as appropriate have been derived and adopted to compile estimates at the Tier 2 level partially for the Livestock and Land sectors. Thus, the inventory has been compiled using a mix of Tiers 1 and 2. This is good practice and improved the accuracy of the emission estimates of most of the key categories and reduced the uncertainty level.

Global Warming Potentials (GWP) as recommended by the IPCC have been used to convert GHGs other than $CO_2$ to the latter equivalent. Based on decision 17/CP.8, the values adopted were those from the IPCC Second Assessment Report for the three direct GHGs, namely carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$) (Table 2.3). Additional gases, known as (indirect gases), which affect global warming, namely oxides of nitrogen ($NO_x$), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide ($SO_2$), have also been computed and reported in the inventory.

**Table 2.3 - Global warming potential**

| Gas | | Global Warming Potential |
|---|---|---|
| Carbon Dioxide | ($CO_2$) | 1 |
| Methane | ($CH_4$) | 21 |
| Nitrous Oxide | ($N_2O$) | 310 |

Default EFs were assessed for their appropriateness prior to their adoption; namely on the basis of the situations under which they have been developed and the extent to which these were representative of national circumstances. Country-specific EFs and stock factors derived using national data and the IPCC equations as appropriate for the Livestock and Land sub-sectors were used instead of the default ones which did not reflect the national context.

Country-specific AD are readily available as a fairly good statistical system exists since 2003 whereby data pertaining to most of the socio-economic sectors are collected, verified and processed to produce official national statistics reports. Additional and/or missing data, and those required to meet the level of disaggregation for higher than the Tier 1 level, were sourced directly from both public and private sector operators by the team members and coordinators. Data gaps were filled through personal contacts with the stakeholders by the national experts and/or from results of surveys, scientific studies and by statistical modelling. All the data and information collected during the inventory process have been stored in the software database.

In some cases, due to the restricted timeframe and lack of a declared National framework for data collection and archiving to meet the requirements for preparing GHG inventories, derived data and estimates were used to fill in the gaps. These were considered reliable and sound since they were based on scientific findings and other observations. Estimates used included fuel use for navigation, domestic aviation, food consumption and forest areas by type. Most AD for the period 1994 to 2002 were generated based on related socio-economic factors or through extrapolations from the available time series AD.

### 2.1.5 Quality assurance and quality control (QA /QC)

Namibia has its own national system for quality control (QC) of data being collected within the different institutions. All data are quality controlled at different stages of the process until the final quality assurance (QA) is made by the National Statistics Agency before archiving in national databases. The private sector also implements its own QC/QA within its data collection and archiving process. Thus, the initial phases of the control system remained beyond the GHG inventory team and the QA/QC process started as from the time the AD are received.

QC and QA procedures, as defined in the *2006 IPCC Guidelines (IPCC, 2006)* have been implemented during the preparation of the inventory. Whenever there were inconsistencies or possible transcription errors, the responsible institution was queried, and the problem discussed and solved as far as possible. However, this process is not exempt of mistakes because outliers were frequently observed from the time series data for various activities. QC was implemented through:

- Routine and consistent checks to ensure data integrity, reliability and completeness;
- Routine and consistent checks to identify errors and omissions;
- Accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emissions calculations; and

- Technical and scientific reviews of data used, methods adopted and results obtained.

QA was undertaken by independent reviewers who were not involved with the preparation of the inventory, the main objectives being to:

- Confirm data quality and reliability from different sources wherever possible;
- Compare AD with those available on international websites such as FAO and IEA;
- Review the AD and EFs adopted within each source category as a first step; and
- Review and check the calculation steps in the software to ensure accuracy.

Even if QA/QC procedures have been followed throughout the inventory process by the inventory compilers of the different IPCC sectors and the QA officer, a QA/QC plan has yet to be developed to fit within the Measure, Report and Verify system under implementation. Thus, systematic records as per the *IPCC 2006 Guidelines* still have to be developed under a QA/QC coordinator. This resulted from the lack of personnel, insufficient capacity and since the inventory management system is still being developed and implemented in the country.

Namibia requested the UNFCCC and Global Support Programme to undertake a QA exercise on its inventory compilation process. Unfortunately, the exercise was performed when the inventory report was not yet completed but on information available at that time. The main conclusions are:

- Attempt at collecting missing AD for improving the completeness of the inventory, namely use of $N_2O$ for medical applications, ODS and incineration of medical waste;
- Improve the Institutional arrangements to ensure annual provision of AD for preparing the inventory;
- Develop and implement a QC management system;
- Improve AD for the AFOLU sector through production of new maps to generate land use changes, national stock and Emission factors, possible use of Collect earth for confirming the assumptions and data used;
- Develop legal arrangements for securing collaboration of other institutions for AD;
- Improve on documentation and archiving; and
- Capacity building in various areas of inventory compilation.

### 2.1.6 Uncertainty assessment

Uncertainty estimation is an essential element of a complete greenhouse gas emissions and removals Inventory. The purpose of estimating the uncertainties attached to emission estimates is principally to provide information on the categories to be prioritized for maximum resources to be allocated to improve the quality of the inventory. Inventories prepared in accordance with IPCC guidelines (IPCC, 2007) will typically contain a wide range of emission estimates, varying from carefully measured and demonstrably complete data on emissions to order-of-magnitude estimates of highly variable emissions such as $N_2O$ fluxes from soils and waterways.

For this Inventory, a Tier 1 uncertainty analysis of the aggregated figures as required by the IPCC 2006 Guidelines, Vol. 1 (IPCC, 2007) was performed. Based on the quality of the data and whether the EFs used were defaults or nationally derived, uncertainty levels were allocated for the two parameters and the combined uncertainty calculated. In most instances, the uncertainty values allocated to AD and EFs from within the range recommended by the IPCC Guidelines. Thus. Lower uncertainties were allocated to AD obtained from measurements made and recorded, higher values for interpolated and extrapolated AD and the highest ones in the range when the AD is subject to expert knowledge.

Regarding the EFs, the average value recommended in the IPCC Guidelines were adopted except for nationally determined EFs when the lower values of the range were adopted. Whenever there was a need to revert to expert judgement, the protocol was to consult with more than one expert from the typical sector or industry to ascertain on the level of uncertainty to be adopted from within the range provided in the IPCC guidelines. In cases where IPCC has a particular recommended methodology, the uncertainty level was derived according to the procedure proposed in the IPCC Guideline and used in the uncertainty analysis. The uncertainty analysis has been performed using the tool available within the IPCC 2006 Software. Uncertainties in total emissions based on the IPCC tool including emissions and removals from the Land sector is presented in Table 2.4. Uncertainty levels for the individual years of the period 1994 to 2014 varied from 26.0% to 29.1% while the trend assessment when adding one successive year on the base year 1994 for the years 1995 to 2014 ranged from 35.7% to 44.7%.

**Table 2.2 - Overall uncertainty (%)**

| Year | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Annual | 26.0 | 27.6 | 27.4 | 27.3 | 27.1 | 27.0 | 30.0 | 27.2 | 26.7 | 26.8 | 26.7 |
| Trend (base year 1994) | - | 35.7 | 36.4 | 37.0 | 37.7 | 38.4 | 39.2 | 39.3 | 41.0 | 41.1 | 41.8 |

| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|---|
| Annual | 26.9 | 27.4 | 27.8 | 26.9 | 28.3 | 27.7 | 28.7 | 29.1 | 26.8 | 27.3 |
| Trend (base year 1994) | 41.0 | 39.5 | 38.6 | 41.8 | 37.5 | 39.0 | 38.5 | 38.2 | 44.7 | 43.6 |

### 2.1.7 Assessment of completeness

An assessment of the completeness of the inventory was made for individual activity areas within each source category and the results are presented within the sections covering the individual sectors. The methodology adopted was according to the *IPCC 2006 Guidelines (IPCC 2007)* with the following notation keys used:

- X Estimated
- NA Not Applicable
- NO Not Occurring
- NE Not Estimated
- EE Estimated Elsewhere

The level of completeness depicting the scope of the inventory is provided in Table 2.5. In cases where was no activity for all sub-categories within a category, only the category row was maintained for ease of presentation and understanding.

**Table 2.5 - Completeness of the 1994 to 2014 inventories**

| Sector / Source category | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ | $NO_X$ | CO | NMVOC | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **1 - Energy** | | | | | | | | | | |
| 1.A - Fuel Combustion Activities | | | | | | | | | | |
| 1.A.1 - Energy Industries | X | X | X | NA | NA | NA | X | X | X | X |
| 1.A.2 - Manufacturing Industries and Construction | X | X | X | NA | NA | NA | X | X | X | X |

| Sector / Source category | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ | $NO_X$ | CO | NMVOC | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.A.3 - Transport | X | X | X | NA | NA | NA | X | X | X | X |
| 1.A.4 - Other Sectors | X | X | X | NA | NA | NA | X | X | X | X |
| 1.A.5 - Non-Specified | X | X | X | NA | NA | NA | X | X | X | X |
| 1.B - Fugitive emissions from fuels | NO | NO | NO | NA | NA | NA | NO | NO | NO | NO |
| 1.C - Carbon Dioxide Transport and Storage | NO | NO | NO | NA | NA | NA | NO | NO | NO | NO |
| 2 - Industrial Processes and Product Use | | | | | | | | | | |
| 2.A - Mineral Industry | | | | | | | | | | |
| 2.A.1- Cement Production | X | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.2 - Lime production | X | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.3 - Glass Production | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.4 - Other Process Uses of Carbonates | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.5 - Other (please specify) | NO | NO | NO | NA | NA | NA | NO | NO | NO | NO |
| 2.B - Chemical Industry | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.C - Metal Industry | | | | | | | | | | |
| 2.C.1 - Iron and Steel Production | NO | NO | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.2 - Ferroalloys Production | NO | NO | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.3 - Aluminium production | NO | NA | NA | NA | NO | NA | NO | NO | NO | NO |
| 2.C.4 - Magnesium production | NO | NA | NA | NA | NA | NO | NO | NO | NO | NO |
| 2.C.5 - Lead Production | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.6 - Zinc Production | X | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.7 - Other (please specify) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.D - Non-Energy Products from Fuels and Solvent Use | | | | | | | | | | |
| 2.D.1 - Lubricant Use | X | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.2 - Paraffin Wax Use | X | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.3 - Solvent Use | NA | NA | NA | NA | NA | NA | NA | NA | X | NA |
| 2.E - Electronics Industry | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.F - Product Uses as Substitutes for Ozone Depleting Substances | | | | | | | | | | |
| 2.F.1 - Refrigeration and Air Conditioning | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA |
| 2.F.2 - Foam Blowing Agents | NA | NA | NA | NO | NA | NA | NA | NA | NA | NA |
| 2.F.3 - Fire Protection | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA |
| 2.F.4 - Aerosols | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA |
| 2.F.5 - Solvents | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA |
| 2.F.6 - Other Applications (please specify) | NA | NA | NA | NO | NO | NA | NA | NA | NA | NA |
| 2.G - Other Product Manufacture and Use | | | | | | | | | | |
| 2.G.1 - Electrical Equipment | NA | NA | NA | NA | NE | NE | NA | NA | NA | NA |
| 2.G.2 - $SF_6$ and PFCs from Other Product Uses | NA | NA | NA | NA | NE | NE | NA | NA | NA | NA |
| 2.G.3 - $N_2O$ from Product Uses | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.G.4 - Other (Please specify) | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.H - Other | | | | | | | | | | |
| 2.H.1 - Pulp and paper Industry | NO | NO | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.H.2 - Food and Beverages Industry | X | X | NA | NA | NA | NA | X | X | X | X |
| 2.H.3 - Other (Please specify) | NO | NO | NO | NA | NA | NA | NO | NO | NO | NO |
| 3 - Agriculture, Forestry, and Other Land Use | | | | | | | | | | |
| 3.A - Livestock | | | | | | | | | | |
| 3.A.1 - Enteric Fermentation | NA | X | NA | NA | NA | NA | NA | NA | NA | NA |

| Sector / Source category | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ | $NO_X$ | CO | NMVOC | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 3.A.2 - Manure Management | NA | X | X | NA | NA | NA | NA | NA | X | NA |
| 3.B - Land | | | | | | | | | | |
| 3.B.1 - Forest land | X | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.2 - Cropland | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.3 - Grassland | X | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.4 - Wetlands | NO | NA | NO | NA | NA | NA | NO | NO | NO | NO |
| 3.B.5 - Settlements | NE | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.6 - Other Land | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.C - Aggregate sources and non-$CO_2$ emissions sources on land | | | | | | | | | | |
| 3.C.1 - Emissions from biomass burning | NA | X | X | NA | NA | NA | X | X | NA | NA |
| 3.C.2 - Liming | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.3 - Urea application | X | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.4 - Direct $N_2O$ Emissions from managed soils | NA | NA | X | NA | NA | NA | NA | NA | NA | NA |
| 3.C.5 - Indirect $N_2O$ Emissions from managed soils | NA | NA | X | NA | NA | NA | NA | NA | NA | NA |
| 3.C.6 - Indirect $N_2O$ Emissions from manure management | NA | NA | X | NA | NA | NA | NA | NA | NA | NA |
| 3.C.7 - Rice Cultivation | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.8 - Other (Please specify) | NA | NO | NO | NA | NA | NA | NA | NA | NA | NA |
| 3.D - Other | | | | | | | | | | |
| 3.D.1 - Harvested Wood Products | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4 - Waste | | | | | | | | | | |
| 4.A - Solid Waste Disposal | NA | X | NO | NA | NA | NA | NO | NO | X | NA |
| 4.B - Biological treatment of solid waste | NA | NO | NO | NA | NA | NA | NO | NO | NO | NA |
| 4.C - Incineration and Open Burning of Waste | X | X | X | NA | NA | NA | X | X | X | X |
| 4.D - Wastewater Treatment and Discharge | NA | X | X | NA | NA | NA | NO | NO | X | NA |
| 4.E - Other (Please specify) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 5 - Other | | | | | | | | | | |
| Memo Items (5) | | | | | | | | | | |
| International Bunkers | | | | | | | | | | |
| 1.A.3.a.i - International Aviation (International Bunkers) | X | X | X | NA | NA | NA | X | X | X | X |
| 1.A.3.d.i - International water-borne navigation (International bunkers) | X | X | X | NA | NA | NA | X | X | X | X |
| 1.A.5.c - Multilateral Operations | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

**X = Estimated, NA = Not Applicable, NO = Not Occurring, NE = Not Estimated, EE = Estimated Elsewhere**

### 2.1.8 Recalculations

The initial inventories submitted for the years 2000 to 2012 in the NIR2 and summarized in the BUR 2 were recalculated to provide for a consistent series in this inventory report. Recalculations are normally carried out if AD and/or EFs are revised or if new updated methodologies are applied. The present National GHG Inventory Report, being an exhaustive one, also reports on recalculations made. The scope of the inventory of the NIR2 has been widened to include additional categories which were not covered within IPPU.

Recalculations have been performed for the past inventories for the full time series to maintain consistency following improvements in EFs in the guidelines, newly derived EFs to better suit national circumstances, improve the accuracy of the inventory and the change from the Revised 1996 IPCC Guidelines (*IPCC 1997*) to the 2006 IPCC Guidelines (*IPCC 2006*) for the year 1994, 2000 and 2010. Recalculations also concerned the categories where new AD sets were used such as for the LAND sector

following problems encountered and reported in the BUR2 which is also provided under the AFOLU sector of this inventory in details.

Recalculated emission for the base years 1994, 2000 and 2010 presented in the NC1, NC2 and NC3 are compared with the recalculated emissions obtained in the present time series (Table 2.6). Original estimates of 1994, 2000 and 2010 were made according to IPCC 1996 Revised GL, Tier 1, Lower coverage of activity areas compared to present inventory and default EFs while recalculated values are compiled in line with 2006 IPCC GL, Mix of Tiers 1 and 2, the latter for most key categories, much better coverage (only ODS, Incineration of medical wastes, Refrigeration and $N_2O$ use for medical purposes not covered and national EFs and stock factors for most key categories.

**Table 2.6 - Comparison of original and recalculated emissions, removals and net removals of past inventories presented in national communications**

| Year | 1994 | | 2000 | | 2010 | |
|---|---|---|---|---|---|---|
| | INC | NIR3 | SNC | NIR3 | TNC | NIR3 |
| Removals | -5,716 | -96,659 | -10,566 | -108,067 | -28,534 | -107,364 |
| Emissions | 5,685 | 18,889 | 9,118 | 18,684 | 27,195 | 20,720 |
| Net removals | -31 | -77,770 | -1,442 | -89,383 | -1,339 | -86,644 |

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### 2.1.9 Time series consistency

This inventory now covers the period 1994 to 2014 and AD within each of the source categories covered were abstracted from the same sources for all years. The same EFs have been used throughout the full time series and the QA/QC procedures were kept constant for the whole inventory period. This enabled a consistent time series to be built with a good level of confidence in the trends of the emissions.

### 2.1.10 Gaps, constraints and needs

Namibia, as a developing country, has its constraints and gaps that need to be addressed to produce better quality reports to the Convention. This is still a big challenge given that now the reporting standards have been raised and there is also a review of the inventory.

In order to reduce uncertainties and aim at producing an inventory in line with TACCC principles, Namibia invested in improving its national GHG inventory management system and Institutional arrangements. One major challenge for estimating emissions for the past years from 1994 to 1999 was gaps in AD. Additionally, the country aimed at adopting higher Tier levels whenever more disaggregated data for the various sectors could be collected and country-specific EFs derived as for Enteric Fermentation and the Land categories which are key categories for the country from previous inventory results. However, AD were not available for the period 1994 to 1998 when the country was still setting up its national statistics department after independence. Thus, most of the AD for this period were sourced from the international databases or extrapolated on the basis of AD for the time series 1999 to 2014. The National Inventory Improvement Plan and a review of the NIR2 enabled the identification of areas that could be improved in terms of data collection, as well as research to be undertaken for developing national EFs. The development of specific sectoral databases for GHG inventory purposes started when computing the present inventory.

For this inventory, one more category, namely solvent use has been covered. Some information was also collected on the use of $SF_6$, use of $N_2O$ for medical purposes, incineration of medical wastes and Ozone

Depleting Substances, but unfortunately, they were not detailed enough to enable computation of emissions in these categories. Further efforts will be invested to address these categories to make the inventory fully exhaustive in the future.

The following problems were encountered during the preparation of this national inventory of GHG:

- Information required for the inventory were obtained from various sources as no institution has yet been endorsed with the responsibility for collection of specific AD needed for the estimation of emissions according to IPCC on an annual basis;
- Almost all of the AD, including those from the NSA are still not yet in the required format for feeding in the software to make the emission estimates;
- End-use consumption data for some of the sectors and categories are not readily available and had to be generated on the basis of scientific and consumption parameters;
- Reliable biomass (bm) data such as timber, fuelwood, wood waste and charcoal consumed or produced were not available and had to be derived using statistical modelling;
- There were frequent inconsistencies when data were collected from different sources;
- Appropriate information on some activities such as beverage production and auto-production of heat and electricity were not always available as these were not released as considered confidential by the producers;
- Lack of solid waste characterization data, amount generated and wastewater generated from the industrial sector were only partly available and had to be derived on the basis of production and demographic data amongst others;
- Lack of EFs to better represent national circumstances and provide for more accurate estimates even if this has started to be addressed for some key categories;
- Emissions for a few categories have not been estimated due to lack of AD; and
- National experts are not yet ready to take over the full inventory compilation process which dictated the collaboration of an international consultant;
- National experts were provided with further capacity building and this will be pursued in the future until they are fully conversant with the whole process.

### 2.1.11 National inventory improvement plan (NIIP)

Based on the constraints, gaps and other challenges encountered during the preparation of the present inventory, a list of the most urgent improvements has been identified. These are listed below and will be addressed during the preparation of the next inventory for preparation of the NIR4 within the framework of the BUR4.

- Adequate and proper data capture, QC, validation, storage and retrieval mechanism need to be improved to facilitate the compilation of future inventories;
- Capacity building and strengthening of the existing institutional framework within a GHG inventory management system to provide improved coordinated action for a smooth implementation of the GHG inventory cycle for sustainable production of inventories;
- Development of emission factors (EFs) more representative of the national context;

- Improve the existing QA/QC system including a QA/QC plan in order to reduce uncertainty and improve inventory quality;
- Find the necessary resources to establish a GHG inventory unit within DEA to be responsible for inventory compilation and coordination;
- Institutionalize the archiving system;
- Pursue efforts for collecting the required AD for categories not covered in this exercise, namely the use of $SF_6$, use of $N_2O$ for medical purposes, incineration of medical waste and Ozone Depleting Substances;
- Conduct new forest inventories to confirm the new approach adopted for the Land sector;
- Produce new maps for 1990 to 2015 to refine land use change data over 5 years periods to replace the low-quality maps available now which is proving inadequate;
- Refine data collection for determining country-specific (CS) weights for dairy cows, other cattle, sheep and goats;
- Develop the digestible energy (DE) factor for livestock as country-specific data is better than the default IPCC value to address this key category fully at Tier 2; and
- Add the missing years 1990 to 1993 to complete the full time series 1990 to at least 2015 in the next inventory compilation.

## 2.2. Time series of greenhouse gas emissions

### 2.1.12 Overview

Namibia remained a net GHG sink over the period 1994 to 2014 as the Land category removals exceeded emissions from the other categories. The net removal of $CO_2$ increased by 20,484 Gg from 77,770 Gg to 98,254 Gg in 2014, representing an increase of 26.3% over these 21 years. During the same period, the country recorded an increase of 12.1% in emissions, 2,291 Gg $CO_2$-eq from 18,889 Gg $CO_2$-eq to 21,180 Gg $CO_2$-eq. The trend for the period 1994 to 2014 indicates that the total removals from the LAND category increased from 96,659 Gg $CO_2$-eq in 1994 to 119,434 (23.6%) Gg $CO_2$-eq in 2014 (Table 2.7 and Figure 2.1).

**Table 2.7 - GHG emissions (Gg $CO_2$-eq) characteristics (1994 - 2014)**

| Year | Total emissions | AFOLU removals | Net | Per capita emission (t) | GDP emissions index (Year 1994 = 100) |
|---|---|---|---|---|---|
| 1994 | 18,889 | -96,659 | -77,770 | 11.9 | 100.0 |
| 1995 | 18,752 | -98,466 | -79,715 | 11.6 | 95.4 |
| 1996 | 18,439 | -100,291 | -81,852 | 11.2 | 90.9 |
| 1997 | 18,442 | -102,133 | -83,691 | 10.9 | 87.2 |
| 1998 | 18,495 | -103,992 | -85,497 | 10.7 | 84.7 |
| 1999 | 18,553 | -105,869 | -87,316 | 10.6 | 82.1 |
| 2000 | 18,684 | -108,067 | -89,383 | 10.4 | 79.9 |
| 2001 | 19,157 | -108,212 | -89,055 | 10.5 | 81.0 |
| 2002 | 18,353 | -112,687 | -94,333 | 9.9 | 74.0 |
| 2003 | 18,842 | -113,128 | -94,287 | 10.0 | 72.9 |
| 2004 | 18,742 | -114,949 | -96,208 | 9.8 | 64.6 |

| Year | Total emissions | AFOLU removals | Net | Per capita emission (t) | GDP emissions index (Year 1994 = 100) |
|---|---|---|---|---|---|
| 2005 | 19,135 | -112,723 | -93,588 | 9.9 | 64.4 |
| 2006 | 20,194 | -109,119 | -88,925 | 10.3 | 63.4 |
| 2007 | 20,725 | -106,355 | -85,630 | 10.4 | 61.7 |
| 2008 | 19,416 | -114,977 | -95,561 | 9.6 | 55.9 |
| 2009 | 21,549 | -103,127 | -81,578 | 10.5 | 62.8 |
| 2010 | 20,720 | -107,364 | -86,644 | 10.0 | 56.8 |
| 2011 | 22,699 | -105,448 | -82,749 | 10.8 | 58.9 |
| 2012 | 23,542 | -104,485 | -80,943 | 11.0 | 58.1 |
| 2013 | 19,829 | -122,363 | -102,534 | 9.2 | 46.4 |
| 2014 | 21,180 | -119,434 | -98,254 | 9.6 | 46.6 |

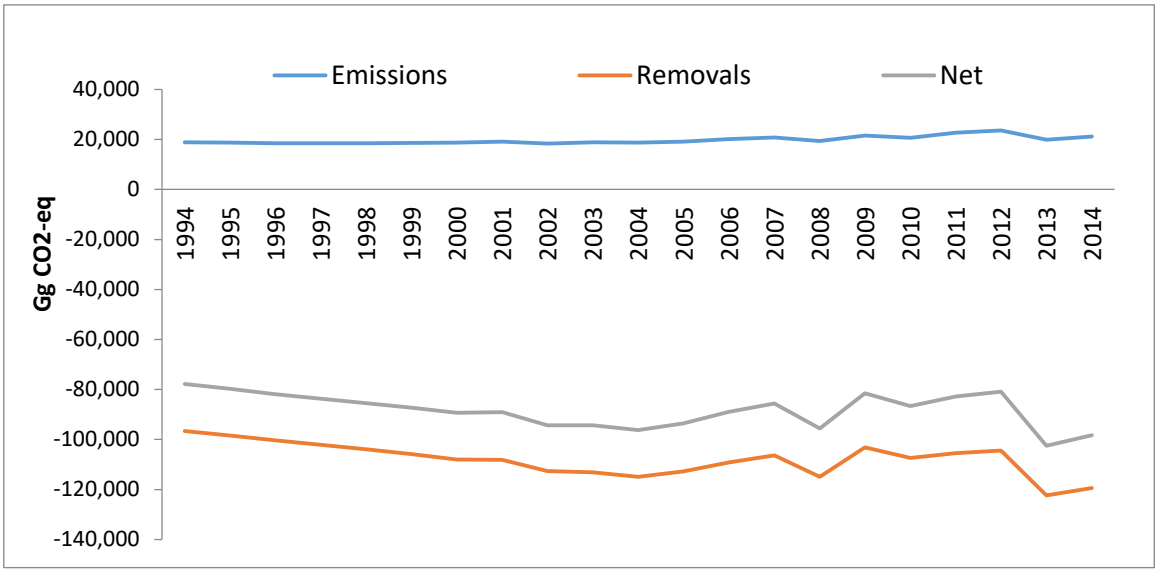


**Figure 2.2 - Evolution of national emissions, national removals and the overall (net) situation (Gg $CO_2$-eq), (1994 - 2014)**

Per capita emissions of GHG decreased gradually from 11.9 tonnes $CO_2$-eq in 1994 to reach 9.9 tonnes in 2002; it then plateaued between 9.8 and 10.0 tonnes up to 2005 after which period it seesawed to reach 9.6 tonnes $CO_2$-eq in 2014 (Figure 3.2). The GDP emission index decreased almost steadily from 100 in the year 1994 to 46.6 in 2014 (Table 3.1) and (Figure 3.3).

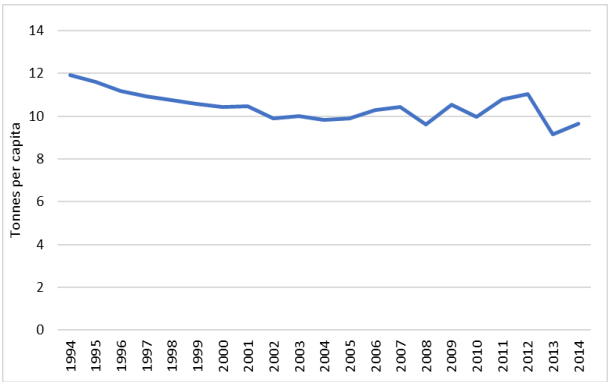


**Figure 2.3 - Per capita GHG emissions (1994 - 2014)**

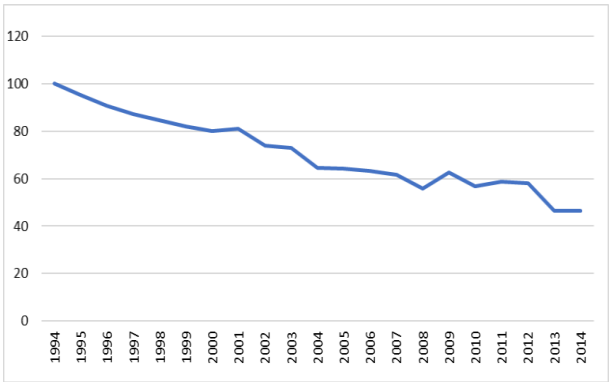


**Figure 2.4 - GDP emissions index (1994 - 2014)**

### 2.1.13 Trend of emissions by source category

Total national emissions increased by 12.1% over these 21 years. The AFOLU sector remained the leading emitter throughout this period followed by Energy, for all years under review. Following the setting up of new industries, IPPU sector took over as the third emitter in lieu of the Waste sector as from the year 2003. Emissions from the AFOLU sector increased from 17,328 Gg $CO_2$-eq in 1994 to peak at 19,275 Gg $CO_2$-eq in 2012 and then regressed to 17,271 in 2014, representing a decrease of 0.3% from the 1994 level. The share of GHG emissions from the AFOLU sector out of total national emissions regressed from 91.7% in 1994 to 81.5% in 2014.

Energy emissions increased from 1,464 Gg $CO_2$-eq (7.8%) of national emissions in 1994 to 3,234 Gg $CO_2$-eq (15.3%) in 2014 as depicted in Table 2.8. During the period 1994 to 2014, the average annual increase of GHG emissions was by 6.0%.

The contribution of the IPPU sector in total national emissions increased from 22 Gg $CO_2$-eq in 1994 to 522 Gg $CO_2$-eq in 2014 (Table 3.2). The very sharp increase in GHG emissions in the IPPU sector is due to the commencement of the production of Zinc in 2003 and cement in 2011.

Waste emissions on the other hand varied slightly over this period with the tendency being for a slight increase over time. Emissions from the waste sector doubled from the 1994 level of 75 Gg $CO_2$-eq to 153 Gg $CO_2$-eq in 2014.

**Table 2.8 - National GHG emissions (Gg, $CO_2$-eq) by sector (1994 - 2014)**

| Year | Total emissions | Energy | IPPU | AFOLU | Waste |
|---|---|---|---|---|---|
| 1994 | 18,889 | 1,464 | 22 | 17,328 | 75 |
| 1995 | 18,752 | 1,473 | 23 | 17,183 | 72 |
| 1996 | 18,439 | 1,566 | 23 | 16,777 | 73 |
| 1997 | 18,442 | 1,617 | 24 | 16,726 | 76 |
| 1998 | 18,495 | 1,759 | 24 | 16,633 | 79 |
| 1999 | 18,553 | 1,893 | 25 | 16,551 | 83 |
| 2000 | 18,684 | 1,934 | 25 | 16,637 | 88 |
| 2001 | 19,157 | 2,116 | 25 | 16,927 | 90 |
| 2002 | 18,353 | 2,163 | 27 | 16,073 | 91 |
| 2003 | 18,842 | 2,454 | 110 | 16,176 | 101 |
| 2004 | 18,742 | 2,521 | 237 | 15,879 | 103 |
| 2005 | 19,135 | 2,671 | 260 | 16,094 | 110 |
| 2006 | 20,194 | 2,823 | 255 | 17,003 | 112 |
| 2007 | 20,725 | 2,907 | 293 | 17,415 | 109 |
| 2008 | 19,416 | 2,752 | 291 | 16,256 | 117 |
| 2009 | 21,549 | 2,832 | 303 | 18,289 | 125 |
| 2010 | 20,720 | 2,923 | 301 | 17,365 | 131 |
| 2011 | 22,699 | 2,796 | 438 | 19,326 | 138 |
| 2012 | 23,542 | 3,003 | 515 | 19,875 | 149 |
| 2013 | 19,829 | 2,861 | 528 | 16,291 | 149 |
| 2014 | 21,180 | 3,234 | 522 | 17,271 | 153 |

### 2.1.14 Trend in emissions of direct GHGs

The share of emissions by gas did not change during the period 1994 to 2014. The main contributor to the national GHG emissions remained $CO_2$ followed by $CH_4$ and $N_2O$. However, the share of $CO_2$ increased while these of $CH_4$ and $N_2O$ regressed over the time series. In 2014, the share of the GHG emissions was as follows: 63.44% $CO_2$, 23.98% $CH_4$ and 12.58% $N_2O$. The trend of the aggregated emissions and removals by gas is given in Table 2.9. and Figure 2.5.

**Table 2.9 - Aggregated emissions and removals (Gg) by gas (1994 - 2014)**

| Year | Total GHG emissions ($CO_2$-eq) | Removals ($CO_2$) ($CO_2$-eq) | Net removals ($CO_2$-eq) | $CO_2$ | $CH_4$ ($CO_2$-eq) | $N_2O$ ($CO_2$-eq) |
|---|---|---|---|---|---|---|
| 1994 | 18,889 | -96,659 | -77,770 | 10,169 | 5,837 | 2,884 |
| 1995 | 18,752 | -98,466 | -79,715 | 10,177 | 5,728 | 2,847 |
| 1996 | 18,439 | -100,291 | -81,852 | 10,268 | 5,458 | 2,713 |
| 1997 | 18,442 | -102,133 | -83,691 | 10,318 | 5,415 | 2,710 |
| 1998 | 18,495 | -103,992 | -85,497 | 10,457 | 5,352 | 2,685 |
| 1999 | 18,553 | -105,869 | -87,316 | 10,591 | 5,295 | 2,667 |
| 2000 | 18,684 | -108,067 | -89,383 | 10,629 | 5,367 | 2,687 |
| 2001 | 19,157 | -108,212 | -89,055 | 11,021 | 5,394 | 2,742 |
| 2002 | 18,353 | -112,687 | -94,333 | 11,070 | 4,797 | 2,487 |
| 2003 | 18,842 | -113,128 | -94,287 | 11,438 | 4,873 | 2,531 |
| 2004 | 18,742 | -114,949 | -96,208 | 11,630 | 4,665 | 2,447 |
| 2005 | 19,135 | -112,723 | -93,588 | 11,799 | 4,832 | 2,504 |
| 2006 | 20,194 | -109,119 | -88,925 | 11,944 | 5,458 | 2,793 |
| 2007 | 20,725 | -106,355 | -85,630 | 12,063 | 5,717 | 2,945 |
| 2008 | 19,416 | -114,977 | -95,561 | 11,910 | 4,944 | 2,563 |
| 2009 | 21,549 | -103,127 | -81,578 | 11,999 | 6,362 | 3,187 |
| 2010 | 20,720 | -107,364 | -86,644 | 12,086 | 5,732 | 2,903 |
| 2011 | 22,699 | -105,448 | -82,749 | 12,922 | 6,477 | 3,300 |
| 2012 | 23,542 | -104,485 | -80,943 | 13,204 | 6,845 | 3,494 |
| 2013 | 19,829 | -122,363 | -102,534 | 13,076 | 4,395 | 2,359 |
| 2014 | 21,180 | -119,434 | -98,254 | 13,436 | 5,079 | 2,665 |

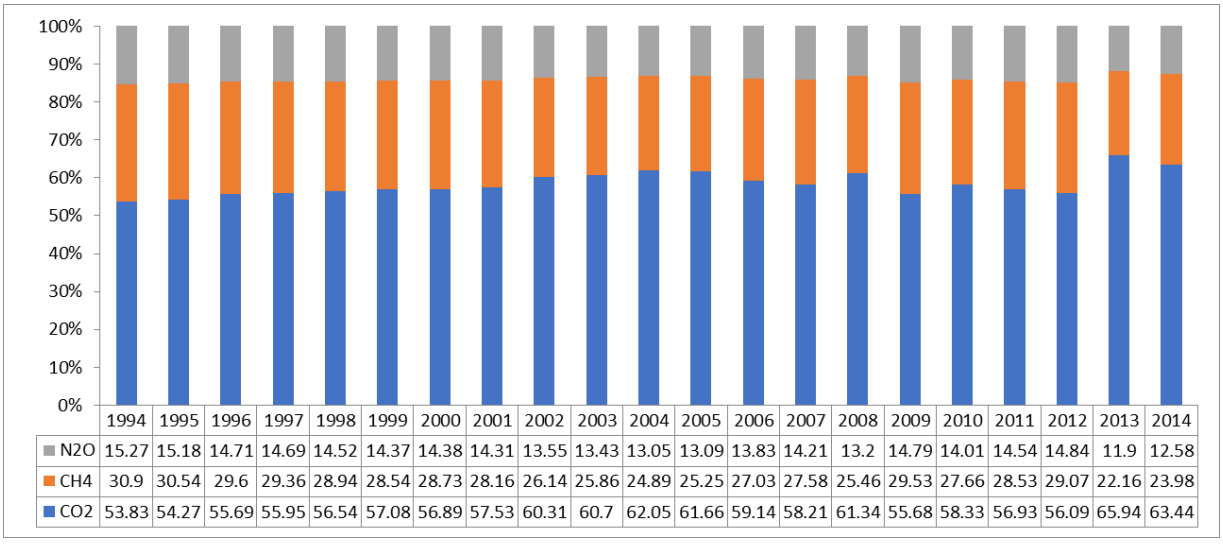


**Figure 2.5 - Share of aggregated emissions (Gg $CO_2$-eq) by gas (1994 - 2014)**

### 2.1.15 Carbon dioxide ($CO_2$)

The most significant anthropogenic GHG was $CO_2$. In 2014, it contributed the more than half of national emissions with 13,436 Gg (63.44%). $CO_2$ emissions increased by 3,268 Gg from the 1994 level of 10,169 Gg (Table 3.3) to 13,436 Gg in 2014. In the same year, the sector that emitted the highest amount of $CO_2$ was AFOLU with 9,769 Gg followed by Energy with 3,142 Gg (Table 2.10).

**Table 2.10 - $CO_2$ emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions | Total net removals | Energy | IPPU | AFOLU - emissions | AFOLU - removals | Waste |
|---|---|---|---|---|---|---|---|
| 1994 | 10,169 | -86,491 | 1,410 | 22 | 8,736 | -96,659 | 1.0 |
| 1995 | 10,177 | -88,290 | 1,417 | 23 | 8,736 | -98,466 | 1.0 |
| 1996 | 10,268 | -90,023 | 1,508 | 23 | 8,736 | -100,291 | 1.0 |
| 1997 | 10,318 | -91,815 | 1,557 | 24 | 8,736 | -102,133 | 1.1 |
| 1998 | 10,457 | -93,535 | 1,696 | 24 | 8,736 | -103,992 | 1.1 |
| 1999 | 10,591 | -95,278 | 1,829 | 25 | 8,735 | -105,869 | 1.2 |
| 2000 | 10,629 | -97,437 | 1,868 | 25 | 8,736 | -108,067 | 1.2 |
| 2001 | 11,021 | -97,191 | 2,046 | 25 | 8,949 | -108,212 | 1.3 |
| 2002 | 11,070 | -101,617 | 2,093 | 27 | 8,949 | -112,687 | 1.3 |
| 2003 | 11,438 | -101,691 | 2,379 | 110 | 8,947 | -113,128 | 1.4 |
| 2004 | 11,630 | -103,320 | 2,444 | 237 | 8,947 | -114,949 | 1.4 |
| 2005 | 11,799 | -100,924 | 2,590 | 260 | 8,947 | -112,723 | 1.5 |
| 2006 | 11,944 | -97,175 | 2,740 | 255 | 8,947 | -109,119 | 1.6 |
| 2007 | 12,063 | -94,292 | 2,822 | 293 | 8,947 | -106,355 | 1.7 |
| 2008 | 11,910 | -103,067 | 2,671 | 291 | 8,946 | -114,977 | 1.7 |
| 2009 | 11,999 | -91,128 | 2,748 | 303 | 8,947 | -103,127 | 1.8 |
| 2010 | 12,086 | -95,279 | 2,837 | 301 | 8,947 | -107,364 | 1.9 |
| 2011 | 12,922 | -92,525 | 2,713 | 438 | 9,769 | -105,448 | 2.1 |
| 2012 | 13,204 | -91,281 | 2,918 | 515 | 9,769 | -104,485 | 2.3 |
| 2013 | 13,076 | -109,288 | 2,776 | 528 | 9,769 | -122,363 | 2.3 |
| 2014 | 13,436 | -105,998 | 3,142 | 522 | 9,769 | -119,434 | 2.4 |

### 2.1.16 Methane ($CH_4$)

Methane was the next contributor in national emissions after $CO_2$. It contributed 5,079 Gg $CO_2$-eq of the total emissions of 2014. Methane emissions decreased by 758 Gg $CO_2$-eq from the 1994 level of 5,837 Gg $CO_2$-eq to 5,079 in 2014 (Table 2.11). AFOLU contributed between 96 to 99% of these emissions followed by the Waste sector.

**Table 2.11 - $CH_4$ emissions (Gg) by source category (1994 - 2014)**

| Year | Total (Gg $CO_2$-eq) | Total | Energy | AFOLU - emissions | Waste |
|---|---|---|---|---|---|
| 1994 | 5,837 | 278 | 1.5 | 274 | 2.4 |
| 1995 | 5,728 | 273 | 1.5 | 269 | 2.4 |
| 1996 | 5,458 | 260 | 1.6 | 256 | 2.3 |
| 1997 | 5,415 | 258 | 1.6 | 254 | 2.4 |
| 1998 | 5,352 | 255 | 1.6 | 251 | 2.5 |
| 1999 | 5,295 | 252 | 1.7 | 248 | 2.7 |

| Year | Total (Gg $CO_2$-eq) | Total | Energy | AFOLU - emissions | Waste |
|---|---|---|---|---|---|
| 2000 | 5,367 | 256 | 1.7 | 251 | 3.0 |
| 2001 | 5,394 | 257 | 1.7 | 252 | 3.0 |
| 2002 | 4,797 | 228 | 1.7 | 224 | 3.1 |
| 2003 | 4,873 | 232 | 1.8 | 227 | 3.5 |
| 2004 | 4,665 | 222 | 1.8 | 217 | 3.6 |
| 2005 | 4,832 | 230 | 1.8 | 224 | 3.9 |
| 2006 | 5,458 | 260 | 1.9 | 254 | 4.0 |
| 2007 | 5,717 | 272 | 1.9 | 267 | 3.8 |
| 2008 | 4,944 | 235 | 1.8 | 229 | 4.2 |
| 2009 | 6,362 | 303 | 1.9 | 297 | 4.6 |
| 2010 | 5,732 | 273 | 1.9 | 266 | 4.9 |
| 2011 | 6,477 | 308 | 1.8 | 301 | 5.2 |
| 2012 | 6,845 | 326 | 1.9 | 318 | 5.7 |
| 2013 | 4,395 | 209 | 1.8 | 202 | 5.7 |
| 2014 | 5,079 | 242 | 1.9 | 234 | 5.9 |

### 2.1.17 Nitrous Oxide ($N_2O$)

Nitrous oxide emissions stood at 2,665 Gg $CO_2$-eq in 2014. Emissions regressed by 219 Gg $CO_2$-eq from 2,884 Gg $CO_2$-eq in the year 1994 to 2,665 Gg $CO_2$-eq (Table 2.12) in 2014. The AFOLU sector was the highest emitter of $N_2O$ with 97 to 98%.

**Table 2.12 - $N_2O$ emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions (Gg $CO_2$-eq) | Total | Energy | AFOLU - emissions | Waste |
|---|---|---|---|---|---|
| 1994 | 2,883.6 | 9.30 | 0.07 | 9.15 | 0.08 |
| 1995 | 2,847.2 | 9.18 | 0.08 | 9.04 | 0.07 |
| 1996 | 2,713.1 | 8.75 | 0.08 | 8.59 | 0.08 |
| 1997 | 2,709.7 | 8.74 | 0.09 | 8.58 | 0.08 |
| 1998 | 2,685.3 | 8.66 | 0.09 | 8.49 | 0.08 |
| 1999 | 2,666.8 | 8.60 | 0.10 | 8.43 | 0.08 |
| 2000 | 2,686.8 | 8.67 | 0.10 | 8.49 | 0.08 |
| 2001 | 2,742.2 | 8.85 | 0.11 | 8.66 | 0.08 |
| 2002 | 2,486.9 | 8.02 | 0.11 | 7.83 | 0.08 |
| 2003 | 2,530.7 | 8.16 | 0.12 | 7.96 | 0.08 |
| 2004 | 2,446.5 | 7.89 | 0.13 | 7.68 | 0.08 |
| 2005 | 2,504.1 | 8.08 | 0.13 | 7.86 | 0.09 |
| 2006 | 2,792.5 | 9.01 | 0.14 | 8.78 | 0.09 |
| 2007 | 2,944.8 | 9.50 | 0.15 | 9.26 | 0.09 |
| 2008 | 2,562.6 | 8.27 | 0.14 | 8.04 | 0.09 |
| 2009 | 3,187.1 | 10.28 | 0.14 | 10.05 | 0.09 |
| 2010 | 2,902.8 | 9.36 | 0.15 | 9.13 | 0.09 |
| 2011 | 3,300.3 | 10.65 | 0.14 | 10.41 | 0.09 |
| 2012 | 3,493.7 | 11.27 | 0.15 | 11.03 | 0.09 |
| 2013 | 2,359.1 | 7.61 | 0.15 | 7.37 | 0.09 |
| 2014 | 2,664.7 | 8.60 | 0.17 | 8.35 | 0.08 |

### 2.1.18 Trends for indirect GHGs and $SO_2$

Emissions of indirect GHGs (CO, $NO_x$ and NMVOC) and $SO_2$, have also been estimated and reported in the inventory. Indirect GHGs have not been included in national total emissions. Emissions of these gases for the period 1994 to 2014 are given in Table 2.13.

Emissions of $NO_x$ decreased from 48.4 Gg in the year 1994 to 38.2 Gg in 2014. Carbon monoxide emissions also regressed from 2,198 Gg in 1994 to 939 Gg in 2014. Emissions of NMVOC increased from 15.9 Gg in 1994 to 24.5 Gg in 2014 whilst emissions of $SO_2$ varied between 1.9 Gg and 4.2 Gg during the same period.

**Table 2.13 - Emissions (Gg) of indirect GHGs and $SO_2$ (1994 - 2014)**

| Year | $NO_x$ | CO | NMVOC | $SO_2$ |
|---|---|---|---|---|
| 1994 | 48.4 | 2,198.1 | 15.9 | 2.6 |
| 1995 | 45.0 | 2,082.6 | 16.0 | 2.1 |
| 1996 | 43.7 | 1,966.5 | 16.2 | 2.2 |
| 1997 | 41.4 | 1,849.1 | 16.7 | 1.9 |
| 1998 | 41.4 | 1,731.1 | 17.6 | 2.3 |
| 1999 | 41.1 | 1,611.9 | 18.4 | 2.5 |
| 2000 | 39.0 | 1,465.5 | 19.8 | 2.2 |
| 2001 | 40.6 | 1,478.7 | 19.7 | 2.4 |
| 2002 | 37.0 | 1,132.8 | 19.3 | 2.7 |
| 2003 | 38.8 | 1,140.6 | 20.1 | 3.0 |
| 2004 | 36.9 | 1,024.7 | 20.5 | 3.5 |
| 2005 | 41.1 | 1,267.2 | 20.4 | 3.7 |
| 2006 | 45.5 | 1,618.8 | 21.3 | 4.2 |
| 2007 | 49.3 | 1,904.4 | 21.4 | 4.0 |
| 2008 | 37.0 | 1,200.4 | 21.3 | 4.1 |
| 2009 | 54.9 | 2,263.2 | 21.7 | 3.7 |
| 2010 | 51.2 | 1,946.0 | 21.8 | 3.0 |
| 2011 | 52.7 | 2,076.8 | 13.0 | 3.0 |
| 2012 | 56.3 | 2,166.1 | 23.9 | 3.7 |
| 2013 | 30.7 | 657.3 | 22.6 | 2.5 |
| 2014 | 38.2 | 939.4 | 24.5 | 2.7 |

### 2.1.19 $NO_x$

Emissions of $NO_x$ decreased by 21% over the inventory period from 48.4 Gg in the year 1994 to 38.2 Gg in 2014 (Table 2.14). The two main sources of $NO_x$ emissions were the Energy and AFOLU sectors. The Energy sector witnessed an increase from 30% to 64% while the AFOLU sector contribution regressed from 70% to 35% of total national emissions from 1994 to 2014. Waste contributed the remainder.

**Table 2.14 - $NO_x$ emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions | Energy | AFOLU | Waste |
|---|---|---|---|---|
| 1994 | 48.4 | 14.3 | 33.8 | 0.2 |
| 1995 | 45.0 | 12.8 | 32.0 | 0.2 |
| 1996 | 43.7 | 13.4 | 30.1 | 0.2 |

| Year | Total emissions | Energy | AFOLU | Waste |
|---|---|---|---|---|
| 1997 | 41.4 | 13.0 | 28.2 | 0.2 |
| 1998 | 41.4 | 14.8 | 26.3 | 0.2 |
| 1999 | 41.1 | 16.5 | 24.4 | 0.2 |
| 2000 | 39.0 | 16.7 | 22.1 | 0.2 |
| 2001 | 40.6 | 18.2 | 22.2 | 0.3 |
| 2002 | 37.0 | 19.9 | 16.8 | 0.3 |
| 2003 | 38.8 | 21.7 | 16.8 | 0.3 |
| 2004 | 36.9 | 21.7 | 14.9 | 0.3 |
| 2005 | 41.1 | 22.1 | 18.7 | 0.3 |
| 2006 | 45.5 | 21.1 | 24.1 | 0.3 |
| 2007 | 49.3 | 20.4 | 28.5 | 0.3 |
| 2008 | 37.0 | 19.0 | 17.6 | 0.4 |
| 2009 | 54.9 | 20.5 | 34.1 | 0.4 |
| 2010 | 51.2 | 21.8 | 29.1 | 0.4 |
| 2011 | 52.7 | 21.1 | 31.2 | 0.4 |
| 2012 | 56.3 | 23.3 | 32.5 | 0.5 |
| 2013 | 30.7 | 21.2 | 9.1 | 0.5 |
| 2014 | 38.2 | 24.4 | 13.3 | 0.5 |

### 2.1.20 CO

The major contributor of CO was the AFOLU sector with between 91% and 98% of national emission followed by the Energy sector with between 25 to 8% (Table 2.15). National CO emissions decreased from 2,198 Gg in the year 1994 to 939 Gg in 2014. The AFOLU sector contributed 858 Gg of total CO emissions compared to 73 Gg by the Energy sector and 8.5 Gg by the Waste sector in 2014.

**Table 2.15 - CO emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions | Energy | %Energy | AFOLU | %AFOLU | Waste | %Waste |
|---|---|---|---|---|---|---|---|
| 1994 | 2,198.1 | 42.4 | 0.02 | 2,152.3 | 0.98 | 3.5 | 0.00 |
| 1995 | 2,082.6 | 43.8 | 0.02 | 2,035.2 | 0.98 | 3.6 | 0.00 |
| 1996 | 1,966.5 | 45.6 | 0.02 | 1,917.2 | 0.97 | 3.7 | 0.00 |
| 1997 | 1,849.1 | 47.1 | 0.03 | 1,798.1 | 0.97 | 3.9 | 0.00 |
| 1998 | 1,731.1 | 49.1 | 0.03 | 1,678.0 | 0.97 | 4.0 | 0.00 |
| 1999 | 1,611.9 | 50.9 | 0.03 | 1,556.9 | 0.97 | 4.2 | 0.00 |
| 2000 | 1,465.5 | 52.8 | 0.04 | 1,408.3 | 0.96 | 4.3 | 0.00 |
| 2001 | 1,478.7 | 55.5 | 0.04 | 1,418.8 | 0.96 | 4.5 | 0.00 |
| 2002 | 1,132.8 | 55.4 | 0.05 | 1,072.6 | 0.95 | 4.7 | 0.00 |
| 2003 | 1,140.6 | 60.0 | 0.05 | 1,075.7 | 0.94 | 5.0 | 0.00 |
| 2004 | 1,024.7 | 62.8 | 0.06 | 956.7 | 0.93 | 5.2 | 0.01 |
| 2005 | 1,267.2 | 65.0 | 0.05 | 1,196.7 | 0.94 | 5.4 | 0.00 |
| 2006 | 1,618.8 | 67.4 | 0.04 | 1,545.7 | 0.95 | 5.7 | 0.00 |
| 2007 | 1,904.4 | 69.1 | 0.04 | 1,829.3 | 0.96 | 6.0 | 0.00 |
| 2008 | 1,200.4 | 64.6 | 0.05 | 1,129.5 | 0.94 | 6.3 | 0.01 |
| 2009 | 2,263.2 | 66.9 | 0.03 | 2,189.8 | 0.97 | 6.6 | 0.00 |
| 2010 | 1,946.0 | 71.0 | 0.04 | 1,868.1 | 0.96 | 6.9 | 0.00 |

| Year | Total emissions | Energy | %Energy | AFOLU | %AFOLU | Waste | %Waste |
|---|---|---|---|---|---|---|---|
| 2011 | 2,076.8 | 66.3 | 0.03 | 2,003.0 | 0.96 | 7.5 | 0.00 |
| 2012 | 2,166.1 | 66.6 | 0.03 | 2,091.2 | 0.97 | 8.2 | 0.00 |
| 2013 | 657.3 | 66.5 | 0.10 | 582.4 | 0.89 | 8.4 | 0.01 |
| 2014 | 939.4 | 72.9 | 0.08 | 858.0 | 0.91 | 8.5 | 0.01 |

### 2.1.21 NMVOCs

In 2014, NMVOCs emissions stood at 24.5 Gg compared to 15.9 Gg in the year 1994. The two main emission sources were the Energy and AFOLU sectors (Table 2.16). NMVOC emissions increased throughout the inventory period for these two sectors with slight variations between years. Emissions from the Waste sector increased from 0.2 Gg to 0.5 Gg during the inventory period.

**Table 2.16 - NMVOC emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions | Energy | IPPU | AFOLU | Waste |
|---|---|---|---|---|---|
| 1994 | 15.9 | 5.9 | 0.7 | 9.2 | 0.2 |
| 1995 | 16.0 | 6.0 | 0.7 | 9.1 | 0.2 |
| 1996 | 16.2 | 6.3 | 0.8 | 9.0 | 0.2 |
| 1997 | 16.7 | 6.4 | 0.9 | 9.3 | 0.2 |
| 1998 | 17.6 | 6.7 | 1.1 | 9.7 | 0.2 |
| 1999 | 18.4 | 7.0 | 1.2 | 10.0 | 0.2 |
| 2000 | 19.8 | 7.2 | 1.3 | 11.0 | 0.2 |
| 2001 | 19.7 | 7.1 | 1.5 | 10.9 | 0.2 |
| 2002 | 19.3 | 7.2 | 1.4 | 10.5 | 0.2 |
| 2003 | 20.1 | 7.7 | 1.6 | 10.5 | 0.3 |
| 2004 | 20.5 | 8.0 | 1.6 | 10.6 | 0.3 |
| 2005 | 20.4 | 8.3 | 1.7 | 10.1 | 0.3 |
| 2006 | 21.3 | 8.6 | 1.7 | 10.6 | 0.3 |
| 2007 | 21.4 | 8.8 | 1.8 | 10.5 | 0.3 |
| 2008 | 21.3 | 8.3 | 1.9 | 10.7 | 0.4 |
| 2009 | 21.7 | 8.6 | 2.1 | 10.7 | 0.4 |
| 2010 | 21.8 | 9.1 | 2.1 | 10.3 | 0.4 |
| 2011 | 13.0 | 8.6 | 2.2 | 1.7 | 0.5 |
| 2012 | 23.9 | 8.7 | 2.3 | 12.4 | 0.5 |
| 2013 | 22.6 | 8.5 | 2.3 | 11.2 | 0.5 |
| 2014 | 24.5 | 9.2 | 2.3 | 12.5 | 0.5 |

### 2.1.22 $SO_2$

The energy sector remained nearly as the sole emitter of $SO_2$ (Table 2.17) during the full inventory period. Emissions fluctuated during the inventory period 1994 to 2014 from 1.9 Gg to 4.2 Gg. The Waste sector emitted an insignificant amount varying from 0.01 to 0.02 Gg during the inventory period.

**Table 2.17 - $SO_2$ emissions (Gg) by source category (1994 - 2014)**

| Year | Total emissions | Energy | Waste |
|---|---|---|---|
| 1994 | 2.6 | 2.6 | 0.01 |
| 1995 | 2.1 | 2.1 | 0.01 |

| Year | Total emissions | Energy | Waste |
|---|---|---|---|
| 1996 | 2.2 | 2.2 | 0.01 |
| 1997 | 1.9 | 1.9 | 0.01 |
| 1998 | 2.3 | 2.2 | 0.01 |
| 1999 | 2.5 | 2.5 | 0.01 |
| 2000 | 2.2 | 2.2 | 0.01 |
| 2001 | 2.4 | 2.4 | 0.01 |
| 2002 | 2.7 | 2.7 | 0.01 |
| 2003 | 3.0 | 3.0 | 0.01 |
| 2004 | 3.5 | 3.5 | 0.01 |
| 2005 | 3.7 | 3.7 | 0.01 |
| 2006 | 4.2 | 4.2 | 0.01 |
| 2007 | 4.0 | 4.0 | 0.01 |
| 2008 | 4.1 | 4.1 | 0.01 |
| 2009 | 3.7 | 3.7 | 0.01 |
| 2010 | 3.0 | 2.9 | 0.01 |
| 2011 | 3.0 | 3.0 | 0.01 |
| 2012 | 3.7 | 3.7 | 0.02 |
| 2013 | 2.5 | 2.5 | 0.02 |
| 2014 | 2.7 | 2.7 | 0.02 |

## 2.3. Summary, Sectoral and Uncertainties tables from IPCC 2006 software for the year 2014

Table 2.18 - Summary and Sectoral tables from IPCC 2006 software for the year 2014

| Inventory Year 2014 | SHORT SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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** | -105,997.6 | 241.9 | 8.6 | NE | NE | NE | NE | NE | 38.2 | 939.4 | 24.5 | 2.7 |
| **1 - Energy** | 3,142.3 | 1.9 | 0.2 | NA | NA | NA | NA | NA | 24.4 | 72.9 | 9.2 | 2.7 |
| 1.A - Fuel Combustion Activities | 3,142.3 | 1.9 | 0.2 | NA | NA | NA | NA | NA | 24.4 | 72.9 | 9.2 | 2.7 |
| 1.B - Fugitive emissions from fuels | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 1.C - Carbon dioxide Transport and Storage | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **2 - Industrial Processes and Product Use** | 522.4 | NO | NO | NE | NE | NE | NE | NE | NO | NO | 2.3 | NO |
| 2.A - Mineral Industry | 319.9 | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B - Chemical Industry | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.C - Metal Industry | 175.8 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.D - Non-Energy Products from Fuels and Solvent Use | 26.8 | NO | NO | NA | NA | NA | NA | NA | NO | NO | 1.3 | NO |
| 2.E - Electronics Industry | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.F - Product Uses as Substitutes for Ozone Depleting Substances | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.G - Other Product Manufacture and Use | NO | NO | NE | NO | NE | NE | NO | NE | NA | NA | NA | NA |
| 2.H - Other | - | - | NO | NA | NA | NA | NA | NA | - | - | 1.0 | - |
| **3 - Agriculture, Forestry, and Other Land Use** | -109,664.7 | 234.0 | 8.3 | NA | NA | NA | NA | NA | 13.3 | 858.0 | 12.5 | NO |
| 3.A - Livestock | NA | 178.0 | 0.5 | NA | NA | NA | NA | NA | NA | NA | 12.5 | NA |
| 3.B - Land | -109,664.9 | | - | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.C - Aggregate sources and non-CO2 emissions sources on land | 0.3 | 56.0 | 7.9 | NA | NA | NA | NA | NA | 13.3 | 858.0 | NA | NA |
| 3.D - Other | NE | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **4 - Waste** | 2.4 | 5.9 | 8.4E-02 | NA | NA | NA | NA | NA | 0.5 | 8.5 | 0.5 | 1.7E-02 |
| 4.A - Solid Waste Disposal | NA | 3.7 | NO | NA | NA | NA | NA | NA | NO | NO | 0.4 | NA |
| 4.B - Biological Treatment of Solid Waste | NA | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| 4.C - Incineration and Open Burning of Waste | 2.4 | 1.0 | 1.3E-02 | NA | NA | NA | NA | NA | 0.5 | 8.5 | 0.2 | 1.7E-02 |
| 4.D - Wastewater Treatment and Discharge | NA | 1.3 | 7.1E-02 | NA | NA | NA | NA | NA | NO | NO | 1.0E-06 | NA |
| 4.E - Other (please specify) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| **5 - Other** | NO | NO | NE | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| Inventory Year 2014 | SHORT SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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 | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 5.B - Other (please specify) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| | | | | | | | | | | | | |
| **Memo Items (5)** | | | | | | | | | | | | |
| **International Bunkers** | 263.1 | 1.5E-02 | 7.1E-03 | NA | NA | NA | NA | NA | 4.3 | 0.8 | 0.3 | 1.0 |
| 1.A.3.a.i - International Aviation (International Bunkers) | 108.7 | 7.6E-04 | 3.0E-03 | NA | NA | NA | NA | NA | 0.4 | 3.8E-02 | 1.7E-02 | 3.5E-02 |
| 1.A.3.d.i - International water-borne navigation (International bunkers) | 154.4 | 1.4E-02 | 4.1E-03 | NA | NA | NA | NA | NA | 3.8 | 0.8 | 0.3 | 1.0 |
| **1.A.5.c - Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| Inventory Year 2014 | LONG SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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** | -105,997.6 | 241.9 | 8.6 | NE | NE | NE | NE | NE | 38.2 | 939.4 | 24.5 | 2.7 |
| **1 - Energy** | 3,142.3 | 1.9 | 0.2 | NA | NA | NA | NA | NA | 24.4 | 72.9 | 9.2 | 2.7 |
| **1.A - Fuel Combustion Activities** | 3,142.3 | 1.9 | 0.2 | NA | NA | NA | NA | NA | 24.4 | 72.9 | 9.2 | 2.7 |
| 1.A.1 - Energy Industries | 5.4 | 1.9E-04 | 4.7E-05 | NA | NA | NA | NA | NA | 1.0E-02 | 1.0E-03 | 1.0E-04 | 3.6E-02 |
| 1.A.2 - Manufacturing Industries and Construction | 174.6 | 2.1E-02 | 3.2E-03 | NA | NA | NA | NA | NA | 0.6 | 1.1 | 0.2 | 0.9 |
| 1.A.3 - Transport | 2,530.6 | 0.6 | 0.1 | NA | NA | NA | NA | NA | 16.3 | 51.2 | 5.4 | 2.5E-02 |
| 1.A.4 - Other Sectors | 371.7 | 1.3 | 1.9E-02 | NA | NA | NA | NA | NA | 6.8 | 20.3 | 3.6 | 1.8 |

| Inventory Year 2014 | LONG SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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 |
| 1.A.5 - Non-Specified | 60.0 | 3.6E-03 | 3.2E-03 | NA | NA | NA | NA | NA | 0.6 | 0.2 | 4.0E-02 | 3.0E-04 |
| **1.B - Fugitive emissions from fuels** | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 1.B.1 - Solid Fuels | NO | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NO |
| 1.B.2 - Oil and Natural Gas | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| 1.B.3 - Other emissions from Energy Production | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| **1.C - Carbon dioxide Transport and Storage** | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1.C.1 - Transport of CO2 | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1.C.2 - Injection and Storage | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1.C.3 - Other | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **2 - Industrial Processes and Product Use** | 522.4 | NO | NO | NE | NE | NE | NE | NE | NO | NO | 2.3 | NO |
| **2.A - Mineral Industry** | 319.9 | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.A.1 - Cement production | 303.2 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.2 - Lime production | 16.7 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.3 - Glass Production | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.4 - Other Process Uses of Carbonates | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.A.5 - Other (please specify) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **2.B - Chemical Industry** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.B.1 - Ammonia Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.2 - Nitric Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.3 - Adipic Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.5 - Carbide Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.6 - Titanium Dioxide Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.7 - Soda Ash Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8 - Petrochemical and Carbon Black Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.9 - Fluorochemical Production | NA | NA | NA | 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 | NO | NO |
| **2.C - Metal Industry** | 175.8 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.C.1 - Iron and Steel Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.2 - Ferroalloys Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.3 - Aluminium production | NO | NA | NA | NA | NO | NA | NA | NO | NO | NO | NO | NO |
| 2.C.4 - Magnesium production | NO | NA | NA | NA | NA | NO | NA | NO | NO | NO | NO | NO |

| Inventory Year 2014 | LONG SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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.C.5 - Lead Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.6 - Zinc Production | 175.8 | NA | NA | NA | NA | NA | NA | NA | 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** | 26.8 | NO | NO | NA | NA | NA | NA | NA | NO | NO | 1.3 | NO |
| 2.D.1 - Lubricant Use | 9.1 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.2 - Paraffin Wax Use | 17.7 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.3 - Solvent Use | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1.3 | NA |
| 2.D.4 - Other (please specify) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **2.E - Electronics Industry** | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.1 - Integrated Circuit or Semiconductor | NA | NA | NA | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.2 - TFT Flat Panel Display | NA | NA | NA | NA | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.3 - Photovoltaics | NA | NA | NA | NA | NO | NA | NA | NO | NA | NA | NA | NA |
| 2.E.4 - Heat Transfer Fluid | NA | NA | NA | NA | NO | NA | NA | NO | NA | NA | NA | NA |
| 2.E.5 - Other (please specify) | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| **2.F - Product Uses as Substitutes for Ozone Depleting Substances** | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.1 - Refrigeration and Air Conditioning | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.2 - Foam Blowing Agents | NA | NA | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.3 - Fire Protection | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.4 - Aerosols | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.5 - Solvents | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.6 - Other Applications (please specify) | NA | NA | NA | NO | NO | NA | NA | NA | NA | NA | NA | NA |
| **2.G - Other Product Manufacture and Use** | NO | NO | NE | NO | NE | NE | NO | NE | NA | NA | NA | NA |
| 2.G.1 - Electrical Equipment | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.2 - SF6 and PFCs from Other Product Uses | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.3 - N2O from Product Uses | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.G.4 - Other (Please specify) | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| **2.H - Other** | - | - | NO | NA | NA | NA | NA | NA | - | - | 1.0 | - |
| 2.H.1 - Pulp and Paper Industry | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.H.2 - Food and Beverages Industry | - | - | NA | NA | NA | NA | NA | NA | - | - | 1.0 | - |
| 2.H.3 - Other (please specify) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **3 - Agriculture, Forestry, and Other Land Use** | -109,664.7 | 234.0 | 8.3 | NA | NA | NA | NA | NA | 13.3 | 858.0 | 12.5 | NO |
| **3.A - Livestock** | NA | 178.0 | 0.5 | NA | NA | NA | NA | NA | NA | NA | 12.5 | NA |
| 3.A.1 - Enteric Fermentation | NA | 173.8 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

| Inventory Year 2014 | LONG SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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.A.2 - Manure Management | NA | 4.2 | 0.5 | NA | NA | NA | NA | NA | NA | NA | 12.5 | NA |
| **3.B - Land** | -109,664.9 | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.1 - Forest land | -119,433.7 | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.2 - Cropland | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.3 - Grassland | 9,755.9 | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.4 - Wetlands | NO | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.5 - Settlements | 12.8 | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.B.6 - Other Land | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **3.C-Aggregatesourcesandnon-CO2emissionssourceson land** | 0.3 | 56.0 | 7.9 | NA | NA | NA | NA | NA | 13.3 | 858.0 | NA | NA |
| 3.C.1 - Emissions from biomass burning | NA | 56.0 | 1.7 | NA | NA | NA | NA | NA | 13.3 | 858.0 | NA | NA |
| 3.C.2 - Liming | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.3 - Urea application | 0.3 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.4 - Direct N2O Emissions from managed soils | NA | NA | 5.8 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.5 - Indirect N2O Emissions from managed soils | NA | NA | 2.6E-02 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.6 - Indirect N2O Emissions from manure management | NA | NA | 0.4 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.7 - Rice cultivations | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.C.8 - Other (please specify) | NA | NO | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **3.D - Other** | NE | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 3.D.1 - Harvested Wood Products | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3.D.2 - Other (please specify) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **4 - Waste** | 2.4 | 5.9 | 8.4E-02 | NA | NA | NA | NA | NA | 0.5 | 8.5 | 0.5 | 1.7E-02 |
| **4.A - Solid Waste Disposal** | NA | 3.7 | NO | NA | NA | NA | NA | NA | NO | NO | 0.4 | NA |
| **4.B - Biological Treatment of Solid Waste** | NA | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| **4.C - Incineration and Open Burning of Waste** | 2.4 | 1.0 | 1.3E-02 | NA | NA | NA | NA | NA | 0.5 | 8.5 | 0.2 | 1.7E-02 |
| **4.D - Wastewater Treatment and Discharge** | NA | 1.3 | 7.1E-02 | NA | NA | NA | NA | NA | NO | NO | 1.0E-06 | NA |
| **4.E - Other (please specify)** | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NA |
| **5 - Other** | NO | NO | NE | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3** | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **5.B - Other (please specify)** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| Inventory Year 2014 | LONG SUMMARY TABLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | Emissions CO2 Equivalents (Gg) | | | | Emissions (Gg) | | | | |
| Categories | NetCO2(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** | 263.1 | 1.5E-02 | 7.1E-03 | NA | NA | NA | NA | NA | 4.3 | 0.8 | 0.3 | 1.0 |
| 1.A.3.a.i - International Aviation (International Bunkers) | 108.7 | 7.6E-04 | 3.0E-03 | NA | NA | NA | NA | NA | 0.4 | 3.8E-02 | 1.7E-02 | 3.5E-02 |
| 1.A.3.d.i - International water-borne navigation (International bunkers) | 154.4 | 1.4E-02 | 4.1E-03 | NA | NA | NA | NA | NA | 3.8 | 0.8 | 0.3 | 1.0 |
| **1.A.5.c - Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: ENERGY | | | | | | |
|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | | | | |
| Categories | CO2 | CH4 | N2O | NOx | CO | NMVOCs | SO2 |
| **1 - Energy** | 3,142.3 | 1.9 | 0.2 | 24.4 | 72.9 | 9.2 | 2.7 |
| **1.A - Fuel Combustion Activities** | 3,142.3 | 1.9 | 0.2 | 24.4 | 72.9 | 9.2 | 2.7 |
| **1.A.1 - Energy Industries** | 5.4 | 1.9E-04 | 4.7E-05 | 1.0E-02 | 1.0E-03 | 1.0E-04 | 3.6E-02 |
| 1.A.1.a - Main Activity Electricity and Heat Production | 5.4 | 1.9E-04 | 4.7E-05 | 1.0E-02 | 1.0E-03 | 1.0E-04 | 3.6E-02 |
| 1.A.1.a.i - Electricity Generation | 5.4 | 1.9E-04 | 4.7E-05 | 1.0E-02 | 1.0E-03 | 1.0E-04 | 3.6E-02 |
| 1.A.1.a.ii - Combined Heat and Power Generation (CHP) | NO | NO | NO | NO | NO | NO | NO |
| 1.A.1.a.iii - Heat Plants | NO | NO | NO | NO | NO | NO | NO |
| 1.A.1.b - Petroleum Refining | NO | NO | NO | NO | NO | NO | NO |
| 1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries | NO | NO | NO | NO | NO | NO | NO |
| 1.A.1.c.i - Manufacture of Solid Fuels | NO | NO | NO | NO | NO | NO | NO |
| 1.A.1.c.ii - Other Energy Industries | NO | NO | NO | NO | NO | NO | NO |
| **1.A.2 - Manufacturing Industries and Construction** | 174.6 | 2.1E-02 | 3.2E-03 | 0.6 | 1.1 | 0.2 | 0.9 |
| 1.A.2.a - Iron and Steel | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.b - Non-Ferrous Metals | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.c - Chemicals | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.d - Pulp, Paper and Print | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.e - Food Processing, Beverages and Tobacco | EE | EE | EE | EE | EE | EE | EE |
| 1.A.2.f - Non-Metallic Minerals | EE | EE | EE | EE | EE | EE | EE |
| 1.A.2.g - Transport Equipment | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.h - Machinery | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.i - Mining (excluding fuels) and Quarrying | 172.3 | 2.1E-02 | 3.1E-03 | 0.6 | 1.1 | 0.2 | 0.9 |
| 1.A.2.j - Wood and wood products | NO | NO | NO | NO | NO | NO | NO |
| 1.A.2.k - Construction | EE | EE | EE | EE | EE | EE | EE |
| 1.A.2.l - Textile and Leather | EE | EE | EE | EE | EE | EE | EE |
| 1.A.2.m - Non-specified Industry | 2.3 | 1.1E-04 | 2.1E-05 | 1.7E-02 | 2.4E-03 | 9.0E-04 | 1.5E-03 |
| **1.A.3 - Transport** | 2,530.6 | 0.6 | 0.1 | 16.3 | 51.2 | 5.4 | 2.5E-02 |
| 1.A.3.a - Civil Aviation | 25.3 | 1.8E-04 | 7.1E-04 | 6.1E-02 | 4.2 | 6.8E-02 | 8.1E-03 |
| 1.A.3.a.i - International Aviation (International Bunkers) (1) | | | | | | | |
| 1.A.3.a.ii - Domestic Aviation | 25.3 | 1.8E-04 | 7.1E-04 | 6.1E-02 | 4.2 | 6.8E-02 | 8.1E-03 |
| 1.A.3.b - Road Transportation | 2,456.6 | 0.6 | 0.1 | 15.5 | 46.8 | 5.3 | 1.7E-02 |
| 1.A.3.b.i - Cars | 516.0 | 0.2 | 2.4E-02 | 1.6 | 11.8 | 1.4 | 5.7E-03 |
| 1.A.3.b.i.1 - Passenger cars with 3-way catalysts | 166.1 | 6.8E-02 | 7.8E-03 | 0.5 | 3.8 | 0.5 | 1.8E-03 |

| Inventory Year 2014 | SECTORAL TABLE: ENERGY | | | | | | |
|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | | | | |
| Categories | CO2 | CH4 | N2O | NOx | CO | NMVOCs | SO2 |
| 1.A.3.b.i.2 - Passenger cars without 3-way catalysts | 349.9 | 0.1 | 1.7E-02 | 1.1 | 8.0 | 1.0 | 3.9E-03 |
| 1.A.3.b.ii - Light-duty trucks | 1,069.6 | 0.3 | 5.2E-02 | 4.8 | 32.5 | 3.2 | 9.3E-03 |
| 1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts | 802.2 | 0.2 | 3.9E-02 | 3.6 | 24.4 | 2.4 | 7.0E-03 |
| 1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts | 267.4 | 8.1E-02 | 1.3E-02 | 1.2 | 8.1 | 0.8 | 2.3E-03 |
| 1.A.3.b.iii - Heavy-duty trucks and buses | 868.6 | 4.6E-02 | 4.6E-02 | 9.1 | 2.1 | 0.5 | 2.2E-03 |
| 1.A.3.b.iv - Motorcycles | 2.4 | 1.1E-03 | 1.1E-04 | 5.1E-03 | 0.4 | 0.1 | - |
| 1.A.3.b.v - Evaporative emissions from vehicles | NO | NO | NO | NO | NO | NO | NO |
| 1.A.3.b.vi - Urea-based catalysts | NO | NO | NO | NO | NO | NO | NO |
| 1.A.3.c - Railways | 48.7 | 2.6E-03 | 1.8E-02 | 0.8 | 0.2 | 7.3E-02 | 1.0E-04 |
| 1.A.3.d - Water-borne Navigation | EE | EE | EE | EE | EE | EE | EE |
| 1.A.3.d.i - International water-borne navigation (International bunkers) (1) | | | | | | | |
| 1.A.3.d.ii - Domestic Water-borne Navigation | EE | EE | EE | EE | EE | EE | EE |
| 1.A.3.e - Other Transportation | EE | EE | EE | EE | EE | EE | EE |
| 1.A.3.e.i - Pipeline Transport | NO | NO | NO | NO | NO | NO | NO |
| 1.A.3.e.ii - Off-road | EE | EE | EE | EE | EE | EE | EE |
| **1.A.4 - Other Sectors** | 371.7 | 1.3 | 1.9E-02 | 6.8 | 20.3 | 3.6 | 1.8 |
| 1.A.4.a - Commercial/Institutional | EE | EE | EE | EE | EE | EE | EE |
| 1.A.4.b - Residential | 100.1 | 1.3 | 1.7E-02 | 0.4 | 17.4 | 2.6 | 4.8E-02 |
| 1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms | 271.5 | 3.7E-02 | 2.2E-03 | 6.4 | 2.9 | 1.0 | 1.7 |
| 1.A.4.c.i - Stationary | EE | EE | EE | EE | EE | EE | EE |
| 1.A.4.c.ii - Off-road Vehicles and Other Machinery | EE | EE | EE | EE | EE | EE | EE |
| 1.A.4.c.iii - Fishing (mobile combustion) | 271.5 | 3.7E-02 | 2.2E-03 | 6.4 | 2.9 | 1.0 | 1.7 |
| **1.A.5 - Non-Specified** | 60.0 | 3.6E-03 | 3.2E-03 | 0.6 | 0.2 | 4.0E-02 | 3.0E-04 |
| 1.A.5.a - Stationary | EE | EE | EE | EE | EE | EE | EE |
| 1.A.5.b - Mobile | 60.0 | 3.6E-03 | 3.2E-03 | 0.6 | 0.2 | 4.0E-02 | 3.0E-04 |
| 1.A.5.b.i - Mobile (aviation component) | EE | EE | EE | EE | EE | EE | EE |
| 1.A.5.b.ii - Mobile (water-borne component) | EE | EE | EE | EE | EE | EE | EE |
| 1.A.5.b.iii - Mobile (Other) | 60.0 | 3.6E-03 | 3.2E-03 | 0.6 | 0.2 | 4.0E-02 | 3.0E-04 |
| 1.A.5.c - Multilateral Operations (1)(2) | | | | | | | |
| **1.B - Fugitive emissions from fuels** | NO | NO | NO | NO | NO | NO | NO |
| **1.B.1 - Solid Fuels** | NO | NO | NO | NO | NO | NO | NO |
| 1.B.1.a - Coal mining and handling | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.i - Underground mines | NO | NO | NA | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: ENERGY | | | | | | |
|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | | | | |
| Categories | CO2 | CH4 | N2O | NOx | CO | NMVOCs | SO2 |
| 1.B.1.a.i.1 - Mining | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.i.2 - Post-mining seam gas emissions | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.i.3 - Abandoned underground mines | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2 | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.ii - Surface mines | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.ii.1 - Mining | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.a.ii.2 - Post-mining seam gas emissions | NO | NO | NA | NO | NO | NO | NO |
| 1.B.1.b - Uncontrolled combustion and burning coal dumps | NO | NA | NA | NO | NO | NO | NO |
| 1.B.1.c - Solid fuel transformation | NO | NO | NO | NO | NO | NO | NO |
| **1.B.2 - Oil and Natural Gas** | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a - Oil | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.i - Venting | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.a.ii - Flaring | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.iii - All Other | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.iii.1 - Exploration | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.iii.2 - Production and Upgrading | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.iii.3 - Transport | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.a.iii.4 - Refining | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.a.iii.5 - Distribution of oil products | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.a.iii.6 - Other | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.b - Natural Gas | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.b.i - Venting | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.ii - Flaring | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.b.iii - All Other | NO | NO | NO | NO | NO | NO | NO |
| 1.B.2.b.iii.1 - Exploration | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.iii.2 - Production | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.iii.3 - Processing | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.iii.4 - Transmission and Storage | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.iii.5 - Distribution | NO | NO | NA | NO | NO | NO | NO |
| 1.B.2.b.iii.6 - Other | NO | NO | NO | NO | NO | NO | NO |
| **1.B.3 - Other emissions from Energy Production** | NO | NO | NO | NO | NO | NO | NO |
| **1.C - Carbon dioxide Transport and Storage** | NO | NA | NA | NA | NA | NA | NA |
| **1.C.1 - Transport of CO2** | NO | NA | NA | NA | NA | NA | NA |
| 1.C.1.a - Pipelines | NO | NA | NA | NA | NA | NA | NA |
| 1.C.1.b - Ships | NO | NA | NA | NA | NA | NA | NA |

| Inventory Year 2014 | SECTORAL TABLE: ENERGY | | | | | | |
|---|---|---|---|---|---|---|---|
| | Emissions (Gg) | | | | | | |
| Categories | CO2 | CH4 | N2O | NOx | CO | NMVOCs | SO2 |
| 1.C.1.c - Other (please specify) | NO | NA | NA | NA | NA | NA | NA |
| **1.C.2 - Injection and Storage** | NO | NA | NA | NA | NA | NA | NA |
| 1.C.2.a - Injection | NO | NA | NA | NA | NA | NA | NA |
| 1.C.2.b - Storage | NO | NA | NA | NA | NA | NA | NA |
| **1.C.3 - Other** | NO | NA | NA | NA | NA | NA | NA |
| **Memo Items (3)** | | | | | | | |
| International Bunkers | 263.1 | 1.5E-02 | 7.1E-03 | 4.3 | 0.8 | 0.3 | 1.0 |
| 1.A.3.a.i - International Aviation (International Bunkers) (1) | 108.7 | 7.6E-04 | 3.0E-03 | 0.4 | 3.8E-02 | 1.7E-02 | 3.5E-02 |
| 1.A.3.d.i - International water-borne navigation (International bunkers) (1) | 154.4 | 1.4E-02 | 4.1E-03 | 3.8 | 0.8 | 0.3 | 1.0 |
| 1.A.5.c - Multilateral Operations (1)(2) | NO | NO | NO | NO | NO | NO | NO |
| **Information Items** | | | | | | | |
| CO2 from Biomass Combustion for Energy Production | 481.3 | | | | | | |

| Inventory Year 2014 | SECTORAL TABLE: IPPU | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Categories | (Gg) | | | CO2 Equivalents(Gg) | | | | (Gg) | | | | |
| | CO2 | CH4 | N2O | HFCs | PFCs | SF6 | Other halogenated gases with CO2 equivalent conversion factors (1) | Other halogenated gases without CO2 equivalent conversion factors (2) | NOx | CO | NMVOCs | SO2 |
| **2 - Industrial Processes and Product Use** | 522.4 | - | - | - | - | - | - | - | - | - | 2.3 | - |
| **2.A - Mineral Industry** | 319.9 | - | - | - | - | - | - | - | - | - | - | - |
| 2.A.1 - Cement production | 303.2 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.2 - Lime production | 16.7 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.3 - Glass Production | - | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.4 - Other Process Uses of Carbonates | - | - | - | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.A.4.a - Ceramics | NO | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.4.b - Other Uses of Soda Ash | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.A.4.c - Non Metallurgical Magnesia Production | NO | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.A.4.d - Other (please specify) (3) | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.A.5 - Other (please specify) (3) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **2.B - Chemical Industry** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.B.1 - Ammonia Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.2 - Nitric Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.3 - Adipic Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production | NA | NA | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.5 - Carbide Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.6 - Titanium Dioxide Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.7 - Soda Ash Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8 - Petrochemical and Carbon Black Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.a - Methanol | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.b - Ethylene | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.d - Ethylene Oxide | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.e - Acrylonitrile | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.8.f - Carbon Black | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.9 - Fluorochemical Production | NA | NA | NA | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.B.9.a - By-product emissions (4) | NA | NA | NA | NO | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.9.b - Fugitive Emissions (4) | NA | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.B.10 - Other (Please specify) (3) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **2.C - Metal Industry** | 175.8 | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| 2.C.1 - Iron and Steel Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.2 - Ferroalloys Production | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: IPPU | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Categories | (Gg) | | | CO2 Equivalents(Gg) | | | | (Gg) | | | | |
| | CO2 | CH4 | N2O | HFCs | PFCs | SF6 | Other halogenated gases with CO2 equivalent conversion factors (1) | Other halogenated gases without CO2 equivalent conversion factors (2) | NOx | CO | NMVOCs | SO2 |
| 2.C.3 - Aluminium production | NO | NA | NA | NA | NO | NA | NA | NA | NO | NO | NO | NO |
| 2.C.4 - Magnesium production (5) | NO | NA | NA | NA | NA | NO | NA | NA | NO | NO | NO | NO |
| 2.C.5 - Lead Production | NO | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.6 - Zinc Production | 175.8 | NA | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.C.7 - Other (please specify) (3) | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **2.D-Non-Energy Products from Fuels and Solvent Use (6)** | 26.8 | NO | NO | NA | NA | NA | NA | NA | NO | NO | 1.3 | NO |
| 2.D.1 - Lubricant Use | 9.1 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.2 - Paraffin Wax Use | 17.7 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.D.3 - Solvent Use (7) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1.3 | NA |
| 2.D.4 - Other (please specify) (3), (8) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| **2.E - Electronics Industry** | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.1 - Integrated Circuit or Semiconductor (9) | NA | NA | NA | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.2 - TFT Flat Panel Display (9) | NA | NA | NA | NA | NO | NO | NO | NO | NA | NA | NA | NA |
| 2.E.3 - Photovoltaics (9) | NA | NA | NA | NA | NO | NA | NO | NO | NA | NA | NA | NA |
| 2.E.4 - Heat Transfer Fluid (10) | NA | NA | NA | NA | NO | NA | NO | NO | NA | NA | NA | NA |
| 2.E.5 - Other (please specify) (3) | NO | NO | NO | NO | NO | NO | NO | NO | NA | NA | NA | NA |
| **2.F - Product Uses as Substitutes for Ozone Depleting** | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.1 - Refrigeration and Air Conditioning | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.1.a - Refrigeration and Stationary Air Conditioning | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.1.b - Mobile Air Conditioning | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.2 - Foam Blowing Agents | NA | NA | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.3 - Fire Protection | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.4 - Aerosols | NA | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.F.5 - Solvents | NA | NA | NA | NE | NE | NA | NA | NA | NA | NA | NA | NA |
| 2.F.6 - Other Applications (please specify) (3) | NA | NA | NA | NO | NO | NA | NA | NA | NA | NA | NA | NA |
| **2.G - Other Product Manufacture and Use** | NO | NO | NE | NO | NE | NE | NO | NE | NA | NA | NA | NA |
| 2.G.1 - Electrical Equipment | NA | NA | NA | NA | NE | - | NA | NE | - | - | - | - |
| 2.G.1.a - Manufacture of Electrical Equipment | NA | NA | NA | NA | NO | NO | NA | NO | NA | NA | NA | NA |
| 2.G.1.b - Use of Electrical Equipment | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.1.c - Disposal of Electrical Equipment | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.2 - SF6 and PFCs from Other Product Uses | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.2.a - Military Applications | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |
| 2.G.2.b - Accelerators | NA | NA | NA | NA | NE | NE | NA | NE | NA | NA | NA | NA |

| Inventory Year 2014 | SECTORAL TABLE: IPPU | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Categories | (Gg) | | | CO2 Equivalents(Gg) | | | | (Gg) | | | | |
| | CO2 | CH4 | N2O | HFCs | PFCs | SF6 | Other halogenated gases with CO2 equivalent conversion factors (1) | Other halogenated gases without CO2 equivalent conversion factors (2) | NOx | CO | NMVOCs | SO2 |
| 2.G.2.c - Other (please specify) (3) | NA | NA | NA | NA | NO | NO | NA | NO | NA | NA | NA | NA |
| 2.G.3 - N2O from Product Uses | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.G.3.a - Medical Applications | NA | NA | NE | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.G.3.b - Propellant for pressure and aerosol products | NA | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.G.3.c - Other (Please specify) (3) | NA | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2.G.4 - Other (Please specify) (3) | NA | NA | NO | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **2.H - Other** | - | - | - | - | - | - | - | - | - | - | 1.0 | - |
| 2.H.1 - Pulp and Paper Industry | NO | NO | NA | NA | NA | NA | NA | NA | NO | NO | NO | NO |
| 2.H.2 - Food and Beverages Industry | - | - | NA | NA | NA | NA | NA | NA | - | - | 1.0 | - |
| 2.H.3 - Other (please specify) (3) | NO | NO | NO | NA | NA | NA | NA | NA | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: AFOLU | | | | | |
|---|---|---|---|---|---|---|
| Categories | (Gg) | | | | | |
| | Net CO2 emissions / removals | Emissions | | | | |
| | | CH4 | N2O | NOx | CO | NMVOCs |
| **3 - Agriculture, Forestry, and Other Land Use** | -109,664.7 | 234.0 | 8.3 | 13.3 | 858.0 | 12.5 |
| **3.A - Livestock** | NA | 178.0 | 0.5 | NA | NA | 12.5 |
| 3.A.1 - Enteric Fermentation | NA | 173.8 | NA | NA | NA | NA |
| 3.A.1.a - Cattle | NA | 151.5 | NA | NA | NA | NA |
| 3.A.1.a.i - Dairy Cows | NA | 0.2 | NA | NA | NA | NA |
| 3.A.1.a.ii - Other Cattle | NA | 151.3 | NA | NA | NA | NA |
| 3.A.1.b - Buffalo | NA | NO | NA | NA | NA | NA |
| 3.A.1.c - Sheep | NA | 10.2 | NA | NA | NA | NA |
| 3.A.1.d - Goats | NA | 9.5 | NA | NA | NA | NA |
| 3.A.1.e - Camels | NA | 2.5E-03 | NA | NA | NA | NA |
| 3.A.1.f - Horses | NA | 1.0 | NA | NA | NA | NA |
| 3.A.1.g - Mules and Asses | NA | 1.6 | NA | NA | NA | NA |
| 3.A.1.h - Swine | NA | 6.9E-02 | NA | NA | NA | NA |
| 3.A.1.j - Other (please specify) | NA | NO | NA | NA | NA | NA |
| 3.A.2 - Manure Management (1) | NA | 4.2 | 0.5 | NA | NA | 12.5 |
| 3.A.2.a - Cattle | NA | 2.9 | 0.4 | NA | NA | - |
| 3.A.2.a.i - Dairy cows | NA | 2.0E-03 | 1.8E-03 | NA | NA | - |
| 3.A.2.a.ii - Other cattle | NA | 2.9 | 0.4 | NA | NA | - |
| 3.A.2.b - Buffalo | NA | NO | NA | NA | NA | - |
| 3.A.2.c - Sheep | NA | 0.4 | NA | NA | NA | - |
| 3.A.2.d - Goats | NA | 0.4 | NA | NA | NA | - |
| 3.A.2.e - Camels | NA | 1.4E-04 | NA | NA | NA | - |
| 3.A.2.f - Horses | NA | 0.1 | NA | NA | NA | - |
| 3.A.2.g - Mules and Asses | NA | 0.2 | NA | NA | NA | - |
| 3.A.2.h - Swine | NA | 6.9E-02 | NA | NA | NA | - |
| 3.A.2.i - Poultry | NA | 0.1 | 2.9E-03 | NA | NA | - |
| 3.A.2.j - Other (please specify) | NA | NA | NA | NA | NA | NA |
| **3.B - Land** | -109,664.9 | NA | NO | NO | NO | NO |
| 3.B.1 - Forest land | -119,433.7 | NA | NO | NO | NO | NO |
| 3.B.1.a - Forest land Remaining Forest land | -118,470.9 | NA | NA | NO | NO | NO |
| 3.B.1.b - Land Converted to Forest land | -962.7 | NA | NA | NO | NO | NO |
| 3.B.1.b.i - Cropland converted to Forest Land | -62.2 | NA | NA | NO | NO | NO |
| 3.B.1.b.ii - Grassland converted to Forest Land | -900.5 | NA | NA | NO | NO | NO |
| 3.B.1.b.iii - Wetlands converted to Forest Land | NO | NA | NA | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: AFOLU | | | | | |
|---|---|---|---|---|---|---|
| Categories | (Gg) | | | | | |
| | Net CO2 emissions / removals | Emissions | | | | |
| | | CH4 | N2O | NOx | CO | NMVOCs |
| 3.B.1.b.iv - Settlements converted to Forest Land | NO | NA | NA | NO | NO | NO |
| 3.B.1.b.v - Other Land converted to Forest Land | NO | NA | NA | NO | NO | NO |
| 3.B.2 - Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.a - Cropland Remaining Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b - Land Converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b.i - Forest Land converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b.ii - Grassland converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b.iii - Wetlands converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b.iv - Settlements converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.2.b.v - Other Land converted to Cropland | NO | NA | NA | NO | NO | NO |
| 3.B.3 - Grassland | 9,755.9 | NA | NA | NO | NO | NO |
| 3.B.3.a - Grassland Remaining Grassland | NO | NA | NA | NO | NO | NO |
| 3.B.3.b - Land Converted to Grassland | 9,755.9 | NA | NA | NO | NO | NO |
| 3.B.3.b.i - Forest Land converted to Grassland | 9,755.9 | NA | NA | NO | NO | NO |
| 3.B.3.b.ii - Cropland converted to Grassland | NO | NA | NA | NO | NO | NO |
| 3.B.3.b.iii - Wetlands converted to Grassland | NO | NA | NA | NO | NO | NO |
| 3.B.3.b.iv - Settlements converted to Grassland | NO | NA | NA | NO | NO | NO |
| 3.B.3.b.v - Other Land converted to Grassland | NO | NA | NA | NO | NO | NO |
| 3.B.4 - Wetlands | NO | NO | NO | NO | NO | NO |
| 3.B.4.a - Wetlands Remaining Wetlands | NO | NO | NO | NO | NO | NO |
| 3.B.4.a.i - Peatlands remaining peatlands | NO | NO | NO | NO | NO | NO |
| 3.B.4.a.ii - Flooded land remaining flooded land | NA | NO | NO | NO | NO | NO |
| 3.B.4.b - Land Converted to Wetlands | - | NO | NO | NO | NO | NO |
| 3.B.4.b.i - Land converted for peat extraction | NA | NO | NO | NO | NO | NO |
| 3.B.4.b.ii - Land converted to flooded land | NO | NO | NO | NO | NO | NO |
| 3.B.4.b.iii - Land converted to other wetlands | NA | NO | NO | NO | NO | NO |
| 3.B.5 - Settlements | 12.8 | NA | NA | NO | NO | NO |
| 3.B.5.a - Settlements Remaining Settlements | NO | NA | NA | NO | NO | NO |
| 3.B.5.b - Land Converted to Settlements | 12.8 | NA | NA | NO | NO | NO |
| 3.B.5.b.i - Forest Land converted to Settlements | 12.8 | NA | NA | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: AFOLU | | | | | |
|---|---|---|---|---|---|---|
| Categories | (Gg) | | | | | |
| | Net CO2 emissions / removals | Emissions | | | | |
| | | CH4 | N2O | NOx | CO | NMVOCs |
| 3.B.5.b.ii - Cropland converted to Settlements | - | NA | NA | NO | NO | NO |
| 3.B.5.b.iii - Grassland converted to Settlements | NO | NA | NA | NO | NO | NO |
| 3.B.5.b.iv - Wetlands converted to Settlements | NO | NA | NA | NO | NO | NO |
| 3.B.5.b.v - Other Land converted to Settlements | NO | NA | NA | NO | NO | NO |
| 3.B.6 - Other Land | NO | NO | NO | NO | NO | NO |
| 3.B.6.a - Other land Remaining Other land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b - Land Converted to Other land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b.i - Forest Land converted to Other Land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b.ii - Cropland converted to Other Land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b.iii - Grassland converted to Other Land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b.iv - Wetlands converted to Other Land | NO | NO | NO | NO | NO | NO |
| 3.B.6.b.v - Settlements converted to Other Land | NO | NO | NO | NO | NO | NO |
| **3.C-Aggregatesourcesandnon-CO2emissionssourceson land (2)** | 0.3 | 56.0 | 7.9 | 13.3 | 858.0 | NO |
| 3.C.1 - Emissions from biomass burning | - | 56.0 | 1.7 | 13.3 | 858.0 | NO |
| 3.C.1.a - Biomass burning in forest lands | NA | 55.9 | 1.6 | 13.2 | 854.9 | NO |
| 3.C.1.b - Biomass burning in croplands | NA | NO | NO | NO | NO | NO |
| 3.C.1.c - Biomass burning in grasslands | NA | 0.1 | 1.0E-02 | 0.2 | 3.1 | NO |
| 3.C.1.d - Biomass burning in all other land | NA | NO | NO | NO | NO | NO |
| 3.C.2 - Liming | NO | NA | NA | NA | NA | NA |
| 3.C.3 - Urea application | 0.3 | NA | NA | NA | NA | NA |
| 3.C.4 - Direct N2O Emissions from managed soils (3) | NA | NA | 5.8 | NA | NA | NA |
| 3.C.5 - Indirect N2O Emissions from managed soils | NA | NA | 2.6E-02 | NA | NA | NA |
| 3.C.6 - Indirect N2O Emissions from manure management | NA | NA | 0.4 | NA | NA | NA |
| 3.C.7 - Rice cultivations | NA | NO | NA | NA | NA | NA |
| 3.C.8 - Other (please specify) | NE | NO | NO | NA | NA | NA |
| **3.D - Other** | NE | NO | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: AFOLU | | | | | |
|---|---|---|---|---|---|---|
| Categories | (Gg) | | | | | |
| | Net CO2 emissions / removals | Emissions | | | | |
| | | CH4 | N2O | NOx | CO | NMVOCs |
| 3.D.1 - Harvested Wood Products | NE | NA | NA | NA | NA | NA |
| 3.D.2 - Other (please specify) | NO | NO | NO | NO | NO | NO |

| Inventory Year 2014 | SECTORAL TABLE: WASTE | | | | | | |
|---|---|---|---|---|---|---|---|
| Categories | Emissions [Gg] | | | | | | |
| | CO2 | CH4 | N2O | NOx | CO | NMVOCs | SO2 |
| **4 - Waste** | 2.4 | 5.9 | 8.4E-02 | 0.5 | 8.5 | 0.5 | 1.7E-02 |
| **4.A - Solid Waste Disposal** | - | 3.7 | - | - | - | 0.4 | - |
| 4.A.1 - Managed Waste Disposal Sites | NA | | NA | NO | NO | NO | NA |
| 4.A.2 - Unmanaged Waste Disposal Sites | NA | | NA | NO | NO | NO | NA |
| 4.A.3 - Uncategorised Waste Disposal Sites | NA | | NA | NO | NO | 0.4 | NA |
| **4.B - Biological Treatment of Solid Waste** | NA | NO | NO | NO | NO | NO | NA |
| **4.C - Incineration and Open Burning of Waste** | 2.4 | 1.0 | 1.3E-02 | 0.5 | 8.5 | 0.2 | 1.7E-02 |
| 4.C.1 - Waste Incineration | NE | NE | NE | NE | NE | NE | NE |
| 4.C.2 - Open Burning of Waste | 2.4 | 1.0 | 1.3E-02 | 0.5 | 8.5 | 0.2 | 1.7E-02 |
| **4.D - Wastewater Treatment and Discharge** | NA | 1.3 | 7.1E-02 | NO | NO | 1.0E-06 | - |
| 4.D.1 - Domestic Wastewaster Treatment and Discharge | NA | 0.6 | 7.1E-02 | NO | NO | 8.0E-07 | NA |
| 4.D.2 - Industrial Wastewater Treatment and Discharge | NA | 0.7 | NA | NO | NO | 2.0E-07 | NA |
| **4.E - Other (please specify)** | NO | NO | NO | NO | NO | NO | NO |

## Table 2.19 - Uncertainty analysis results

| Uncertainties for the period 1994 to 2014 – Level and Trend assessments - Base year- 1994, Year T-2014 (rows with no activity have been deleted for ease of presentation of results | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M |
| 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 | Type A Sensitivity (%) | Type B Sensitivity (%) | Uncertainty in trend in national emissions introduced by emission factor uncertainty (%) | Uncertainty in trend in national emissions introduced by activity data uncertainty (%) | Uncertainty introduced into the trend in total national emissions (%) |
| **1.A - Fuel Combustion Activities** | | | | | | | | | | | | |
| 1.A.1.a.i - Electricity Generation - Liquid Fuels | CO2 | 0.6635502 | 4.7145176 | 1.5 | 7 | 7.15891053 | 1.19812E-07 | 5.027E-05 | 6.115E-05 | 0.000351866 | 0.000129724 | 1.40638E-07 |
| 1.A.1.a.i - Electricity Generation - Liquid Fuels | N2O | 0.00159458 | 0.0113295 | 1.5 | 500 | 500.00225 | 3.37515E-09 | 1.208E-07 | 1.47E-07 | 6.03978E-05 | 3.11739E-07 | 3.64799E-09 |
| 1.A.1.a.i - Electricity Generation - Liquid Fuels | CH4 | 0.0005401 | 0.0038374 | 1.5 | 100 | 100.011249 | 1.54918E-11 | 4.091E-08 | 4.978E-08 | 4.09146E-06 | 1.05589E-07 | 1.67512E-11 |
| 1.A.1.a.i - Electricity Generation - Solid Fuels | CO2 | 29.93144 | 0.671187 | 0.2 | 7 | 7.00285656 | 2.32363E-09 | 0.0004823 | 8.706E-06 | 0.00337633 | 2.46243E-06 | 1.13996E-05 |
| 1.A.1.a.i - Electricity Generation - Solid Fuels | N2O | 0.147126 | 0.0032992 | 0.2 | 297 | 297.000067 | 1.00984E-10 | 2.371E-06 | 4.279E-08 | 0.000704147 | 1.21039E-08 | 4.95823E-07 |
| 1.A.1.a.i - Electricity Generation - Solid Fuels | CH4 | 0.0066444 | 0.000149 | 0.2 | 75 | 75.0002667 | 1.31341E-14 | 1.071E-07 | 1.933E-09 | 8.03035E-06 | 5.46629E-10 | 6.44866E-11 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels | CO2 | 34.36326 | 59.862991 | 6.5 | 7 | 9.55248659 | 3.43938E-05 | 0.0002127 | 0.0007765 | 0.001489217 | 0.007137771 | 5.31655E-05 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels | N2O | 0.0873084 | 0.1515447 | 6.5 | 297 | 297.071119 | 2.13173E-07 | 5.334E-07 | 1.966E-06 | 0.000158411 | 1.80695E-05 | 2.54204E-08 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels | CH4 | 0.0295722 | 0.0513297 | 6.5 | 75 | 75.2811397 | 1.57051E-09 | 1.807E-07 | 6.658E-07 | 1.35493E-05 | 6.1203E-06 | 2.21042E-10 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Other Fossil F | CO2 | 1.2587076 | 22.648161 | 6.5 | 7 | 9.55248659 | 4.92299E-06 | 0.0002731 | 0.0002938 | 0.00191185 | 0.002700456 | 1.09476E-05 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Other Fossil F | N2O | 0.02129328 | 0.383134 | 6.5 | 297 | 297.071119 | 1.36255E-06 | 4.62E-06 | 4.97E-06 | 0.001372239 | 4.5683E-05 | 1.88513E-06 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Other Fossil F | CH4 | 0.01081836 | 0.1946568 | 6.5 | 75 | 75.2811397 | 2.25861E-08 | 2.347E-06 | 2.525E-06 | 0.000176057 | 2.32099E-05 | 3.15348E-08 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels | CO2 | 73.58934 | 89.767722 | 6.5 | 7 | 9.55248659 | 7.73399E-05 | 4.288E-05 | 0.0011644 | 0.000300152 | 0.010703466 | 0.000114654 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels | N2O | 0.3617235 | 0.4412473 | 6.5 | 297 | 297.071119 | 1.80724E-06 | 2.108E-07 | 5.723E-06 | 6.25976E-05 | 5.26122E-05 | 6.6865E-09 |
| 1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels | CH4 | 0.163359 | 0.199273 | 6.5 | 75 | 75.2811397 | 2.36701E-08 | 9.518E-08 | 2.585E-06 | 7.13886E-06 | 2.37603E-05 | 6.15517E-10 |
| 1.A.2.m - Non-specified Industry - Biomass | CO2 | 0 | 0.0471744 | 5 | 18.6941667 | 19.3512756 | 8.76521E-11 | 6.119E-07 | 6.119E-07 | 1.1439E-05 | 4.3268E-06 | 1.49572E-10 |
| 1.A.2.m - Non-specified Industry - Biomass | N2O | 0 | 0.0005223 | 5 | 281.818182 | 281.862533 | 2.27942E-12 | 6.775E-09 | 6.775E-09 | 1.90922E-06 | 4.79039E-08 | 3.6474E-12 |
| 1.A.2.m - Non-specified Industry - Biomass | CH4 | 0 | 0.0002654 | 5 | 245.454545 | 245.505466 | 4.46386E-13 | 3.442E-09 | 3.442E-09 | 8.44842E-07 | 2.43383E-08 | 7.1435E-13 |
| 1.A.2.m - Non-specified Industry - Liquid Fuels | CO2 | 1.29636 | 2.3376234 | 12.5 | 7 | 14.3265488 | 1.17968E-07 | 9.054E-06 | 3.032E-05 | 6.33793E-05 | 0.000536013 | 2.91327E-07 |
| 1.A.2.m - Non-specified Industry - Liquid Fuels | N2O | 0.003348 | 0.0060111 | 12.5 | 297 | 297.262931 | 3.35832E-10 | 2.305E-08 | 7.797E-08 | 6.84446E-06 | 1.37834E-06 | 4.87465E-11 |
| 1.A.2.m - Non-specified Industry - Liquid Fuels | CH4 | 0.001134 | 0.002036 | 12.5 | 75 | 76.0345316 | 2.52068E-12 | 7.806E-09 | 2.641E-08 | 5.85425E-07 | 4.66857E-07 | 5.60678E-13 |
| 1.A.3.a.i - International Aviation (International Bunkers) - Liquid | CO2 | 72.7305865 | 108.69832 | 4 | 5 | 6.40312424 | 5.09518E-05 | 0.0002168 | 0.0014099 | 0.001083809 | 0.00797579 | 6.47879E-05 |
| 1.A.3.a.i - International Aviation (International Bunkers) - Liquid | N2O | 0.63067082 | 0.9425589 | 4 | 110 | 110.072703 | 1.13216E-06 | 1.88E-06 | 1.223E-05 | 0.000206756 | 6.91607E-05 | 4.75311E-08 |
| 1.A.3.a.i - International Aviation (International Bunkers) - Liquid | CH4 | 0.01068072 | 0.0159627 | 4 | 79 | 79.101201 | 1.67691E-10 | 3.183E-08 | 2.071E-07 | 2.51472E-06 | 1.17127E-06 | 7.69567E-12 |
| 1.A.3.a.ii - Domestic Aviation - Liquid Fuels | CO2 | 16.7509 | 25.304893 | 4 | 5 | 6.40312424 | 2.76136E-06 | 5.343E-05 | 0.0003282 | 0.000267133 | 0.001856758 | 3.51891E-06 |
| 1.A.3.a.ii - Domestic Aviation - Liquid Fuels | N2O | 0.146816 | 0.2214608 | 4 | 110 | 110.072703 | 6.25005E-08 | 4.64E-07 | 2.873E-06 | 5.10411E-05 | 1.62498E-05 | 2.86925E-09 |
| 1.A.3.a.ii - Domestic Aviation - Liquid Fuels | CH4 | 0.0024864 | 0.0037505 | 4 | 79 | 79.101201 | 9.25732E-12 | 7.858E-09 | 4.865E-08 | 6.20801E-07 | 2.75198E-07 | 4.61128E-13 |

**Uncertainties for the period 1994 to 2014 – Level and Trend assessments - Base year- 1994, Year T-2014 (rows with no activity have been deleted for ease of presentation of results**

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | Type A Sensitivity (%) | Type B Sensitivity (%) | Uncertainty in trend in national emissions introduced by emission factor uncertainty (%) | Uncertainty in trend in national emissions introduced by activity data uncertainty (%) | Uncertainty introduced into the trend in total national emissions (%) |
| 1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels | CO2 | 69.045102 | 166.1483 | 5 | 3.5 | 6.10327781 | 0.000108155 | 0.0010224 | 0.0021551 | 0.003578465 | 0.015239011 | 0.000245033 |
| 1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels | N2O | 1.00466908 | 2.4163731 | 5 | 12 | 13 | 1.03787E-07 | 1.486E-05 | 3.134E-05 | 0.000178332 | 0.000221628 | 8.09212E-08 |
| 1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels | CH4 | 0.61792366 | 1.4198881 | 5 | 9.62 | 10.8417895 | 2.49253E-08 | 8.28E-06 | 1.842E-05 | 7.96554E-05 | 0.000130231 | 2.33051E-08 |
| 1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fu | CO2 | 146.721732 | 349.89396 | 5 | 3.5 | 6.10327781 | 0.000479655 | 0.0021315 | 0.0045385 | 0.007460294 | 0.03209204 | 0.001085555 |
| 1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fu | N2O | 2.13493528 | 5.1316769 | 5 | 12 | 13 | 4.68097E-07 | 3.154E-05 | 6.656E-05 | 0.000378467 | 0.000470674 | 3.64771E-07 |
| 1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fu | CH4 | 1.31309338 | 2.9518285 | 5 | 9.62 | 10.8417895 | 1.07724E-07 | 1.675E-05 | 3.829E-05 | 0.000161102 | 0.00027074 | 9.92539E-08 |
| 1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuel | CO2 | 267.869535 | 802.22075 | 5 | 3.5 | 6.10327781 | 0.002521414 | 0.0060114 | 0.0104057 | 0.021039784 | 0.07357915 | 0.005856564 |
| 1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuel | N2O | 3.922926 | 12.135495 | 5 | 12 | 13 | 2.61777E-06 | 9.305E-05 | 0.0001574 | 0.001116639 | 0.001113059 | 2.48578E-06 |
| 1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuel | CH4 | 2.2853972 | 5.1240788 | 5 | 9.62 | 10.8417895 | 3.24611E-07 | 2.897E-05 | 6.646E-05 | 0.00027871 | 0.000469977 | 2.98558E-07 |
| 1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid F | CO2 | 89.290092 | 267.40692 | 5 | 3.5 | 6.10327781 | 0.000280157 | 0.0020037 | 0.0034686 | 0.007013085 | 0.024526383 | 0.000650727 |
| 1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid F | N2O | 1.30764603 | 4.0451649 | 5 | 12 | 13 | 2.90864E-07 | 3.102E-05 | 5.247E-05 | 0.000372212 | 0.00037102 | 2.76198E-07 |
| 1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid F | CH4 | 0.76179934 | 1.7080263 | 5 | 9.62 | 10.8417895 | 3.60679E-08 | 9.657E-06 | 2.215E-05 | 9.29034E-05 | 0.000156659 | 3.31731E-08 |
| 1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels | CO2 | 160.791072 | 868.57812 | 5 | 3.5 | 6.10327781 | 0.002955794 | 0.0086287 | 0.0112664 | 0.03020055 | 0.079665404 | 0.00725865 |
| 1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels | N2O | 2.62343328 | 14.171538 | 5 | 12 | 13 | 3.56986E-06 | 0.0001408 | 0.0001838 | 0.00168938 | 0.001299804 | 4.54349E-06 |
| 1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels | CH4 | 0.17771645 | 0.9600074 | 5 | 9.62 | 10.8417895 | 1.13941E-08 | 9.537E-06 | 1.245E-05 | 9.17442E-05 | 8.80512E-05 | 1.617E-08 |
| 1.A.3.b.iv - Motorcycles - Liquid Fuels | CO2 | 0.8460133 | 2.363577 | 5 | 3.5 | 6.10327781 | 2.18875E-08 | 1.678E-05 | 3.066E-05 | 5.87263E-05 | 0.000216786 | 5.04448E-08 |
| 1.A.3.b.iv - Motorcycles - Liquid Fuels | N2O | 0.01198336 | 0.0334795 | 5 | 12 | 13 | 1.99239E-11 | 2.377E-07 | 4.343E-07 | 2.85208E-06 | 3.07072E-06 | 1.75636E-11 |
| 1.A.3.b.iv - Motorcycles - Liquid Fuels | CH4 | 0.00837144 | 0.0233884 | 5 | 9.62 | 10.8417895 | 6.7629E-12 | 1.66E-07 | 3.034E-07 | 1.59726E-06 | 2.14517E-06 | 7.15299E-12 |
| 1.A.3.c - Railways - Liquid Fuels | CO2 | 35.05671 | 48.686767 | 5 | 3.5 | 6.10327781 | 9.28706E-06 | 5.64E-05 | 0.0006315 | 0.000197402 | 0.004465518 | 1.99798E-05 |
| 1.A.3.c - Railways - Liquid Fuels | N2O | 4.1945046 | 5.5769622 | 5 | 12 | 13 | 5.52856E-07 | 3.527E-06 | 7.234E-05 | 4.23202E-05 | 0.000511515 | 2.63439E-07 |
| 1.A.3.c - Railways - Liquid Fuels | CH4 | 0.04123067 | 0.0548198 | 5 | 9.62 | 10.8417895 | 3.71541E-11 | 3.467E-08 | 7.111E-07 | 3.33489E-07 | 5.02803E-06 | 2.53923E-11 |
| 1.A.3.d.i - International water-borne navigation (International bu | CO2 | 139.69015 | 154.41417 | 10 | 3 | 10.4403065 | 0.000273358 | 0.0002888 | 0.0020029 | 0.000866279 | 0.02832553 | 0.000803086 |
| 1.A.3.d.i - International water-borne navigation (International bu | N2O | 1.15288789 | 1.2603881 | 10 | 90 | 90.5538514 | 1.3701E-06 | 2.565E-06 | 1.635E-05 | 0.00023085 | 0.000231204 | 1.06747E-07 |
| 1.A.3.d.i - International water-borne navigation (International bu | CH4 | 0.273346 | 0.2988339 | 10 | 50 | 50.9901951 | 2.4421E-08 | 6.082E-07 | 3.876E-06 | 3.04076E-05 | 5.48177E-05 | 3.9296E-09 |
| 1.A.4.b - Residential - Biomass | CO2 | 461.144208 | 481.28537 | 20 | 297 | 297.672639 | 2.158804575 | 0.0013225 | 0.0062428 | 0.39279564 | 0.176572687 | 0.185466328 |
| 1.A.4.b - Residential - Biomass | CH4 | 25.3198617 | 26.452802 | 20 | 75 | 77.6208735 | 0.000443436 | 7.226E-05 | 0.0003431 | 0.0054196 | 0.009704933 | 0.000123558 |
| 1.A.4.b - Residential - Biomass | N2O | 4.83117516 | 5.0541665 | 20 | 999 | 999.20018 | 0.002682466 | 1.37E-05 | 6.556E-05 | 0.013685681 | 0.001854259 | 0.000190736 |
| 1.A.4.b - Residential - Liquid Fuels | CO2 | 102.10887 | 100.13758 | 5 | 7 | 8.60232527 | 7.8047E-05 | 0.0003762 | 0.0012989 | 0.002633746 | 0.009184552 | 9.12926E-05 |
| 1.A.4.b - Residential - Liquid Fuels | CH4 | 0.271782 | 0.2562855 | 5 | 75 | 75.1664819 | 3.90325E-08 | 1.134E-06 | 3.324E-06 | 8.50795E-05 | 2.35063E-05 | 7.79106E-09 |
| 1.A.4.b - Residential - Liquid Fuels | N2O | 0.2231256 | 0.2017856 | 5 | 297 | 297.042085 | 3.77874E-07 | 1.043E-06 | 2.617E-06 | 0.000309797 | 1.85076E-05 | 9.63166E-08 |
| 1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels | CO2 | 365.33844 | 271.52559 | 20 | 3 | 20.2237484 | 0.003171575 | 0.0024717 | 0.003522 | 0.00741498 | 0.099616583 | 0.009978446 |
| 1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels | CH4 | 1.036644 | 0.7719304 | 20 | 50 | 53.8516481 | 1.81754E-07 | 6.994E-06 | 1.001E-05 | 0.000349689 | 0.000283204 | 2.02487E-07 |
| 1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels | N2O | 0.9181704 | 0.6837097 | 20 | 90 | 92.1954446 | 4.1792E-07 | 6.194E-06 | 8.868E-06 | 0.000557505 | 0.000250838 | 3.73731E-07 |

| Uncertainties for the period 1994 to 2014 – Level and Trend assessments - Base year- 1994, Year T-2014 (rows with no activity have been deleted for ease of presentation of results | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J | K | L | M |
| 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 | Type A Sensitivity (%) | Type B Sensitivity (%) | Uncertainty in trend in national emissions introduced by emission factor uncertainty (%) | Uncertainty in trend in national emissions introduced by activity data uncertainty (%) | Uncertainty introduced into the trend in total national emissions (%) |
| 1.A.5.b.iii - Mobile (Other) - Liquid Fuels | CO2 | 14.869647 | 60.024194 | 5 | 3.5 | 6.10327781 | 1.41159E-05 | 0.0005346 | 0.0007786 | 0.001871229 | 0.005505379 | 3.38107E-05 |
| 1.A.5.b.iii - Mobile (Other) - Liquid Fuels | N2O | 0.24261003 | 0.9773475 | 5 | 12 | 13 | 1.69791E-08 | 8.697E-06 | 1.268E-05 | 0.000104366 | 8.96417E-05 | 1.89278E-08 |
| 1.A.5.b.iii - Mobile (Other) - Liquid Fuels | CH4 | 0.01643487 | 0.0752078 | 5 | 9.62 | 10.8417895 | 6.99291E-11 | 7.059E-07 | 9.755E-07 | 6.79081E-06 | 6.89801E-06 | 9.36977E-11 |
| **2.A - Mineral Industry** | | | | | | | | | | | | |
| 2.A.1 - Cement production | CO2 | 0 | 303.16 | 35 | 0 | 35 | 0.011841591 | 0.0039323 | 0.0039323 | 0 | 0.194639427 | 0.037884506 |
| 2.A.2 - Lime production | CO2 | 3.96704 | 16.69283 | 5 | 2 | 5.38516481 | 8.4994E-07 | 0.0001514 | 0.0002165 | 0.000302886 | 0.001531055 | 2.43587E-06 |
| **2.C - Metal Industry** | | | | | | | | | | | | |
| 2.C.6 - Zinc Production | CO2 | 0 | 175.76336 | 10 | 50 | 50.9901951 | 0.008448123 | 0.0022798 | 0.0022798 | 0.113991961 | 0.032241796 | 0.014033701 |
| **2.D - Non-Energy Products from Fuels and Solvent Use** | | | | | | | | | | | | |
| 2.D.1 - Lubricant Use | CO2 | 0.50306667 | 9.064 | 15 | 50 | 52.2015325 | 2.3547E-05 | 0.0001093 | 0.0001176 | 0.00546584 | 0.002494032 | 3.60956E-05 |
| 2.D.2 - Paraffin Wax Use | CO2 | 17.688 | 17.688 | 15 | 100 | 101.118742 | 0.000336474 | 6.075E-05 | 0.0002294 | 0.006074642 | 0.004866995 | 6.05889E-05 |
| **3.A - Livestock** | | | | | | | | | | | | |
| 3.A.1.a.i - Dairy Cows | CH4 | 2.8873215 | 3.849762 | 20 | 20 | 28.2842712 | 1.24706E-06 | 2.568E-06 | 4.994E-05 | 5.13579E-05 | 0.00141239 | 1.99748E-06 |
| 3.A.1.a.ii - Other Cattle | CH4 | 2244.04092 | 3177.3573 | 20 | 20 | 28.2842712 | 0.849478277 | 0.0044006 | 0.0412137 | 0.088012734 | 1.165700341 | 1.366603527 |
| 3.A.1.c - Sheep | CH4 | 275.0496 | 214.63638 | 20 | 30 | 36.0555128 | 0.006299125 | 0.0017283 | 0.0027841 | 0.051848841 | 0.078745221 | 0.008889112 |
| 3.A.1.d - Goats | CH4 | 172.11705 | 198.7061 | 20 | 30 | 36.0555128 | 0.005398783 | 0.0002462 | 0.0025774 | 0.007386672 | 0.07290076 | 0.005369084 |
| 3.A.1.e - Camels | CH4 | 0 | 0.05313 | 0 | 0 | 0 | 0 | 6.892E-07 | 6.892E-07 | 0 | 0 | 0 |
| 3.A.1.f - Horses | CH4 | 22.226778 | 20.881098 | 20 | 30 | 36.0555128 | 5.96184E-05 | 9.379E-05 | 0.0002709 | 0.002813673 | 0.007660801 | 6.66046E-05 |
| 3.A.1.g - Mules and Asses | CH4 | 30.57747 | 33.39609 | 20 | 30 | 36.0555128 | 0.000152498 | 6.845E-05 | 0.0004332 | 0.002053578 | 0.012252268 | 0.000154335 |
| 3.A.1.h - Swine | CH4 | 0.374703 | 1.44291 | 20 | 30 | 36.0555128 | 2.84677E-07 | 1.257E-05 | 1.872E-05 | 0.000377068 | 0.000529371 | 4.22414E-07 |
| 3.A.2.a.i - Dairy cows | N2O | 0.42006938 | 0.5600925 | 20 | 30 | 36.0555128 | 4.28937E-08 | 3.736E-07 | 7.265E-06 | 1.12079E-05 | 0.000205485 | 4.23498E-08 |
| 3.A.2.a.i - Dairy cows | CH4 | 0.0315 | 0.042 | 20 | 30 | 36.0555128 | 2.41197E-10 | 2.802E-08 | 5.448E-07 | 8.40454E-07 | 1.54088E-05 | 2.38139E-10 |
| 3.A.2.a.ii - Other cattle | N2O | 97.7775755 | 138.44407 | 20 | 30 | 36.0555128 | 0.00262073 | 0.0001917 | 0.0017958 | 0.005750726 | 0.050791991 | 0.002612897 |
| 3.A.2.a.ii - Other cattle | CH4 | 42.751548 | 60.53229 | 20 | 30 | 36.0555128 | 0.000501012 | 8.381E-05 | 0.0007852 | 0.002514396 | 0.022207925 | 0.000499514 |
| 3.A.2.c - Sheep | CH4 | 8.251488 | 8.5854552 | 20 | 30 | 36.0555128 | 1.00786E-05 | 2.401E-05 | 0.0001114 | 0.000720191 | 0.003149809 | 1.044E-05 |
| 3.A.2.d - Goats | CH4 | 5.8519797 | 8.7430682 | 20 | 30 | 36.0555128 | 1.0452E-05 | 1.74E-05 | 0.0001134 | 0.000522088 | 0.003207633 | 1.05615E-05 |
| 3.A.2.e - Camels | CH4 | 0 | 0.0029568 | 20 | 30 | 36.0555128 | 1.19541E-12 | 3.835E-08 | 3.835E-08 | 1.15059E-06 | 1.08478E-06 | 2.5006E-12 |
| 3.A.2.f - Horses | CH4 | 2.02510644 | 2.5405336 | 20 | 30 | 36.0555128 | 8.82518E-07 | 2.692E-07 | 3.295E-05 | 8.07673E-06 | 0.000932064 | 8.68809E-07 |
| 3.A.2.g - Mules and Asses | CH4 | 2.7519723 | 4.0075308 | 20 | 30 | 36.0555128 | 2.19597E-06 | 6.835E-06 | 5.198E-05 | 0.000205044 | 0.001470272 | 2.20374E-06 |
| 3.A.2.h - Swine | CH4 | 0.374703 | 1.44291 | 20 | 30 | 36.0555128 | 2.84677E-07 | 1.257E-05 | 1.872E-05 | 0.000377068 | 0.000529371 | 4.22414E-07 |
| 3.A.2.h - Swine | N2O | 0 | 1.1220211 | 20 | 30 | 36.0555128 | 1.72138E-07 | 1.455E-05 | 1.455E-05 | 0.000436615 | 0.000411644 | 3.60083E-07 |
| 3.A.2.i - Poultry | CH4 | 0.19506942 | 2.1649509 | 20 | 30 | 36.0555128 | 6.4087E-07 | 2.488E-05 | 2.808E-05 | 0.000746446 | 0.000794271 | 1.18805E-06 |
| 3.A.2.i - Poultry | N2O | 0.12189207 | 0.9018682 | 20 | 30 | 36.0555128 | 1.11214E-07 | 9.699E-06 | 1.17E-05 | 0.000290955 | 0.000330875 | 1.94133E-07 |

**Uncertainties for the period 1994 to 2014 – Level and Trend assessments - Base year- 1994, Year T-2014 (rows with no activity have been deleted for ease of presentation of results**

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | Type A Sensitivity (%) | Type B Sensitivity (%) | Uncertainty in trend in national emissions introduced by emission factor uncertainty (%) | Uncertainty in trend in national emissions introduced by activity data uncertainty (%) | Uncertainty introduced into the trend in total national emissions (%) |
| **3.B - Land** | | | | | | | | | | | | |
| 3.B.1.a - Forest land Remaining Forest land | CO2 | -95039.297 | -118470.94 | 20 | 10 | 22.3606798 | 738.1147473 | 0.0221884 | 1.5366952 | 0.221884064 | 43.46430278 | 1889.194849 |
| 3.B.1.b.i - Cropland converted to Forest Land | CO2 | -250.24106 | -62.193408 | 20 | 10 | 22.3606798 | 0.000203418 | 0.0032985 | 0.0008067 | 0.03298481 | 0.022817351 | 0.001608629 |
| 3.B.1.b.ii - Grassland converted to Forest Land | CO2 | -1369.6171 | -900.5177 | 20 | 10 | 22.3606798 | 0.042646627 | 0.0107865 | 0.0116807 | 0.107865121 | 0.330379522 | 0.120785513 |
| 3.B.3.b.i - Forest Land converted to Grassland | CO2 | 8671.94533 | 9755.9385 | 20 | 10 | 22.3606798 | 5.005394292 | 0.0157394 | 0.126545 | 0.157394005 | 3.579232607 | 12.83567893 |
| 3.B.5.b.i - Forest Land converted to Settlements | CO2 | 55.4527875 | 12.770945 | 20 | 10 | 22.3606798 | 8.57721E-06 | 0.0007441 | 0.0001657 | 0.007440773 | 0.00468537 | 7.73178E-05 |
| 3.B.5.b.ii - Cropland converted to Settlements | CO2 | 7.86272611 | 0 | 10 | 10 | 14.1421356 | 0 | 0.000129 | 0 | 0.001289912 | 0 | 1.66387E-06 |
| **3.C - Aggregate sources and non-CO2 emissions sources on land** | | | | | | | | | | | | |
| 3.C.1.a - Biomass burning in forest lands | CH4 | 2932.76466 | 1173.8915 | 20 | 20 | 28.2842712 | 0.115951418 | 0.032899 | 0.0152266 | 0.657980868 | 0.430674161 | 0.618419056 |
| 3.C.1.a - Biomass burning in forest lands | N2O | 1273.32919 | 509.67277 | 20 | 10 | 22.3606798 | 0.013661017 | 0.0142808 | 0.006611 | 0.142808233 | 0.186987381 | 0.055358472 |
| 3.C.1.c - Biomass burning in grasslands | N2O | 16.4059471 | 3.0934691 | 20 | 10 | 22.3606798 | 5.03259E-07 | 0.000229 | 4.013E-05 | 0.002290209 | 0.001134924 | 6.53311E-06 |
| 3.C.1.c - Biomass burning in grasslands | CH4 | 12.1721543 | 2.2951545 | 20 | 20 | 28.2842712 | 4.43245E-07 | 0.0001699 | 2.977E-05 | 0.003398373 | 0.00084204 | 1.2258E-05 |
| 3.C.3 - Urea application | CO2 | 0.33900729 | 0.2813294 | 10 | 20 | 22.3606798 | 4.16227E-09 | 1.912E-06 | 3.649E-06 | 3.82481E-05 | 5.16067E-05 | 4.12617E-09 |
| 3.C.4 - Direct N2O Emissions from managed soils | N2O | 1359.42348 | 1795.1404 | 20 | 20 | 28.2842712 | 0.271154634 | 0.0009832 | 0.0232849 | 0.01966384 | 0.658596321 | 0.434135781 |
| 3.C.5 - Indirect N2O Emissions from managed soils | N2O | 1.12590542 | 7.9370331 | 20 | 20 | 28.2842712 | 5.30074E-06 | 8.448E-05 | 0.000103 | 0.001689618 | 0.002911917 | 1.13341E-05 |
| 3.C.6 - Indirect N2O Emissions from manure management | N2O | 89.092281 | 130.16146 | 20 | 20 | 28.2842712 | 0.001425558 | 0.0002267 | 0.0016883 | 0.004534846 | 0.047753287 | 0.002300941 |
| **4.A - Solid Waste Disposal** | | | | | | | | | | | | |
| 4.A - Solid Waste Disposal | CH4 | 8.42614095 | 76.862008 | 30 | 60 | 67.0820393 | 0.002796187 | 0.0008587 | 0.000997 | 0.051524966 | 0.042298392 | 0.004443976 |
| **4.C - Incineration and Open Burning of Waste** | | | | | | | | | | | | |
| 4.C.2 - Open Burning of Waste | CH4 | 8.44282666 | 20.735474 | 40 | 100 | 107.703296 | 0.000524585 | 0.0001305 | 0.000269 | 0.013045358 | 0.015214751 | 0.00040167 |
| 4.C.2 - Open Burning of Waste | N2O | 1.63939282 | 4.0263278 | 40 | 100 | 107.703296 | 1.97791E-05 | 2.533E-05 | 5.223E-05 | 0.002533091 | 0.002954337 | 1.51447E-05 |
| 4.C.2 - Open Burning of Waste | CO2 | 0.95970879 | 2.3570325 | 40 | 100 | 107.703296 | 6.77828E-06 | 1.483E-05 | 3.057E-05 | 0.001482884 | 0.001729484 | 5.19006E-06 |
| **4.D - Wastewater Treatment and Discharge** | | | | | | | | | | | | |
| 4.D.1 - Domestic Wastewaster Treatment and Discharge | N2O | 22.0842512 | 22.008863 | 20 | 0 | 20 | 2.03791E-05 | 7.682E-05 | 0.0002855 | 0 | 0.008074553 | 6.51984E-05 |
| 4.D.1 - Domestic Wastewaster Treatment and Discharge | CH4 | 5.15437885 | 12.364351 | 20 | 30 | 36.0555128 | 2.09034E-05 | 7.582E-05 | 0.0001604 | 0.00227458 | 0.0045362 | 2.57508E-05 |
| 4.D.2 - Industrial Wastewater Treatment and Discharge | CH4 | 28.2485139 | 14.38095 | 25 | 30 | 39.0512484 | 3.31723E-05 | 0.0002769 | 0.0001865 | 0.00830678 | 0.006595056 | 0.000112497 |
| **Total** | | | | | | | | | | | | |
| | | **Sum(C): -77094.629** | **Sum D: -97506.801** | | | **Sum(H): 746.626** | | | | | **Sum(M): 1904.917** | |
| | | | | **Uncertainty in total inventory: 27.324** | | | | | | | **Trend uncertainty: 43.645** | |

# 3 Mitigation actions and their effects

## 3.1 Context

As a signatory Party to the Convention, Namibia invested in its implementation for nearly a decade now according to its capabilities. This is reflected in the progress recorded in reducing the emissions intensity per capita and per unit of GDP produced. Based on results presented in the NIR3, per capita emissions of GHG decreased gradually from 11.9 tonnes $CO_2$-eq in 1994 to reach 9.6 tonnes $CO_2$-eq in 2014 while the GDP emission index decreased steadily from 100 in the year 1994 to 46.6 in 2014. Namibia is committed to further progress in the decoupling of carbon emissions from economic growth to match the low carbon pathway embedded in its policies and strategies.

To meet this objective, Namibia established the NCCC in 2001 to drive implementation of mitigation actions. Cabinet approved the first NPCC in 2011 and the NCCAP in 2014 to enhance climate change mitigation activities. In line with the latest decisions of the COP, the country produced its INDC in 2015 which led to the PA to which Namibia is also a signatory Party. The INDC identified a potential reduction of about 89% of national GHG emissions at the 2030-time horizon compared to the BAU scenario on partly through national investments and the rest conditionally with support from the international community. The projected GHG emissions to be avoided in 2030 is of the order of 20,000 Gg $CO_2$-eq inclusive of sequestration in the AFOLU sector and compared to the BAU scenario (Republic of Namibia 2015b). The outcomes of COP21 and Namibia's commitment, have created the necessary drive for more structured and focused mitigation efforts. The country has reviewed its policies, strategies and regulations towards creating a favourable environment for mitigation in view of serious implementation of the NDC post 2020. New policies produced for the energy sector since 2016 to promote implementation of the PA are:

- National integrated resource plan for the electricity supply industry;
- National energy policy;
- National renewable energy policy; and
- National independent power producer (IPP) policy.

Namibia provided its voluntary and conditional contributions in its INDC in 2015 and these will be revisited by the year 2020. The initial contributions will be economy-wide and will address the Intergovernmental Panel on Climate Change (IPCC) sectors Energy, Industrial Process and Product Use (IPPU), Agriculture Forestry and Land Use (AFOLU) and Waste. The INDC envisaged mitigation in all sectors with the highest reductions anticipated in the AFOLU sector which is concurrently the highest emitting sector of the economy is given in Table 3.1.

**Table 3.1 - Namibia's measures contributing to mitigation as per the INDC**

| Sector | Measure | GHG amount | % of BAU scenario in 2030 |
|---|---|---|---|
| ENERGY | Increase share renewables in electricity production from 33% to 70% | 740 | 3.3 |
| | Increase energy efficiency and DSM | 51 | 0.2 |
| | Mass transport in Windhoek, car and freight pooling | 510 | 2.3 |
| IPPU | Replace 20% clinker in cement production | 36 | 0.2 |

| Sector | Measure | GHG amount | % of BAU scenario in 2030 |
|---|---|---|---|
| AFOLU | Reduce deforestation rate by 75 % | 13,537 | 59.8 |
| | Reforest of 20 000 ha per year | 1779 | 7.9 |
| | Restore 15 M ha of grassland | 1359 | 6.0 |
| | Reduce removal of wood by 50 % | 701 | 3.1 |
| | Afforest 5000 ha per year | 578 | 2.6 |
| | Plant 5000 ha of arboriculture per year | 358 | 1.6 |
| | Fatten 100 000 cattle heads in feedlots | 201 | 0.9 |
| | Soil carbon | 180 | 0.8 |
| WASTE | Transform 50% MSW to electricity and compost | 205 | 0.9 |

**Source: Republic of Namibia 2015b**

Namibia has developed its first Nationally Appropriate Mitigation Action (NAMA) which has been deposited into the UNFCCC NAMA registry. The NAMA, while aiming at relieving the hardships of the poorest segments of the population, will contribute to sustainable development of the country, and mitigation. The overall target of the NAMA is to support Namibia in achieving the goal defined in the Off-Grid Energisation Master Plan (OGEMP), namely to provide access to electricity to the population living or working in off-grid areas through the adoption of appropriate technologies that will enable reduction of GHG emissions compared to extension of the grid and generation of electricity from fossil fuel energy sources. More specifically, the NAMA aims at giving access to electricity for regions, households and companies which are currently without access to electricity, as well as improving the share of renewable energies (mainly using solar energy). The NAMA will reduce GHG emissions through the replacement of fossil fuels with renewable energies and will provide the conditions for income generation and new business opportunities. This will also lead to enhanced private sector involvement. Finally, the NAMA aims to achieve additional sustainable development benefits, such as better air quality, job creation and improved livelihoods for the poor (UNDP 2015).

## 3.2 Mitigation actions implemented and planned

Namibia should provide information on the implemented and planned mitigation policies, programmes and actions including their effects. Within the framework of the BUR3, data has been collected and analysed with a focus on improving reporting of information provided in previous BURs on mitigation actions to the UNFCCC. However, when performing this exercise for this BUR, it was evident that shortcomings still exist within the system in place to collect and report exhaustively on mitigations actions implemented, namely by the private sector and that capacity building and more concerted efforts will be required. This will be more explicitly described in the MRV emissions section of the appropriate chapter of this report.

Based on information collected within the exercise for reporting in this BUR on mitigation activities implemented to-date, Namibia considers that it has achieved a fair part of its voluntary contribution as per the differentiated responsibilities embedded in the Convention. Furthermore, Namibia stresses on the fact that most of the actions are voluntary and that once the conditional funding starts to flow in, the full potential of mitigation can then be captured. In this vein, the country has already reviewed and updated existing policies and developed new ones to be in line with the PA.

Tables 3.1 to 3.4 provide detailed information on policies as well as planned and implemented actions, including those of the INDC.

## Table 3.2 - Mitigation policies and strategies

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| 1. Climate Change Strategy and Action Plan (CCSAP) | Mainstream Climate change adaptation and mitigation in the medium to long-term national development plan | The CCSAP was developed to implement the National Policy on Climate Change (NPCC) and covers the period 2013 to 2020. The CCSAP paves the way to the strategic options to be adopted for mitigating and adapting to climate change to implement the Convention | All greenhouse gas not controlled by the Montreal protocol | Policy | Ongoing | Public and private sector | Number of institutions to have mainstreamed climate change into their strategies | A number of policies and strategies developed such as Renewable Energy Policy (REP); Independent Power Producer (IPP) Policy; Updated Energy Policy; IPP Market and Investment Framework, and Electricity National Integrated Resource Plan (NIRP) | Monitoring and Evaluation of implementation of policies and strategies<br><br>Provided enough resources are available | Policies and strategies being implemented, | Improved energy security, mitigation of GHGs, improved livelihood | Is quantified under individual mitigation actions below |
| 2. Barrier Removal to Namibian Renewable Energy Programme (NAMREP) | Increase the share of Renewable Energy | The project ran from 2003-2011; the first phase (NAMREP I) focused on providing technical assistance to government, NGOs, finance and other sectors to remove and reduce barriers in terms of capacities, institutional development, technical constraints, financial instruments and public awareness. Phase II focused on promoting the delivery of commercially, institutionally and technically sustainable solar energy services to rural and off-grid communities. | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Residential sector | Completed in 2010 | Ministry of Mines and Energy | Increased share of renewables in the energy mix, NEI created to implement and monitor actions under this olicy | Barriers identified and removed enabling penetration of solar technologies | Surveys, interviews, capacity building in the rural communities. Projects on solar water heaters, solar Home Systems and Solar cookers rolled out as well as demonstrations<br><br>Provided enough resources are available | 12 regions visited, surveyed and interviews conducted; 5 villages and 148 households covered. Adoption and penetration is timid due to low purchasing power of villagers mainly | Energy access and security; job creation; improved livelihood | Included elsewhere under actions |
| 3. Off Grid Energy Master Plan (OGEMP), 2007 | Electrify remote rural areas | Increase access to electricity while increasing the share of renewables in the energy mix | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Residential and | Ongoing | Ministry of Mines and Energy | Number of shops established, loans granted, | Approved by cabinet in 2007; Renewable | Transmission to the remote rural areas are onerous and not economical, Low purchasing power of rural | The Solar Revolving Fund set up to support implementation of the plan; GRN has also | Energy access, improved livelihood | Included elsewhere under actions |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | | | | Institutional sectors | | | electrification rates improved | Energy Institute created to implement and monitor the activities | communities and need to support them<br><br>Provided enough resources are available | increased the capitalization of the Solar Revolving Fund (SRF) with more and more rural households (4000) benefit from the offered low interest loans to acquire off-grid household energy systems. | | |
| 4. Namibia Energy Efficiency Programme (NEEP) in buildings | Improve energy efficiency of buildings through identification of savings potentials | To develop a rating system for buildings and building codes to improve energy efficiency in buildings. Included 60 energy efficiency audits in commercial and industrial sectors. GEF funded Programme | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Commercial and Residential sectors | Completed in 2014 | Ministry of Mines and Energy | No. of audits undertaken Savings opportunities identified Reduced energy consumption per m2 in buildings Cost savings | Renewable Energy & Energy Efficiency Institute (REEEI). In 2014 this institution was transformed into the Namibia Energy Institute (NEI) to include the other energy sectors. | Perform energy audits in buildings<br><br>Provided enough resources are available and more technicians trained | Fifteen audits done, three facilities implemented energy efficiency measures. Project supported the establishment of the Green Building Council of Namibia | Energy savings; | 17,000 t $CO_2$-eq/yr savings expected but difficult to quantify |
| 5. Assessment of investment and financial flows to mitigate climate change in the energy sector | Quantify the required investment and financial flows required to mitigate in the energy sector | Evaluate investments needed and the flow of funds to implement projects for mitigation in the energy sector | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors | Study completed and implementation ongoing | Ministry of Environment and Tourism | Funds attracted and invested | Subsidy to be provided on the LPG kits for cars, | Modelling approach used and estimates of emissions reduction based on GHG inventory of INC; Fuel switching to LPG will be adopted by car owners<br><br>Provided enough resources are available | Various capacity development trainings/workshops were conducted, Assessment recommendations compiled and about USD600mil spent to date on projects/ interventions commissioned | Improved energy access and security, Improved livelihood | 1,200,000 t $CO_2$-eq/yr by 2030 expected |
| 6. Renewable Energy and Energy Efficiency Capacity | To increase the use of renewable energy and promote energy | The objective was to do an assessment of the extent to which energy efficiency is incorporated into rural and peri-urban houses in Namibia | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Commercial, Institutional and | Completed in 2009 | Ministry of Mines and Energy | No. persons capacitated, No of audits undertaken on energy | Renewable Energy & Energy Efficiency Institute | Policy being implemented<br><br>Provided enough resources are available | New Institution (NEI) created to implement policy | Improved energy access and security, Improved livelihood | Emission reduction not quantified |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| Building Programme (REEECAP) | efficiency measures | | | Residential sectors | | | efficiency | (REEEI). In 2014 this institution was transformed into the Namibia Energy Institute (NEI) to include the other energy sectors. | | | | |
| 7. Rural Electricity Distribution Master Plan (REDMP), 2010 | Improve rural electrification | The REDMP for Namibia was conceptualized and developed as part of the Government's policy and agenda to guide the social upliftment of especially poor, rural communities and economic development of the nation. | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Commercial, Institutional and Residential sectors | Originally introduced in 2000. It is reviewed and updated every 5 years | Ministry of Mines and Energy | Level of access to electricity by rural population | Establish the status quo with regards to the planned versus achieved electrification of rural communities from 2005 up until 2010, establish rural electrification targets and priorities for the next 20 years | Establish a structured methodology and approach to derive a rural electrification master plan for achieving the 20-year targets.<br><br>Provided enough resources are available | Master plan reviewed and implemented | Improved energy access and security, Improved livelihood | Emission reduction not quantified |
| 8. Solar Thermal Technology Roadmap for Namibia | Increase share of solar in the energy mix | Promote widespread adoption of flat plate solar thermal collector capacity in Namibia by 2030. | $CO_2$, $CH_4$, $N_2O$ | National; Energy - Commercial, Institutional and Residential sectors | Ongoing: Preparation work has started | Ministry of Mines and Energy | Flat plate solar thermal collector capacity installed | Preparation undertaken | Awareness campaigns<br><br>Provided enough resources are available | To be assessed | Energy security; technology transfer; job creation | Emission reduction not quantified |
| 9. Develop an Independent Power Producer Framework | Promote electricity generation by Independent Power Producers | Decentralize the electricity generation sector while tapping renewable energy sources as well as support Namibia's economic growth and employment enhancement targets | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors | Completed in 2017 | Ministry of Mines and Energy; Nampower | IPP Frame-work Establish-ed; MW installed capacity | Draft framework produced | Reduce Namibia's dependence on energy imports, increase access to reliable and affordable electricity for all consumers | Licences approved for a number of IPPs | Energy security; Attract investments | Emission reduction not quantified |
| 10. Renewable Energy Feed-in | Generate electricity from | A capacity of 70 MW is expected to be generated through the REFIT | $CO_2$, $CH_4$, $N_2O$ | National; Energy - | Ongoing - 2 project on PV are | Nampower and | 2 projects on PV completed | 19 licenses delivered and | IPCC 2006 GL and baseline from GHG inventory of | 20 MW power under production in 2016 | Energy security; technology | 13,392 t $CO_2$-eq/yr annually |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| Tariff (REFIT) Programme | solar and wind energy; increase renewable energy share in the energy mix. | Programme, each Independent Power Producers (IPPs) generating 5 MW | | All sectors | completed while 12 are still under construction in 2014. 4 installed until 2016. | Independent Power Producers | with 12 being commissioned | N$110 secured for Areva Mine Solar PV construction phase | Namibia<br><br>Implementation will depend on availability of resources | | transfer; improved livelihood through job creation | |
| 11. National Renewable Energy Policy for Namibia | Increase share of renewables in electricity production from 33% to 70% | The overarching mission of Namibia's National Renewable Energy Policy is to enable access to modern, clean, and affordable energy services for all Namibians. This policy aims to make renewable energy a powerful tool for the Government of Namibia to meet its short-term and long-term national development goals, and to assist Namibians climb the development ladder, empowered by access to energy at levels that facilitate engagement in productive activity. Additionally, the policy's vision is for Namibia to become a regional leader in the development and deployment of renewable energy within southern Africa. | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors | Finalised 2016 | Ministry of Mines and Energy; Nampower | Finalisation of feed in tariffs; Removal of barriers; no of technicians trained on installation and maintenance of RE systems, No of licenses delivered by regulator | Barrier removal studies completed; 19 licenses delivered by regulator | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Implementation will depend on availability of resources | Policy has clearly paved the way for increase in the share of renewables in the country's energy mix. Feed in tariffs partly worked out; Technicians trained on installation and maintenance of RE systems | Energy security, job creation, improved health and livelihood | 740 000 t $CO_2$-eq/yr by 2030 expected (Note that actual emission reductions reduced are reported per project where implemented) |

## Table 3.3 - Energy Sector – Planned and implemented actions

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| 1. Concentrating Solar Power (CSP) Technology Transfer for electricity generation in Namibia (NAM CSP TT) | Increase the share of solar in the energy mix | The CSP TT NAM aims to develop the necessary technological framework and conditions for the successful transfer and deployment of CSP technology for on-grid power generation. | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors | Ongoing | Ministry of Mines and Energy, National Planning Commission | Programme components implemented; CSP installed capacity | Capacity development, Identification of site for first CSP project, Feasibility studies undertaken | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Implementation will depend on availability of resources | Pre-feasibility study completed in 2012, map of solar radiation done, Funds secured from the GEF, through UNDP, for funding r a full feasibility study | Energy security; Technology transfer; job creation | 482,944 t $CO_2$-eq/yr expected Emissions avoided provided below under actions implemented |
| 2. Concentrated Solar Power (CSP) with Thermal Energy Storage (TES) | Develop a CSP Plant incorporating thermal storage | Aim to provide:<br>1. A clean and renewable solution for flexible and dispatchable power,<br>2. Voltage support and system stability to the national grid, and<br>3. Ancillary services (including frequency response reserves, frequency regulating reserves, spinning reserves and ramping reserves). | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors | Ongoing | Nampower | MW installed capacity | The project will involve the construction of the CSP Plant with storage and potentially hybridized with PV. Implementation to commence late 2016 for commercial operation in March 2021. | IPCC 2006 GL and baseline from GHG inventory of Namibia, Implementation options (trough or central receiver with storage) of between 50 and 200 MW<br><br>Implementation will depend on availability of resources | Feasibility study completed | Increased security of energy supply. Employment and taxes. Technology transfer. | To be determined once the installed capacity has been confirmed |
| 3. NAMA: Intervention A | Increase number of mini grids in rural areas | Mini grids will be established in rural communities. These mini grids will preferably be near schools and potential future tourism projects, such as ecologies. The mini grids will use renewable energy sources (solar, wind, hydro) and will provide electricity for lighting, radio and phone charging for households, for service and production activities in Rural Productivity Zones (RPZs), and for lighting and the Internet for public buildings. The mini grids to be financed will be selected using the | $CO_2$, $CH_4$, $N_2O$ | National; Energy - All sectors rural areas | Proposal in drafting stage | Ministry of Mines and Energy and Ministry of Environment and Tourism | Support requested to develop full NAMA project and partial funding; Energy Zones identified | NAMA submitted to the UNFCCC NAMA Registry | Estimated using Institute for Energy and Transport Joint Research Centre (European Commission) (IET) (2012). Photovoltaic Geographical Information System. Geographical Assessment of Solar Resource and Performance of Photovoltaic Technology. Available from http://re.jrc.ec.europa.eu/pvgis/.<br><br>Implementation will depend | Energy zones identified and NAMA deposited in UNFCCC registry | Improved energy access and security, Job creation, Better livelihood. | 110 t $CO_2$-eq/yr (expected) |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | | approach of "reversed auctioning". Under reversed auctioning, offers are accepted, starting from the cheapest, until the budget available for the specific auction is used up. In the case of the mini grids, auctioning will be based on value for money. Proposals will be ranked by their standing in the Value for Money Index (VMI), which will be calculated as "grant support requested (in N$) per one OGEMP Point Score | | | | | | | on availability of resources | | | |
| 4. NAMA: Intervention B | Invest in Energy Zones | Intervention B will support the installation of Energy Zones (EZs). Currently, so-called Energy Shops sell suitable, approved energy products and compatible appliances to consumers. Under Intervention B, these will be developed into the concept of Energy Zones, by adding a Rural Productivity Zone component. | $CO_2$, $CH_4$, $N_2O$ | National; Energy – Rural areas All sectors | Full project proposal being developed | Ministry of Mines and Energy, and Ministry of Environment and Tourism | Support requested to develop full NAMA project and partial funding; Energy Zones identified | NAMA submitted to the UNFCCC NAMA Registry | Estimated using Institute for Energy and Transport Joint Research Centre (European Commission) (IET) (2012). Photovoltaic Geographical Information System. Geographical Assessment of Solar Resource and Performance of Photovoltaic Technology. Available from http://re.jrc.ec.europa.eu/pvgis/.<br><br>Implementation will depend on availability of resources | Energy zones identified and NAMA deposited in UNFCCC registry | Improved energy access and security, Job creation, Better livelihood. | 18 t $CO_2$-eq/yr (expected) |
| 5. Conversion of biomass to electricity | Harvest invader bush (which is a local fuel source, currently a nuisance for farmers) to generate electricity | The National Integrated Resource Plan (NIRP) proposess that a commercial scale pilot project owned by the government would support the operation and economic characteristics of a Biomass-to-Electricity power station to encourage private sector investment. | $CO_2$, $CH_4$, $N_2O$ | National; Energy – Rural areas All sectors | Planned | Nampower | MW installed capacity | Pre-feasibility study undertaken | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Encroacher bush supply will be regular | Initial planning | Energy security, Job creation, improved rangeland productivity through de-bushing | To be determined after commissioning of generation plant |
| 6. Organic Energy Solutions | Reduce O&L carbon footprint by | Ohlthaver & List (O&L) Energy plans to convert encroacher bush to energy. The bush-thinning | $CO_2$, $CH_4$, $N_2O$ | Energy – Industrial sector | Ongoing | Ohlthaver & List | Installation started | Area invaded by bush identified. | IPCC 2006 GL and baseline from GHG inventory of Namibia | Boiler installed | Rangeland rehabilitated, Reduction in the | 10,603 t $CO_2$-eq/yr after commissioning |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | 20% by 2019 | project will eventually replace 80% of the current 3600 tons of heavy fuel oil (HFO) used by it brewery (Namibia Breweries Limited (NBL). | | | | | | Biomass boiler installed at the O&L brewery. | Encroacher bush supply will be regular | | use of fossil fuel. | of generation plant |
| 7. Xaris gas power plant. | Increase electricity generation capacity | 250MW Gas power plant worth N$7 billion located in Walvis Bay. | $CH_4$, $N_2O$ | Energy – Rural areas All sectors | Tendering stage | Nampower | MW installed capacity | Project conceptualized | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Implementation will depend on availability of resources | None | Energy security | To be determined after commissioning of generation plant |
| 8. Kudu Gas-to-Power Project | Increase electricity generation capacity | The 884 megawatt (MW) Kudu power plant will be located in the area of Oranjemund and is expected to be commissioned in 2019. Since the expected Namibian domestic electricity demand from the power plant is approximately 400MW, the remainder of the electricity must be exported by means of power purchase agreements with Zambia (Copperbelt Energy Corporation) and South Africa (Eskom). | $CH_4$, $N_2O$ | Energy – Rural areas All sectors | Planned | NAMCOR | MW installed capacity | Envisaged Subsea wells, Floating Production Facility, transport pipeline, Onshore reception facilities | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided project is still viable, availability of resources | None | Energy security; revenue from the sale of electricity to neighbouring countries | To be determined after commissioning of generation plant |
| 9. Solar PV grid tied system at Spar | Increase the share of Renewable Energy | The Electricity Control Board (ECB) has drafted the net-metering rules to allow feeding back in the grid. This has stimulated private sector investment in rooftop solar PV | $CO_2$, $CH_4$, $N_2O$ | Energy – Commercial sector | Implemented | ECB and MME. | Supply power to the commercial institution with excess sent to the grid | Feed in tariff put in place by Erongo Red | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Systems are maintained properly and technology meets expected lifetime | PV system installed, Feed in tariff implemented | Energy security | 300 t $CO_2$-eq/yr when project developed |
| 10. Solar PV grid tied system at Nampower | Increase the share of RE | Supply power to the commercial institution with excess sent to the grid since the institution does not produce electricity on a 24-hour basis everyday | $CO_2$, $CH_4$, $N_2O$ | Energy Institutional sector | Implemented | Nampower | No of days system functional and amount sent to the grid | Systems installed and excess electricity sent to grid | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Systems are maintained properly and technology meets expected lifetime | 2 systems installed and excess electricity sent to grid | Savings on running the institution for autoproduction, Lower pollution of the environment | 200 t $CO_2$-eq/yr when project developed |
| 11. Photovoltaic | Reduce energy consumption | To provide water pumps operated by photovoltaic panels | $CO_2$ | Energy – Rural areas | Ongoing Implemented in | NEI, NAMREP | No. of solar water pumps | Government incentive, Bank | IPCC 2006 GL and baseline from GHG inventory of | Phase 1 : 826 units and Phase 2 : 4618. Post | Improved quality of life, Farming | 4,017 t $CO_2$-eq/yr |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| water pumps | from the grid, increase water availability to communities and growers | | | Agriculture sectors | 3 phases under (NAMREP). Phase 1 2004-2006, Phase 2 2007-2010 and Post NAMREP 2011-2018 | | installed, No of farmers reached | loans at low interest, | Namibia, Water is available, cost not prohibitive, technology is user friendly<br><br>Systems are maintained properly and technology meets expected lifetime | NAMREP until 2016 : 5452 – Total until 2016 : 10,896 representing some 6 MW capacity | security | |
| 12. Mariental Solar PV | Generate solar energy as part of NamPower Sol PV Tender | 37 Megawatt solar photovoltaic (PV) power plant which will be situated in Mariental | $CO_2$, $CH_4$, $N_2O$ | Energy – Rural areas All sectors | Ongoing, Project started March 2018 | Nampower | Contract allocated | Tender realized and promoter chosen | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Systems are maintained properly and technology meets expected lifetime | Project implementation just started | Energy security; job creation during construction; Gender emporwerment | 24,773 t $CO_2$-eq/yr |
| 13. The CBEND Project (Combating Bush Encroachment for Namibia's Development) | Supply electricity to remote community through off-grid system, Use of biomass from invader bush to produce electricity, | The CBEND Project has installed a 250 kW bush-to-electricity power plant on a commercial farm in the Otavi area, in one of the most bush infested areas of Namibia. The gasifier is fuelled with invader bush, and feeds electricity directly into the national grid. It is considered as a proof-of-concept project to determine the financial feasibility of this approach, assess the technical robustness of the technology, and establish Namibia's first independent power producer | $CO_2$, $CH_4$, $N_2O$ | Energy – Onsite agriculture and residential sectors | Power plant completed but not in operation as technological issues are preventing connection to the grid system | Desert Research Foundation of Namibia (DRFN) | Performance of plant | Small grid built to supply electricity produced, grid connected | IPCC 2006 GL and baseline from GHG inventory of Namibia, Biomass supply for long term operation, Technology mastered<br><br>Provided technological problems are solved | Plant Commissioned but not started operating up to now, technical problem. | Job creation, increasing rangeland productivity through de-bushing | 300 t $CO_2$-eq/yr estimated hen project running |
| 14. Baynes Hydropower Project | Increase renewable energy generation capacity | The 300 megawatt (MW) Baynes hydropower plant will be developed by Namibia and Angola at a cost of US$ 1,3 billion and is expected to be commissioned by 2024. The hydropower project is situated along the Cunene River, 200 kilometres downstream of Ruacana in the Kunene region. | $CO_2$, $CH_4$, $N_2O$ | Energy – Rural areas All sectors | Planned | Namibian and Angolan Energy Ministries | Agreement between Namibian and Angolan ministries of energy | Initial studies completed; decision to proceed pending solutions to issues with local residents. | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | None | Energy security | To be determined after commissioning of generation plant |
| 15. Ruacana hydro project | Increase share of renewable | The Ruacana Hydropower station on the Kunene river is the core of | $CO_2$, $CH_4$, $N_2O$ | Energy – Rural areas | Completed | Nampower | MW installed capacity | Additional electricity | IPCC 2006 GL and baseline from GHG inventory of | Turbine installed in 2012 and upgrade | Energy security, improved quality | 128,955 t $CO_2$-eq/yr since 2016 |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| 4th turbine | energy generation capacity | the Namibian power supply system. It is a run-of-river plant with capacity of 332 MW. However, due to being a run-of-river plant, the variations in Southern Angola's rainfall limit its performance. It is therefore operated as a base load plant during the rainy season (February-May) and as a peak plant for the rest of the year. | | All sectors | | | | needs exist, grid can support output and transmit to users | Namibia, dependency on electricity imports reduced, improve GDP, electricity security<br><br>Systems are maintained properly and technology meets expected lifetime | performed on other 3 turbines in 2016 | of life, income generation, job creation | |
| 16. Erongo wind farm | Increase share of renewable energy | | $CO_2$, $CH_4$, $N_2O$ | Project: wind | Ongoing: under development | IPP | MW installed capacity | PPA made with Nampower | IPCC 2006 GL and baseline from GHG inventory of Namibia, market exists for additional electricity<br><br>Systems are maintained properly and technology meets expected lifetime | Farm site identified, EIA under way, Licence granted by regulator | Energy security, improved quality of life, income generation, job creation | 250 000 t $CO_2$-eq/yr expected after commissioning of project |
| 17. Wind park in Walvis Bay | Increase share of renewable energy | The wind park Walvis Bay with one turbine and a capacity of 220 kW, which was erected in 2005, feeds the power grid operated by the regional provider ErongoRED. 4 second hand wind turbines expected to be installed as from 2013 for additional 2.5 MW capacity. | $CO_2$, $CH_4$, $N_2O$ | Project: wind | Completed | IPP ErongoRED | Equipment installed and windfarm operational | Wind farm commissioned | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | Wind farm operational and feeding the grid | Energy security, improved quality of life, income generation, job creation | 186 t $CO_2$-eq/yr |
| 18. Tsumkwe solar -200 KW solar hybrid system energy project | Provide electricity to 1000 persons in a rural settlement | Tsumkwe was identified in the Off-Grid Energisation Master Plan (OGEMP) as a potential location for a mini grid. | $CO_2$, $CH_4$, $N_2O$ | Community settlement - energy Residential and Institutional sectors | Completed and operational | Desert Research Foundation of Namibia (DRFN), Otjozondjupa Regional Council, MME, Nampower | 192 KW installed capacity | Rural electricity distribution master plan implemented | IPCC 2006 GL and baseline from GHG inventory of Namibia, lower dependency on fuelwood, ecosystems preserved<br><br>Systems are maintained properly and technology meets expected lifetime | Plant commissioned in 2010 and operational 2011, all households (1000 people) connected, improved quality of life, job creation | Access to electricity, Improved livelihood, job creation | 128 t $CO_2$-eq/yr |
| 19. Usab solar energy project | Electrify the school and | Provide electricity to rural school and community garden | $CO_2$, $CH_4$, $N_2O$ | Community settlement - | Implemented and ongoing | MME | Plant commissioned | Rural electricity distribution | IPCC 2006 GL and baseline from GHG inventory of | School and the community garden | Access to electricity, | Not yet determined |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | community garden | | | Energy Institutional sectors | | | since June 2014 and supplying electricity | master plan implemented | Namibia<br><br>Systems are maintained properly and technology meets expected lifetime | connected and using electricity, | Improved quality of life | |
| 20. Gam off-grid solar system | Give access to electricity to inhabitants through an off-grid system | Provide electricity to 2000 inhabitants through an off-grid system | $CO_2$, $CH_4$, $N_2O$ | Community – Energy Residential sector | Implemented and functional | MME | No of inhabitants supplied with electricity | Rural electricity distribution master plan implemented | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Systems are maintained properly and technology meets expected lifetime | 2000 inhabitants provided with electricity in their household, | Access to electricity, improved quality of life, job creation | 195 t $CO_2$-eq/yr |
| 21. Energy audits in commercial and industrial sectors | increase energy efficiency through 60 audits | Perform energy audits of commercial and industrial facilities to identify solutions to improve energy savings | $CO_2$, $CH_4$, $N_2O$ | National – Energy Commercial and industrial sectors | Implemented and functional | MME | No of audits performed | Sensitization, Incentive possibly to start with free audits | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>More technicians are available for audits | | Savings on electricity bill, improved environmental quality from lower pollution from burning fossil fuels | 17000 t $CO_2$ when fully implemented |
| 22. Substitute all electric water heaters with solar ones | Reduce energy consumption of fossil origin | Replace all electric water heaters by solar ones over 10 years | $CO_2$, $CH_4$, $N_2O$ | National – Energy All sectors | Implemented and functional | NEI | No of electric water heaters replaced | Sensitization done, Loan system, incentives | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | Some 12000 installed by 2016 | Savings on electricity bill, improved environmental quality from lower pollution from burning fossil fuels | Under evaluation and will be calculated for BUR4 |
| 23. Solar water heating in all government and parastatal building by cabinet in 2007 | Substitute fossil fuel with renewable solar energy | Replace electric water heaters by solar water heaters | $CO_2$, $CH_4$, $N_2O$ | National – Energy Institutional sector | No of electric water heaters replaced | Ministry of Works | No of solar water heaters installed in all new buildings | Legislation passed for all new institutional buildings to be serviced by solar water heaters | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | | Savings on electricity bill | Under evaluation and will be calculated for BUR4 |
| 24. Gobabeb Mini Grid | Provide electricity to rural settlement | Gobabeb Solar PV with Diesel Backup Mini Grid (26 kWp PV). The mini grid has been constructed as part of the Demonstration | $CO_2$, $CH_4$, $N_2O$ | Community settlement - energy Residential | Completed and operational | MME | Project implemented and operational | Demonstration minigrid constructed | IPCC 2006 GL and baseline from GHG inventory of Namibia | Hybrid power generation, energy efficiency and energy saving utilities, an | Energy security; energy access, Improved livelihood | 16 t $CO_2$-eq/yr |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | | Gobabeb Renewable Energy and Energy Efficiency (DEGREEE) project. | | and Institutional sectors | | | | | Systems are maintained properly and technology meets expected lifetime | energy management system, an energy tariff structure, and an energy awareness programme functional. System replaces two environmentally harmful diesel generators, supplying electricity to the centre's buildings, offices, as well as houses of staff and visitors | | |
| 25. Ohorongo cement using wood chips to replace coal | Increase renewable energy use in the industrial sector | Ohorongo cement is using wood chips from invasive bushes for heat production to be used in the manufacturing process. | $CO_2$, $CH_4$, $N_2O$ | Utility – Energy, Industrial sector | Ongoing | The German Schwenk Zement Group | About 30,000 t of coal replaced annually since 2014 | Technology adopted for burning wood chips instead of coal | IPCC 2006 GL and baseline from GHG inventory of Namibia,<br><br>Wood chips production will remain cost effective | Reduction in use of coal. | Job creation, improved rangeland productivity through debushing | 43,585 t CO2e per year |
| 26. LED Campaign | Replace 1M incandescent bulbs with compact fluorescent bulbs. | Nampower is providing one Million LED bulbs free of charge to save energy from lighting as LED bulbs are more energy efficient. This project will contribute to awareness regarding energy efficiency. | $CO_2$, $CH_4$, $N_2O$ | National, Energy Residential sector | Ongoing: awareness campaign and provisioning of LED bulbs has commenced | Nampower | No. of bulbs distributed | Awareness campaigns, free distribution to launch the lamps and encourage adoption | IPCC 2006 GL and baseline from GHG inventory of Namibia,<br><br>Lamps used over a period of 12 hours daily on average, lamps are replaced by equivalent ones, | 250 000 bulbs distributed @ 2016, public aware of benefits, | Improved lighting, cost saving | 3,421 t CO2e per year |
| 27. Solar home systems | Increase renewable energy use in the residential sector | Introducing solar PV to reduce the reliance on fossil fuel based energy in the residential sector | $CO_2$, $CH_4$, $N_2O$ | National, Energy Residential sector | Ongoing | MME | No. solar home system installed over time | Sensitization campaign done, Loan incentive by GRN in place | IPCC 2006 GL and baseline from GHG inventory of Namibia,<br><br>Barriers to technology adoption removed, Cost is not prohibitive. Savings are assumed to be sustained | 17,054 solar system by 2016. | Access to energy, Improved quality of life; generation of income | 1269 t $CO_2$-eq/yr annually since 2016 |
| 28. Solar water heaters | Increase renewable energy use in the residential | Introducing solar water heaters) to reduce the reliance on fossil fuel based energy in the residential sector | $CO_2$, $CH_4$, $N_2O$ | National, Energy Residential sector | Ongoing | MME | No. solar water heaters installed over time | Sensitization campaign done, Loan incentive by | IPCC 2006 GL and baseline from GHG inventory of Namibia, | 14,265 SWHs installed by 2016. | Access to energy, Improved quality of life; | 60,445 t $CO_2$-eq/yr since 2016 |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Action** | **Main objective** | **Description** | **Gases** | **Coverage/ Type** | **Status** | **Implementing entity** | **Progress Indicators** | **Steps taken / envisaged** | **Methodologies / Assumptions** | **Outcomes achieved** | **Co-benefits** | **GHG reductions** |
| | sector | | | | | | | GRN in place | Barriers to technology adoption removed, Cost is not prohibitive. Savings are assumed to be sustained | | generation of income | |
| 29. Solar cookers | Reduce use of fuelwood | Promote the adoption of solar cookers as alternative to using fuelwood | $CO_2$, $CH_4$, $N_2O$ | National, Energy Residential sector | Ongoing | MME | No. of cookers installed | Awareness campaigns and incentive by GRN | IPCC 2006 GL and baseline from GHG inventory of Namibia,<br><br>Barriers to technology adoption removed, Cost is not prohibitive. Benefits assumed to be sustained | 1346 adopted until 2016 | Improved quality of life | 10 t $CO_2$-eq/yr since 2016 |
| 30. Solar Water Heater demonstration projects (included in the SOLTRAIN Programme) | Implement solar thermal demonstration projects and capacity building | 1. Eenhana Vocational Training Centre (500 litres, 4.6 KWth)<br>2. Joe's Beerhouse (2538 litres, 42 KWth)<br>3. National Housing Enterprise (160 litres, 1.47 KWth)<br>4. National Youth Service (300 litres, 2.8 KWth)<br>5. Okakarara Vocational Training Centre (500 litres, 4.6 KWth)<br>6. Polytechnic Hotel School (500 litres, 5.6 KWth) | $CO_2$, $CH_4$, $N_2O$ | Community, Energy Institutional sector | Ongoing, Phases I and II completed (2008 – 2016). Phase III underway | NEI | No of water heaters installed | GRN support for projects , Trainings and workshops conducted | IPCC 2006 GL and baseline from GHG inventory of Namibia, estimated based on reference case electricity offset (at the SAPP grid average emission factor)<br><br>Systems are maintained properly and technology meets expected lifetime | 6 Projects implemented, Capacity of solar thermal installers improved. Improved power supply in various vocational training centres | Access to energy, Technology transferimproved quality of life | 157 t $CO_2$-eq/yr |
| 31. Sustainable urban transport system for Windhoek | Improve transport system and lower urban pollution | Improve transportation system of Windhoek through adoption of mass transport, cars and freight pooling. The German Cooperation through funding from the German government is supporting the municipalities of Windhoek in purchasing of buses for local transportation. | $CO_2$; $CH_4$; $N_2O$ | Urban region, Energy Transport sector | The masterplan is in place and is currently under review with the support of GIZ. | City of Windhoek | Mass transport systems implemented; modal shifts; % people carpooling | Masterplan produced and implementation started timidly | Provided resources are available Provided resources are available | Masterplan developed, support partly secured, Several buses have been purchased already and are in operation | Improved traffic safety, reduced congestion, improved local air quality thus improved health and lastly improved productivity | 510,000 t $CO_2$-eq/yr by 2030 (planned; conditional) |

## Table 3.4 - IPPU Sector – Planned and implemented actions

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Action | Main objective | Description | Gases | Type | Status | Implementing entity | Progress Indicators | Steps taken / envisaged | Methodologies / Assumptions | Outcomes achieved | Co-benefits | GHG reductions |
| 1. Reduce clinker used in cement production | Reduce IPPU emissions resulting from the production of clinker | Certain Supplementary Cementitious Materials (SCMs) have hydraulic properties (i.e. they function similarly to clinker). These occur naturally (pozzalans, mainly metakaolin) or are the result of human activities (mainly industrial waste activities). | $CO_2$ | Manufacturing - mineral sector cement production | Planned | The German Schwenk Zement Group | Amount of clinker replaced per tonne of cementitious product | Sourcing for clinker alternates | IPCC 2006 GL and baseline from GHG inventory of Namibia<br>Provided alternative material available to replace clinker | None | Improved work environment and health | To be calculated when project implemented |

## Table 3.5 - AFOLU Sector – Planned and implemented actions

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Action | Main objective | Description | Gases | Type | Status | Implementing entity | Progress Indicators | Steps taken / envisaged | Methodologies / Assumptions | Outcomes achieved | Co-benefits | GHG reductions |
| 1. Fatten 100 000 cattle heads in feedlots (INDC Measure) | Improve feed quality to reduce enteric fermentation | Meatco has invested and has a plan to continue investing in expanding feedlots to increase the number of animals to be fattened for fast growth and reaching market sizes within a shorter time. This also enables effective manure management and reduces land required to keep the animals. | $CH_4$ | Programme: cattle management (goal) | Ogoing on a small scale, Planned expansion | Meatco, O&L, & Feed-master | Number of feedlots establish-ed countrywide. | Included in Namibia's INDC | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>It is assumed that when animals are kept in feedlots there is less enteric fermentation (less energy is required to produce a unit of beef). Provided resources are available | Project not yet started | Contribution to food safety. Manure management (collection of manure for energy production and fertilizers). Improved livelihood of local farmers (who sell weaners to Meatco) | 201,000 t $CO_2$-eq/year in 2030 (planned; conditional) |
| 2. Afforest 5000 ha per year (INDC Measure) | Plant forest to capture and store $CO_2$ | Reforesting and increasing the productivity of forest land that has been converted in to other forms of land use will contribute to achieving Namibia's land degradation | $CO_2$ | Policy: soil carbon (goal) | Ongoing on a very small scale | MET (with funding from UNCCD) | Draft report and database. Samples taken from a number of | Included in Namibia's INDC | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>ISRIC for soil grid model | Reduction in degradation | Improved land management | 578,000 t $CO_2$-eq/year in 2030 (planned; conditional) |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Action | Main objective | Description | Gases | Type | Status | Implementing entity | Progress Indicators | Steps taken / envisaged | Methodologies / Assumptions | Outcomes achieved | Co-benefits | GHG reductions |
| | | neutrality target. | | | | | regions in the country. | | Provided resources are available | | | |
| 3. Soil carbon (INDC Measure) | Develop and promote more sustainable practices to enhance soil carbon content | Planting of trees including in places where there have never been plants before | CH4, $CO_2$ | Policy: afforest (goal) | Ongoing | Dept of Forestry, MAWF | Trial made in some areas | Mobilization of land identified for planting the species | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | | Contribution to food security | 180,000 t $CO_2$-eq/year in 2030 (planned; conditional) |
| 4. Plant 5000 ha of arboriculture per year (INDC Measure) | Cultivation of fruit trees to act as sinks | Cultivate and manage individual trees, shrubs and other woody plants | CH4, $CO_2$ | Policy: arboriculture (goal) | Planned | | Ha of arbori-culture planted 250 ha | Included in Namibia's INDC Own gov funds | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Provided resources are available | Project not yet started | Job creation | 358 000 t $CO_2$-eq/year in 2030 when fully implemented(planned; conditional) |
| 5. Reduce deforestation rate by 75 % (INDC Measure) | Reduce deforestation to maintain the carbon sink | A forestry research strategy was developed which included the identification and mapping of drivers of deforestation to target reductions | CH4, $CO_2$ | Policy: reduce deforestation (goal) | Ongoing. The strategy is to be revised. | MAWF with support from GOPA and NAFOLA project as well as GIZ | Research publication available. Forest act being implemented and enforced | Research publication; extension messages disseminated; research being carried out; and law enforcement being implemented. | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Forest research strategy. Provided resources are available, Success of sensitization campaign, availability of alternatives to forest biomass and other resources | Community forests established through Nafola/GOPA project and GIZ | Local employment. Biodiversity conservation. Improved ecosystem services. | 13,537,000 t $CO_2$-eq/year in 2030 (planned; conditional) |
| 6. Reduce removal of wood by 50 % (INDC Measure) | Reduce wood removal to maintain the carbon sink | The Forest Act includes rules to regulate removal of wood which will increase the sink. | $CH_4$, $CO_2$ | Policy: reduce deforestation (goal) | Ongoing | MAWF | Number of wood harvesting permits issued. | Alternative energy source identified. Permit system for wood harvesting in place. | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Forest Act amended Provided resources are available, Success of sensitization campaign, availability of alternatives to forest biomass and other resources | Reduction in wood removal due to the permit control system in place. | None identified | 701,000 t $CO_2$-eq/year in 2030 (planned; conditional) |
| 7. Reforest 20 000 ha per year (INDC Measure) | Reforest land previously classified as such to | The tree planting strategy was developed to guide planting activities in the country. | $CH_4$ | Policy: reforest (goal) | Ongoing | MAWF | Number of hectares planted | Mobilization of land identified for planting the | IPCC 2006 GL and baseline from GHG inventory of Namibia | | Contribution to food safety. | 1,779,000 t $CO_2$-eq/year in 2030 (planned; conditional) |

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Action | Main objective | Description | Gases | Type | Status | Implementing entity | Progress Indicators | Steps taken / envisaged | Methodologies / Assumptions | Outcomes achieved | Co-benefits | GHG reductions |
| | enhance carbon sinks | | | | | | | species. Species identification. | Tree planting strategy. Provided resources are available | | | |
| 8. Restore 15 M ha of grassland (INDC Measure) | Restore grassland to improve soil carbon storage | The rangeland management policy was developed. The de-bushing project is underway. | $CH_4$ | Policy: reforest (goal) | Ongoing | MAWF | Number of hectares de-bushed. | Identified affected area. Mobilising funds | IPCC 2006 GL and baseline from GHG inventory of Namibia<br><br>Rangeland Policy & Forest Act. Provided resources are available | | Increased carrying capacity of rangeland. Poverty alleviation. | 1,359,000 t $CO_2$-eq/year in 2030 (planned; conditional) |

## Table 3.6 - Waste Sector

| Description | | | | | Implementation | | | | Methodology | Effects | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of Action | Main objective | Description | Gases | Type | Status | Implementing entity | Progress Indicators | Steps taken / envisaged | Methodologies / Assumptions | Outcomes achieved | Co-benefits | GHG reductions |
| 1. Biogas Fish river small CDM (unfccc 2012) from landfill and water treatment plants | Convert waste to energy | Biogas Fish river small CDM (UNFCCC 2012) from landfill and water treatment plants. | $CH_4$ | Waste – Waste to Energy | Planned - Proposal stage | City Council | CDM proposal submitted for approval | Proposal prepared and submitted to CDM board | CDM approved methodologies<br><br>Provided resources are available | CDM proposal prepared | Cleaner environment, Reduced health hazards, job creation, returns from carbon credits | Not available |
| 2. Windhoek CDM from Gammams water-treatment plant (245 kW) | Convert waste to energy | Windhoek CDM from Gammams water treatment plant (245 kW) | $CH_4$ | Waste – Waste to Energy | Planned - Proposal stage | Windhoek City Council | CDM proposal submitted for approval | Proposal prepared and submitted to CDM board | CDM approved methodologies<br><br>Provided resources are available | CDM proposal prepared | Cleaner environment, Reduced health hazards, job creation, returns from carbon credits | 7,869 t $CO_2$ -eq when implemented |
| 3. Kupferberg CDM from landfill gas UNFCCC 2012 | Convert waste to energy | Kupferberg CDM from landfill gas UNFCCC 2012 | $CH_4$ | Waste – Waste to Energy | Planned - Proposal stage | Windhoek City Council | CDM proposal submitted for approval | Proposal prepared and submitted to CDM board | CDM approved methodologies<br><br>Provided resources are available | CDM proposal prepared | Cleaner environment, Reduced health hazards, job creation, returns from carbon credits | Not available |

### 3.2.1 Constraints and Barriers to mitigation

Namibia faces several challenges to mitigate climate change, namely in implementing actions already planned. These will be presented later in this BUR under constraints, gaps and needs. Following is a brief description of the major challenges and barriers to be overcome for the different sectors for successful implementation.

***AFOLU:***

- Land ownership coupled with high financial costs, a harsh arid climate lack of technology and capacity.

***Energy***

- Vastness of the country with the wide distribution of settlements, lack of capacity and prohibitive cost of renewable technologies for the persons in these settlements.
- Namibia's transport is dominated by the road component for both passengers and goods. Taking into consideration the extended geographic nature of the country with low population densities outside its urban areas, there is little prospect for the transport landscape to change in the short or medium term.

***IPPU***

- Low potential as Namibia is not highly industrialized.
- Lack of coal ash in the country for use in the cement industry.

***Waste***

- Waste generated is on the low side within geographic areas for profitable conversion to energy because and it may not be efficient based on emissions to transport waste over long distances to reach the economies of scale for returns on investments.

### 3.2.2. Summary of mitigation actions

A total of 54 mitigation has been identified for reporting purposes and this number is not exhaustive on account of the absence of a tracking system. Out of the 11 policies, plans and strategies, 4 are under implementation or completed within past and the present NDPs. For the Energy sector, 24 are completed or ongoing with an estimated reduction of 281,260 tonnes $CO_2$ -eq being avoided presently. The planned actions are expected to result in a reduction of 801,272 tonnes $CO_2$ -eq in the short to medium term. Emissions to be avoided in the IPPU sector is yet to be estimated while the estimates for the AFOLU sector must be revised as per the latest baseline. Estimates for the Waste sector are presently being reviewed considering the latest GHG inventory. A summary of the actions is given in Table 3.7.

**Table 3.7 - Summary of mitigation actions**

| Type of action | No. of action | Completed or implemented | Planned |
|---|---|---|---|
| Policies, plans and strategies | 11 | 4 | 7 |
| Energy sector | 31 | 24 | 7 |
| IPPU sector | 1 | 0 | 1 |

| | | | |
|---|---|---|---|
| AFOLU sector | 8 | 7 | 1 |
| Waste sector | 3 | 0 | 3 |
| **Total** | **54** | **35** | **19** |

# 4 Information on domestic Measurement Reporting and Verification

Signatory Parties to the UNFCCC are obliged to submit Biennial Update Reports every 2 years to the COP and the latter should contain a chapter detailing the arrangements implemented by the country to domestically follow and track Emissions, Mitigation and Support received and needed to implement the Paris Agreement (PA) and the Convention. Namibia presented conceptual MRV systems in its BUR1 and BUR2, with the intent of implementing same. To-date, some progress has been recorded but this is still insufficient to meet the reporting requirements. Recognising this gap in the reporting framework, this is a very urgent item on the agenda of the country and is considered of utmost importance in the near future, in line with the revision of the NDC and its implementation post 2020. The development and implementation of the MRV system is highly valued by the COP, as the instrument to lead to the level of transparency required by the PA. Transparency will caution the results expected through activities implemented to mitigate climate change within the framework of the NDC and, enable assessment and verification of the emissions avoided. This will reflect good use of funds and support provided and also warrant further actions in the same vein while enhancing reporting standard to the Convention on mitigation.

Based on the collection of data and other information for producing the last 3 GHG inventories and mitigation and needs chapters of the 3 BURs, it is evident that the present institutional arrangements for the MRV of Emissions (GHG inventory) are still weak and need strengthening while the MRV for Mitigation and Support are still in their infancies. Further work, brainstorming and consultation with stakeholders has led to the design of an improved MRV concept which will take on board objectively performing institutional arrangements to make the systems functional in the coming years, after appropriate capacity building. The proposed new concepts for the 3 MRV systems are presented in the BUR3, the intent being to meet the requirements of the PA.

Proposals for revamping the MRV system follow but the development and implementation will require more commitment from the concerned stakeholders and the private sector with possibly some new legislations or regulations to guarantee the appropriate flow of information on an annual basis for compilation of the reports. Concurrently, it would be wise to strengthen the CCU of MET with the appointment of at least another officer on the permanent establishment or project-wise on a contract renewable annually and supported from GEF funds tapped for reporting purposes. The proposed framework, along with the strengthening of the CCU of MET, should enable Namibia in a few years to develop and implement the robust MRV systems required for reporting once the stakeholders are fully capacitated, and the collaborators assume their role in the national system.

Efforts have been deployed to develop the MRV systems and build capacity domestically to sustainably assess and report emissions, mitigation actions, including emissions reductions and support needed and received within the framework of the UNFCCC. Progress has been made but there remain challenges relating to:

- Systematic availability of all data required for the UNFCCC reports;
- Sufficiency of resources to implement the MRV components exhaustively;

- Adequate capacity to undertake mitigation assessments; and
- Formalised roles and responsibilities of institutions and individuals for accountability.

## 4.1 Development and coordination of the MRV system

Namibia has in place a Monitoring and Evaluation (M&E) system to support its development agenda as laid out in the National Development Plan (NDP). Government implemented a continuous M&E process under the aegis of the National Planning Commission (NPC) for all socio-economic development engines, with a view to track progress on the various goals and strategies earmarked in the NDP, including those of the Ministry of Environment and Tourism, which has the leading role on climate change. This M&E system has been very useful to track progress achieved in the implementation of the NDP and also to inform government on its revision, updating as well as development of new plans and strategies. The initial MRV concept was based on this M&E model but has not met the reporting requirements of the UNFCCC. The existing systems have been reviewed and new proposals made, taking into consideration the present UNFCCC context which is more demanding in terms of outputs and indicators. This entails a reorganisation of the existing M&E system (Republic of Namibia 2014) which fulfilled the objective of gauging progress on the NDP.

Namibia is experiencing challenges to integrate climate change MRV into the NPC's M&E system. The NPC is responsible for M&E of National Development and serves on the NCCC but procedures for integrating climate change MRV elements within the national M&E process has been attempted but proved difficult and unsuccessful. When reviewed within the context of the preparation of the BUR3, it is evident that the MRV system for reporting on climate change will need to be looked at with a different perspective and kept separate from the M&E system of the NPC.

Presently, the multi-sectoral NCCC oversees the implementation and coordination of sector-specific and cross-sectoral climate change activities while also providing advice and guidance to the representatives of the public and private sectors. The NCCC reports to Cabinet through the MET. The latter, through its DEA and CCU, follows and reports on all climate change activities, including reporting to the Convention.

This system is based on the institutional structure for implementation of the National Climate Change Policy as shown in Figure 4.1. The Cabinet of Namibia is the Government entity responsible for approving policies. The Parliamentary Standing Committee on Economics, Natural Resources and Public Administration advises the Cabinet on relevant policy matters and the MET is responsible for all environmental issues in the country, including climate change. MET is the National Focal Point to the Convention and is the coordinating body for all climate change activities through its CCU of the DEA. The CCU is supported directly by a formalized multi-sectoral National Climate Change Committee (NCCC) for the implementation and coordination of sector-specific and cross-sectoral activities while also providing advice and guidance on climate change issues. Since climate change affects directly or indirectly all socio-economic development sectors and is embedded in almost all the Sustainable Development Goals (SDGs), therefore all Ministries through their various departments, Institutions and Agencies actively collaborate and contribute in the implementation of climate change activities at local, regional and national levels. The existing local and regional structures are also integrated for implementation of climate change activities at different levels within their areas of jurisdiction.

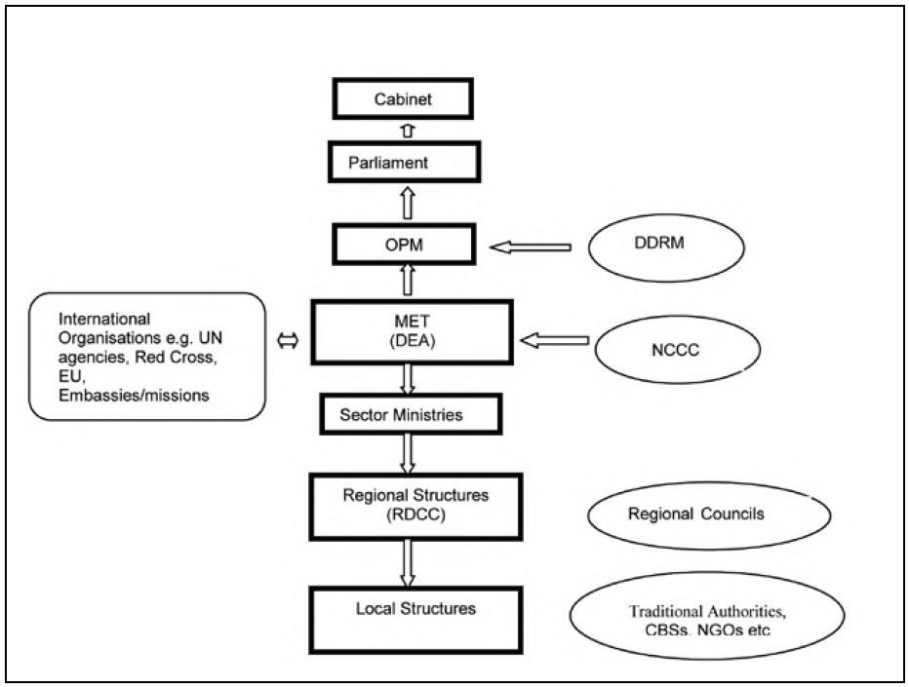


**Figure 4.1 - Institutional structure for implementation of the National Climate Change Policy**
**Source: Namibia National Policy on Climate Change (2011)**

Presently, government departments and private sector organizations regularly measure, collect and verify data on their activities to track progress, productivity, quality assurance and to conform to legislations amongst others. These data are then analysed and reported to the parent ministries for transmission to the NPC and administrative entities to inform them of the progress and achievements for sustainable decision-making and for guiding implementation and reviewing of Policies and Strategies within the NDP. Most of these data are then stored in private databases and/or centralized within the NSA for further analysis and eventual archiving. The NSA has been established to set up a robust national statistical system to provide quality data for supporting primarily the M&E and as well for other purposes such as providing data for reporting to the Convention to which the country is a Party, research and planning at various levels. The NSA also regularly undertakes surveys and censuses to supplement routine data collection, especially for elements not covered under annual organizational activities.

However, even if this system functions well and has delivered for ensuring sustainable development of the country, this has been achieved according to the capabilities of government and the institutions, taking into consideration the financial, technical and technological capacities, including availability of funds, level of knowledge required, availability of appropriate staff and the necessary tools. Unfortunately, data required specifically for compiling GHG inventories, following mitigation and adaptation actions, assessing needs and reporting on support received have not been integrated within the system during its development up to now. These data are mostly dispersed with individual public and private sector institutions and organizations, demanding for collection on an ad-hoc basis when the BURs are being produced.

The GHG inventory is viewed as the core component within the MRV system for capturing emissions, NAMAs and other mitigation actions while supporting the low carbon path on which government has embarked. More information on these MRV systems is provided in the following subsections.

## 4.2 MRV of emissions

With the advent of the new more demanding requirements and increased frequency of reporting to the Convention, the ad-hoc set-up adopted until about four years ago, with total dependency on consultants for the preparation of reports, is deemed no longer sustainable. Namibia thus decided to produce these reports in-house, accompanied and supported by consultants to provide the necessary capacity building to the national experts over a few years until they become fully independent. This exercise started with the production of the BUR1 when priority was given to the crucial thematic area of inventory of GHGs.

This exercise started with mapping of national institutions, both private and public, which will have to collaborate in the compilation of the GHG inventories. The collaboration of the institutions was secured through correspondences at the high managerial level and institutional arrangements set up for producing the GHG inventory. Capacity building started on this item and was extended to mitigation and support needed and received also. This was the commencement of the development of the MRV system even if that was not the aim initially. The MRV framework and the wider national M&E system for implementing the climate change policy will support the development and implementation of the domestic MRV system.

To date after outsourcing the compilation of the first three national GHG inventories, Namibia has been able to utilise active working groups to support the preparation of the three latest inventories, including three stand-alone NIRs, in collaboration with consultants to ensure capacity building of national experts. Institutional arrangements made initially have been constantly reviewed and improved.

The institutional arrangements put in place since Namibia started capacity development to prepare its inventory have been working at a lower level than expected to be considered as fully operational and sustainable. This is due to various reasons, the most important ones being the unavailability of the inventory compilers for the 4 IPCC sectors at the required time and within short spans of time to deliver. Another factor is the lack of official commitment of the different stakeholders with the current mechanism of requesting representation in committees rather than nomination for performing tasks related to the inventory compilation on an annual basis. It is proposed that the responsibility for compilation rests with the CCU supported by an external consultant while the other stakeholders either under the lead of a ministry or directly will contribute annual data sets according to an agreed Protocol or Memorandum of Understanding (MOU). It is worth highlighting that most of the data are already collected but not in an organized way to meet the stringent reporting requirements of the UNFCCC.

The MET is considering establishing a MOU with the NSA and it is recommendable that this be extended to all ministries, not only to serve the needs of reporting to the UNFCCC but also to other Conventions and national development at large. This would facilitate and improve data collection from the Ministries as the NSA has a legal framework to collect data. The challenge is that the NSA has capacity and staff turnover challenges which would need to be overcome if such a system is to be established.

The GHG inventory is the backbone to reporting as well as for planning and prioritizing mitigation actions and investments. It would be wise to further develop and strengthen the existing system to

make it sustainable. Given that climate change is embedded within almost all the SDGs, it will surely mean the participation of most if not all Ministries, including the Agencies falling within their ambit. The best option is seen as each Ministry having a designated responsible Officer at a certain level, with an alternate, tasked to liaise with other colleagues to collect information on activities emitting GHGs or acting as sinks. This responsible Officer and/or his alternate is obligated to attend the NCCC meetings and also contribute in working groups of the CCU of MET on all issues pertinent to climate change. The responsible Officer and the alternate should both attend to meetings and working group sessions when they are available. Additional information can be requested by CCU as and when needed from the responsible Officer and other specific stakeholders.

In addition to the NSA, the Ministries identified as essential to designate a responsible Officer and an alternate for contributing on climate change through monitoring of their own ministerial activities in relation to the SDGs and to collect appropriate data for the GHG inventory are:

- Ministry of Agriculture, Water and Forestry
  - Directorate of Livestock,
  - Directorate of Crops and Soils; and
  - Directorate of Forestry
- Ministry of Environment and Tourism;
  - Directorate of Environment (CCU); and
  - Directorate of Waste
- Ministry of Finance;
  - Directorate of Customs, and
  - Road Fund Administration
- Ministry of Fisheries and Marine Resources
  - Directorate of Fisheries;
  - Directorate of Maritime Affairs and
  - Namibia Ports Authority
- Ministry of Industrialization, Trade and SME development;
  - Industrial Development
- Ministry of Land Reform
  - General survey office
- Ministry of Mines and Energy
  - Nampower;
  - Electricity Control Board;
  - Namibian Energy Institute;
  - Directorate of Energy and Petroleum Affairs; and
  - Directorate of Mines
- Ministry for Urban and Rural development
  - City Councils
- Ministry of Works and Transport
  - Roads Authority (NATIS);
  - Transnamib;
  - Marine Affairs; and
  - Aviation Authority (Airports)

The other main stakeholders are:

- Manufacturing companies individually or through the Chamber of Commerce and Industry.
- Mining companies individually or through the Chamber of Mines;
- Agricultural (Crops and Livestock) producers individually or through the Chamber or Agriculture;
- CBOs, NGOs, CSOs as appropriate on an ad-hoc basis; and
- Academic institutions, Research Institutions and UNAM on an ad-hoc basis

Alternatively, the responsible officer with an alternate of the ministry could be responsible to deal with the respective private sector companies falling under them.

The change from the present institutional arrangement will thus be mainly the designation of the responsible Officer in the ministries listed above with one ministry taking the lead and being responsible for each IPCC sector. The responsible ministries are:

- Ministry of Mines and Energy for Energy sector
- Ministry of Industrialization, Trade and SME development; Industrial Development for IPPU sector
- Ministry of Agriculture, Water and Forestry for AFOLU sector
- Ministry of Environment and Tourism – Waste sector

The CCU of MET will continue to be responsible for general issues, coordination of QA/QC, capacity building and archiving over and above being the overall coordinator for producing the GHG inventories. The new institutional arrangements can be depicted in figure 4.1. NSA will keep to its responsibility of archiving all GHG inventory inputs such as AD and outputs such as the reports and compilation databases from the software with a duplicate copy resting with MET.

So far, AD collection templates, to also include other information needed to move to Tier 2 level as and when required have been developed and used during the preparation of the BUR2 and BUR3. These are being consolidated and adapted to meet the requirements of GHG inventories and the intent is to aim at collecting AD and information annually for maximum sustainability. This practice when fully implemented will avoid the rush and cumbersome situation faced during the compilation of previous inventories. It should however be recognized that the exercise of AD collection has progressed even if there is still some way to go for optimal functionality. QC of AD will be strengthened, databasing facilitated and archiving by NSA with a copy at CCU made easier.

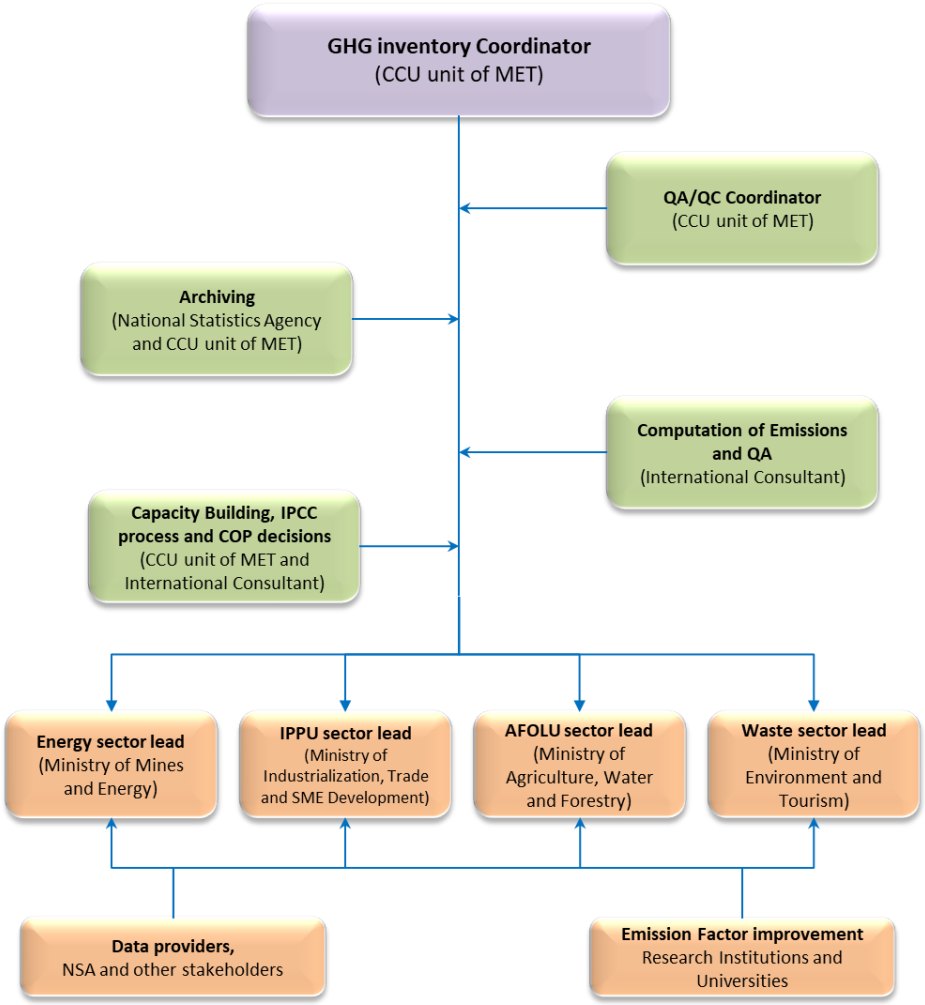


**Figure 4.2 - Institutional arrangements for the MRV emissions component**

The establishment of the QC system within the framework of inventory preparation remains problematic because of lack of personnel in the CCU. Quality control will be shared between the institutions or agencies primarily collecting the AD first, to be then verified by the lead ministry responsible for the IPCC sector and eventually by the NSA which will also perform the QA before archiving these data. QA of the inventory compilation and reporting will be under the responsibility of the CCU in collaboration with the external consultant and/or final peer reviewer. In case, the capacity does not exist, then other institutions of the NCCC will be resorted to and eventually international consultants called upon until adequate capacity has been imparted to the personnel of the CCU and NCCC members to fully undertake this task independently. Documentation will be the prime responsibility of the institution responsible for implementing the activity jointly with the CCU.

## 4.3 MRV of mitigation (including NAMAs)

Reporting on mitigation actions implemented by the country in the BUR1 and BUR2 proved very challenging due to a paucity of information on the status and progress of activities implemented since quite some years now. Thus, the information provided to the COP was not of the best quality and sometimes incomplete. The information provided did not reflect the real situation in the country when in fact there are numerous actions completed or under way in Namibia to implement the Convention as per its obligations. This situation is attributed to the fact that there existed no formal

recording system for tracking these mitigation actions within the Namibian institutions and also because it was not a reporting requirement. Of prime importance within the reporting context now and to tap needed resources while being transparent and meeting the obligations of the PA, Namibia must develop and implement robust MRV systems to track and report on both Mitigation and Support received prior to rolling out the activities of its NDC in addition to MRV of Emissions.

Namibia continued to build and improve its system for measuring, reporting and verifying mitigation actions and their effects while tracking support received in implementing these. The institutional arrangements follow closely those described above for the GHG inventory, involving many of the same institutions collaborating for the MRV of emissions but with somewhat different responsibilities for the MRV mitigation and support systems. The Mitigation Working Groups (MWG) established during the production of the BUR2, with representatives responsible for collecting and reporting data related to mitigation actions according to the IPCC sectors AFOLU, Energy, IPPU and Waste, functioned sparingly on account of limited capacity and the absence of well-developed procedures. The existing arrangements have to be reviewed and upgraded to be fully operational and to deliver for meeting reporting standards.

These two MRVs are linked and could be treated individually or together, the latter reducing the load of work. Reporting on mitigation actions implemented by the country in the BUR1 was not the best. There was no big improvement in the BUR2 apart from the addition of proposed abatement actions included in the INDC. Based on information collected for preparing the mitigation and support chapters of the BUR3, the vast majority of the mitigation activities implemented to-date falls under the Energy – renewables, Agriculture Forest and Other land Use change, and the private sector (various industries and commercial enterprises). It is thus proposed to work out a system comprising only the stakeholders concerned with mitigation activities to track these under the responsibility of the reinforced CCU. This MRV system can be regularly revisited when preparing the UNFCCC reports to ensure it continues to meet its objectives. For making the apparent linkages on funding, the Ministry of Finance and National Planning Commission should be fully fledged members of the MRV mitigation and support systems. Ministries/Institution/Agencies implementing mitigation actions automatically joins the mitigation working group to provide data collected on the action.

The responsibility for individual mitigation actions will rest with the responsible officer of the Ministry that has implemented the mitigation action and is supported by representatives of other collaborating Ministries and Agencies under the IPCC sectoral lead and CCU.

The main institutions identified to fully participate in the MRV Mitigation and partially in the MRV Support team are:

- MET with CCU responsible for follow-up and monitoring in conjunction with NSA
- Ministry of Agriculture, Water and Forestry (Crops, Livestock and Forestry Divisions);
- Ministry of Works and transport
- Namibian Energy Institute (NEI) – SRF and RE Divisions
- NamPower;
- Central-North Regional Electricity Distributor (CENORED);
- Electricity Control Board (ECB);
- Green Building Council (GBC);

- Environment Investment Fund;
- Manufacturing companies through the Chamber of Commerce and Industry;
- Mining companies individually or through the Chamber of Mines; and
- Agricultural (Crops and Livestock) producers individually or through the Chamber or Agriculture;
- CBOs, NGOs, CSOs as appropriate on an ad-hoc basis.

### 4.3.1 Operational procedures

User-friendly templates have been designed during the preparation of the BUR2 for the collection of data and other information on mitigation actions, to the extent possible. However, these templates have not been used during the preparation of the BUR3 due to time constraints as the funding came late to allow for this exercise and the lack of the MRV mitigation system. Details of the range of information covered in the templates are provided below:

- **Mitigation action description**:
  Name of action, main objective, description, coverage (sector and gases) and type (policy, programme or project);
- **Implementation information**:
  Status (planned, ongoing, implemented), implementing agency and progress indicators;
- **Methodology**
  Methodology for estimating emissions reductions including assumptions
- **Effects**:
  Outcomes achieved, co-benefits (non-GHG impacts) and estimated GHG emission reductions
- **Costs and support**
  Cost of implementing and running action and support received
- **Other**:
  Barriers and opportunities for replication of mitigation action.

The templates will be availed to the Ministries and other organisations for filling once annually after collection and QC of the required information. This collected information will be reviewed by the working group, quality controlled and sent to CCU of MET for analysis and databasing for use when preparing the BURs. CCU, with the support of an international consultant will perform the QA of the information, calculate emissions reduction after developing the appropriate baseline and choosing the best method. The working group members will be party to these steps to enhance their capacity for an eventual take over in the future. The information collected, along with the calculated emissions reductions, benefits and support received is then compiled and reported in the BUR.

Raw data on mitigation will be archived by the appropriate institution with a copy at the NSA and MET. The latter will also be responsible for archiving all compilations relating to national communications and BUR reports submitted to the UNFCCC. The Institutional Arrangements of the MRV mitigation component is depicted in Figure 4.2.

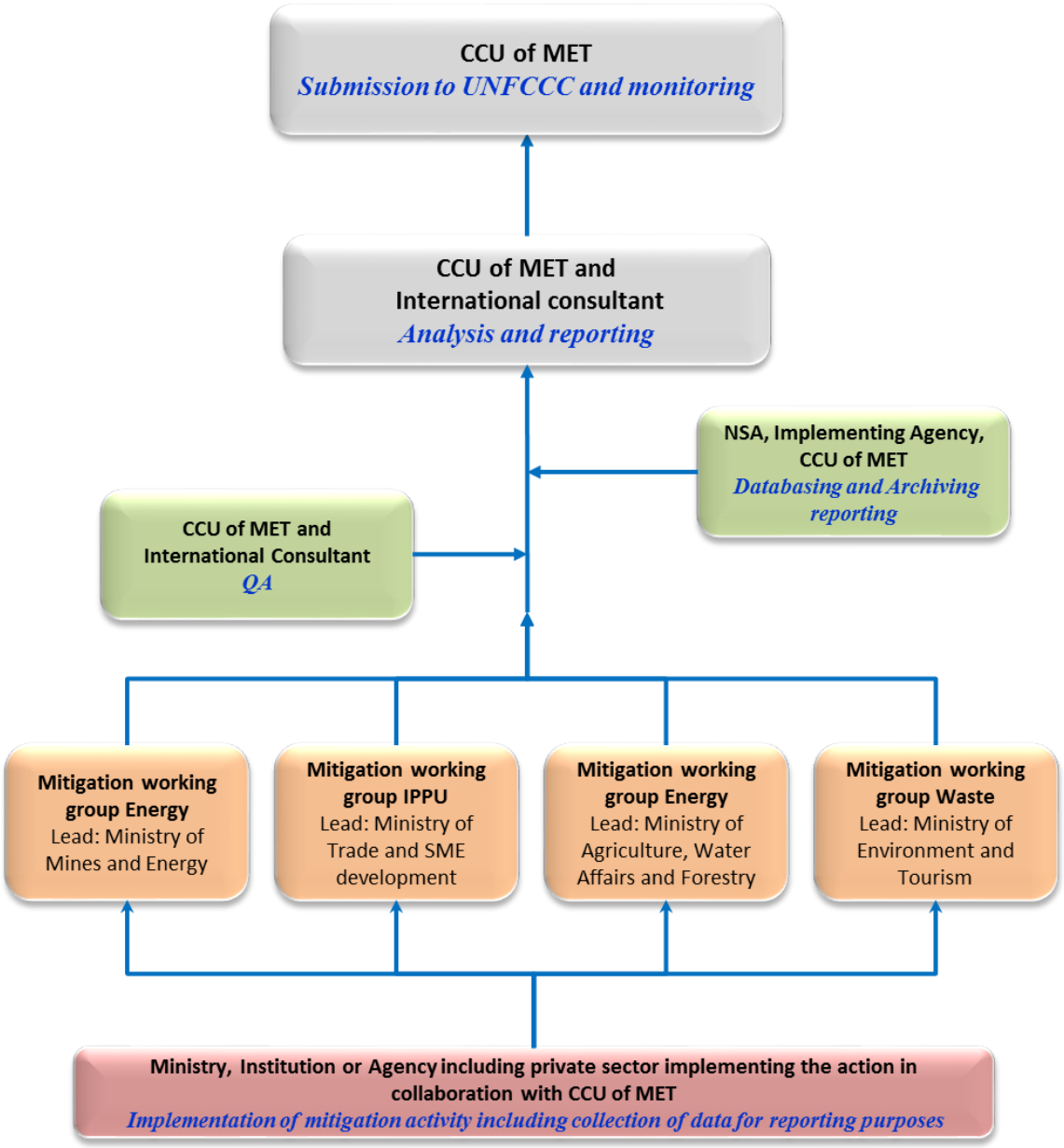


**Figure 4.3 - Institutional arrangements for the proposed MRV mitigation component**

### 4.3.2 NAMAs

Namibia submitted its first NAMA entitled *Rural Development in Namibia through Electrification with Renewable Energies* to the UNFCCCC registry to seek support for its preparation and implementation. The NAMA includes the MRV system proposed by UNDP (UNDP 2015).

Implementation of the NAMA will be under the responsibility of MET as the NAMA Coordinating Authority (NCA). The MET is already acting as NAMA Approver/Focal Point to the UNFCCC and as the National Designated Authority (NDA) to the Green Climate Fund (GCF). The Environmental Investment Fund (EIF) will assume the role of NAMA Implementing Entity (NIE) and will be supported

in technical issues by the Namibia Energy Institute (NEI) for this particular NAMA. The National Climate Change Committee (NCCC) will act as the supervisory board for the NAMA.

The main responsibility for the MRV system will lie with the managing institution, which may delegate some of the tasks to the project implementers (PPPs, grid operators, equipment suppliers). The process should unfold in the following sequence.

- The Executing Entity collects data according to the monitoring plan and ensure they fulfill all related requirements such as record keeping and quality control.
- The Executing Entity submits the monitoring results to the NIE in an annual report.
- The NIE collects the monitoring reports, combines and summarizes the results in a NAMA monitoring report and stores them in a central database.
- This report includes information on GHG emission reductions, progress in the sustainable development (SD) indicators, and the financial performance of the NAMA activity.
- The NCA verifies and approves the annual monitoring report.
- The NIE arranges for an external verification entity to confirm the contents of the annual monitoring report.
- The final monitoring report together with the verification report of the external verifier is submitted to the NAMA donor(s).

The NCA is responsible for creating reporting templates. These templates will include at a minimum the following information.

- Details about the activity;
- ESP contact details;
- A description of the measuring system;
- Data parameters to be measured;
- Default values and assumptions adopted;
- Details of the sampling plan; and
- Estimation of emission reductions.

The reporting template is provided by the NCA to the NIE. The templates are completed and submitted annually to the NCA by the NIE.

The goal of verification is to have an independent third-party auditor ensure that the NAMA is operating as planned and that the measuring and reporting system is implemented successfully. The verification also ensures that emissions reductions and SD benefits are really measured. Auditors should be from accredited entities. They can be entities accredited under the CDM or under other accreditation system acceptable to the Government of Namibia and the NAMA donor(s).

Evaluation should be made every one or two years. The verification will consist of:

- Desk review of documents;
- Site visits/interviews of key stakeholders;

- Drafting of the evaluation report;
- Feedback on the report by the NAMA Coordinating Authority;
- Finalization of the evaluation report.

The proposed NAMA MRV process is shown in Figure 4.3.

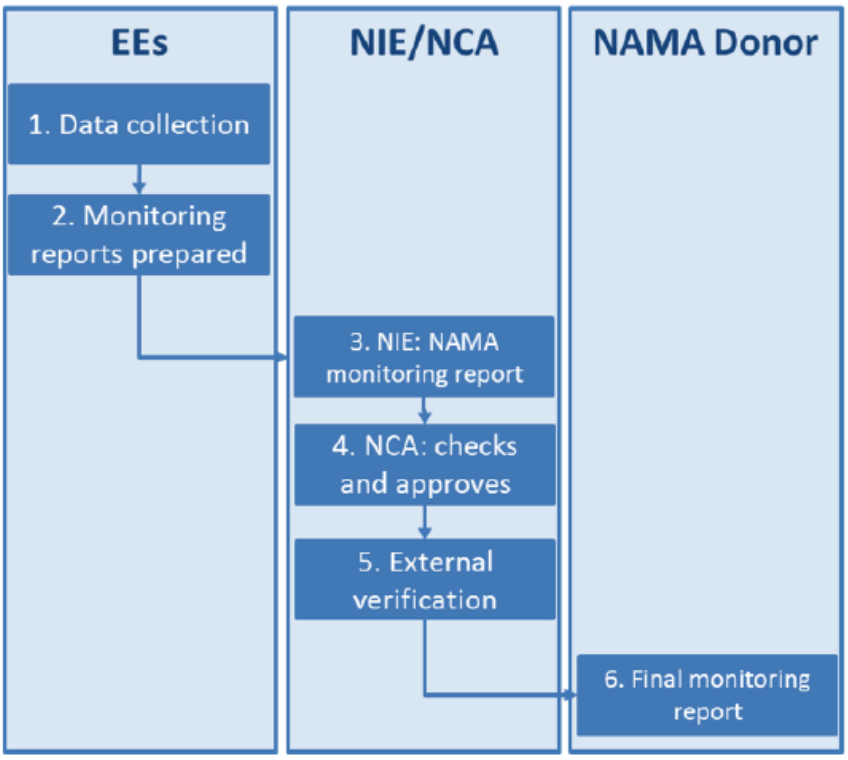


**Figure 4.4 - NAMA MRV process**
**Source: UNDP 2015**

## 4.4 MRV of Support

There is need to track support received for reporting to the COP and for implementing mitigation actions by the country. Namibia to-date does not have a functional system for this exercise. Information are disaggregated and may be obtained from different ministries and/or other institutions depending on the type of support received, though a fair amount of this information may be available with the ministry of Finance, NPC and MET. The challenge is to put in place a centralized system for tracking all support received regarding funding, capacity development and technology transfer in relation to climate change. Since most of these are and will be project-based, it is recommendable that the MRV for support is not completely dissociated from the MRV mitigation component as already described. However, the operational framework will have to be different from the one proposed for MRV mitigation due to the different roles and responsibilities of various ministries.

Therefore, it is recommended that the responsibility be taken by the Ministry of Finance through NPC in close collaboration with the Environment Investment Fund and CCU of MET. The latter will have a crucial role as it will be the ministry to monitor implementation of mitigation actions being executed by other entities while being the lead ministry for executing projects for reporting to the Convention. As for NAMAs, user-friendly templates will have to be designed for tracking support

received during the project cycle for reporting in the BURs. This should be done on an annual basis by NPC or EIF which will balance inflows and outflows of funds primarily and submit to MET for merging with capacity building and technological support received from its monitoring component. CCU of MET can then compile all this information for inclusion in the BUR.

The main ministries and institutions identified to be part of the MRV support are:

- MET with CCU responsible for follow-up of activities;
- Ministry of Finance through NPC;
- Ministry of Mines and Energy;
- Ministry of Agriculture Water Affairs and Forestry (Crops, Livestock and Forestry Divisions);
- Namibia Energy Institute (NEI) – Solar Revolving Fund (SRF) and Renewable Energy (RE) Divisions;
- NamPower;
- Central-North Regional Electricity Distributor (CENORED);
- Electricity Control Board (ECB);
- Green Building Council (GBC);
- Private sector through the Chamber of Commerce and Industry.

**Operational procedures**

The CCU of MET develops user-friendly templates that the Ministries and other organisations will complete once annually and send back for analysis, compilation of information and reporting. The information collected is handed over to NSA for databasing and archiving. The NSA sends back a copy of the quality-controlled data to CCU of MET for storage in a second archive. However, it is strongly recommended that this be agreed at the topmost managerial level for appropriate action. In case this does not work, then MET may have to resort to official MOUs and also look at appropriate legislations to be able to collect this information, especially when dealing with the private sector.

## 4.5 Constraints and gaps

Developing and making the MRV system fully functional face serious challenges. First and foremost is the inadequacy of the present institutional arrangements for the three components of the MRV system. While significant progress has been made for the MRV emissions component for preparing GHG inventories, there is still a long way to go for the mitigation MRV and still more for the MRV of support. Existing institutional arrangements will have to be constantly reviewed, strengthened and/or initiated where still inexistent. Institutional arrangements also need to be formalised to ensure ongoing and sustainable domestic MRV.

The development and implementation of the proposed MRV system will demand for additional staff or a review of conditions of service of staff members of CCU of MET. There is a lack of financial resources to support the comprehensive MRV system required by the UNFCCC. Already, government budget is strained due to the numerous national priorities and it may prove difficult to allocate enough funds to cover all these expenses. Additionally, there is a lack of capacity to develop and implement the MRV system. This capacity building constraint will be addressed within the framework of the CBIT project once it is funded and successfully completed. Additional support is

required from the international community to overcome the other constraints enlisted elsewhere in this report and which are linked to the MRV systems.

# 5 Constraints and gaps, and related financial, technical and capacity needs, including a description of support needed and received

## 5.1 Reporting

Namibia has made tangible progress in raising its reporting standards to the UNFCCC, shifting from total reliance on consultants to a mix of collaboration between consultants and national experts. The objective of the country is to become fully independent for reporting at the required standards to the Convention in the near to medium term. As it stands presently, there still exist challenges and constraints and gaps to reach a fully-fledged status. Capacity building of national experts was furthered during the preparation of the BUR3 report to enable them to overcome the constraints and gaps. This process will continue with the preparation of future reports, namely the NC4 and it is expected that constraint removal and filling of gaps will progress more rapidly in the medium and longer terms. To achieve this, national investments will continue, the institutional arrangements will be further enhanced but sustained support will be needed from the bilateral and multilateral partners, and donor institutions to hasten the process.

## 5.2 Implementation

Namibia started implementing mitigation since more than a decade now. Mitigation is embedded in the national development plans as detailed in the national climate change policy. Various policies falling under the latter have been reviewed and updated ones produced in 2017 to cater for the latest COP decisions and the PA. However, implementation of mitigation actions faces multiple barriers and difficulties in various areas and the country stands to remove these challenges to move forward. Weaknesses exist at the institutional, organizational and individual levels, notwithstanding financial and technology transfer needs, especially at a time when the country has endured a drought over the past four years. There is an urgent need to improve the enabling environment for tackling climate change activities, with special emphasis on mitigation in the country. Many barriers have been removed in the recent years to speed up implementation of mitigation projects. Namibia has high expectations on the ratification of the PA. There is hope that the pledges will become reality soon and needs of non-Annex I Parties will be fulfilled to enable them start implementing the identified mitigation and adaptation projects.

## 5.3 Technical and capacity building needs

The flow of technical and capacity building support has been below plans made as per the BUR1. Namibia has thus recorded slow progress on furthering technical capabilities and capacity building. Conscious of this situation, the country invested in capacity building of national experts for reporting to the Convention within the grant availed by the GEF. However, this is only marginal and for reporting only while enhancing of technical capabilities and capacity building for implementation of mitigation projects remain a void that should be filled urgently. An updated list of the technical and capacity building needs since the submission of the BUR2 is provided in Table 5.1.

**Table 5.1 - Technical and capacity building needs including support received and additional requirements**

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| Preparation of BURs and NCs (Strengthen existing institutional arrangements) | Ongoing | Additional technical assistance from partners and resource persons or consultants | Capacity building from consultants contracted with the GEF funds | Specific technical assistance to analyze weaknesses and propose solutions for enhancing the existing institutional arrangements |
| Preparation of BUR (enhance coordination) | Ongoing | Technical assistance from partners and resource persons or consultants | Consultant contracted with the BUR3 GEF funds | Further technical assistance and or resource persons to prepare a Guidebook on this issue |
| Preparation of BUR (compile GHG inventories) | Ongoing | Further capacity building on generating missing AD, computing emissions, undertaking Uncertainty estimates, running the LAND module of the IPCC 2006 software and applying the EMEP Corinair methods | Some capacity building for running the 2006 software, use of 2006 Guidelines from Consultant contracted with the BUR3 GEF funds | Further technical assistance on generating missing AD, computing emissions, undertaking Uncertainty estimates, running the LAND module of the IPCC 2006 software and applying the EMEP Corinair methods |
| Preparation of BUR and NCs (Prepare maps for refining the FOLU component) | Planned | Funds lacking under BUR3 to realize this activity. Assistance for correcting satellite images, producing reliable land cover land use maps and generating land use changes over time | Not completed | Technical assistance for correcting satellite images, producing reliable land cover land use maps and generating land use changes over the period 1990 to 2015 at 5 years' intervals |
| Preparation of BUR (develop and implement MRV) | Ongoing | Technical assistance from partners and resource persons or consultants | Some progress from Consultants contracted with BUR3 GEF funds | Further technical assistance and or resource persons to be contracted with future GEF allocations for the next BUR preparation |
| Preparation of BUR (assess outcomes of mitigation actions) | Ongoing | Technical assistance from partners and resource persons or consultants | Consultant with the BUR3 GEF funds | Further technical assistance and or resource persons to be contracted with future GEF allocations for the next BUR preparation |
| Improve knowledge on market mechanisms linked to mitigation | Planned | Assistance to enhance capacities to understand and take advantage of existing market mechanisms for developing mitigation and adaptation projects | None | Technical assistance to enable the follow-up and understanding of financial mechanisms |
| Resource mobilization (funds) | Planned | Assistance for building capacity of national | None | Technical assistance to enable the follow-up and |

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| | | experts to prepare projects of the required standard to attract investors | | mobilization of funds from partners |
| Solar home systems | Ongoing | Capacity building for installation and maintenance of solar home systems and assessment of impacts | None. Capacity building of a number of national experts done with government support | Further support to increase number of available technicians and capacity building on assessing GHG reduction impacts |
| Solar water heaters | Ongoing | Capacity building for installation and maintenance of solar water heaters and assessment of impact | None. Capacity building of a number of national experts done with government support | Further support to increase number of available technicians and capacity building on assessing GHG reduction impacts |
| Photovoltaic pumps | Ongoing | Capacity building for installation and maintenance of photovoltaic pumps and assessment of impact | None. Capacity building of a number of national experts done with government support | Further support to increase number of available technicians and capacity building on assessing GHG reduction impacts |
| Solar cookers | Ongoing | Technical assistance for promoting penetration, adoption and assessment of impact | None. Some awareness raising programmes delivered but not extensive enough | Further support to enhance capabilities of more NGO members for sensitization of the public |
| Low emission bulbs | Ongoing | Capacity building to assess impact | None | Capacity building on assessing GHG reduction impacts |
| Solar street lighting | Ongoing | Capacity building to assess impact | None | Capacity building on assessing GHG reduction impacts |
| Establishment of the Renewable Energy and Energy Efficiency Institute (REEEI) | Ongoing | Capacity building to enhance capabilities of Institute staff | None. The Namibia Energy Institute has been created with the responsibility of monitoring RE projects | Support to enhance capabilities of officers of the Institute to also assess emission avoidance effects |
| Improve energy efficiency in buildings | Ongoing | Capacity building of architects and engineers to integrate energy efficiency concepts in new buildings | None | Support to enhance capabilities of a higher number of professionals for performing energy audits in buildings |
| Reduce distribution losses in the electricity network | Planned | Capacity building of engineers to assess and implement measures to reduce losses | None | Additional support to improve the capacity of engineers and other concerned staff |
| Energy audits in industries | Planned | Assistance to train engineers and technicians in performing energy audits to kick-start the programme | None | Support to enhance capabilities of a higher number of professionals for performing energy audits in buildings |

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| Reduce deforestation | Ongoing | Technical assistance to assess degradation level | Some support received from German Development Bank (KfW) through GIZ | Technical assistance to further enhance capacity of foresters |
| Promote reforestation and afforestation | Planned | Technical assistance on transplanting techniques | None | Technical assistance to further enhance capacity of foresters on the latest techniques for successful reforestation and afforestation |
| Promote community forest management | Ongoing | Technical assistance for awareness raising | None | Technical assistance to further enhance capacity of stakeholders on forest management |
| Use alternatives to poles for construction | Ongoing | Assistance to evaluate impact and rate of adoption of alternative materials and market evaluation | None | Support to design and implement studies on adoption of alternative construction materials |
| Improve livestock feed quality to reduce enteric fermentation | Ongoing | Assistance to evaluate impact of feed quality on enteric fermentation, research on quality of pastures | None | Support to design and implement studies on better quality feeds on enteric fermentation and on improved pastures |
| Switch from Fuelwood/charcoal to solar/LPG | Ongoing | Assistance to promote technology and evaluate impact | None | Support for capacity building of NGOs to promote the technology adoption and assess impacts thereafter |
| Promote waste sorting and recycling | Ongoing | Assistance to promote sorting and recycling of waste and evaluate impact | None | Support for capacity building to enhance adoption of the technology and assess impacts thereafter |
| Reduce waste generation | Ongoing | Assistance to sensitize public to reduce waste generation and evaluate impact | None | Support for preparation of materials for, and sensitization campaigns and evaluate results afterwards |
| Convert waste to energy | Planned | Technical assistance to prepare projects for funding | None | Support for assessing waste conversion to energy evaluation and feasibility |
| Composting of abattoir sludge | Ongoing | Assistance to evaluate impact and prepare project for funding | None | Support for project evaluation of project feasibilty |
| Promote composting of domestic waste | Ongoing | Technical assistance to promote technology absorption rate | None | Further support to train more sensitizers to enhance technology penetration |
| Switch to improved | Ongoing | Assistance to evaluate | None | Additional support to |

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| water treatment technologies | | impact and other benefits | | develop sound project proposals |

## 5.4 Financial Needs

Substantial funding is required to enable Namibia to meet its reporting obligations and implement the Convention. Appropriate and timely funding is essential for meeting reporting requirements at the right standard. On the other way round, funding implementation of mitigation actions as provided for within the country's development strategy and agenda has been practically inexistent. Namibia, as a developing country, faces numerous difficult challenges to maintain the welfare of its population. As such, the country will not be able to allocate adequate funding to meet the climate change agenda, even if this is of prime importance to it. Efforts, including incentives to attract private investors, have been deployed to bring in the funds needed.

Reporting has become more stringent and frequent. This demands for more serious management and a sustainable system to be put in place. Human and other resources are already lacking, and it is a fact that countries need to have a fully-fledged team dedicated to data collection, QA/QC, and report preparation. Countries should also prepare themselves for verification amongst others to meet the standards, namely the transparency component as it stands today. While it is recognized that the international community is providing some support through the implementing agencies of the GEF, these amounts are not adequate and very often, problems arise in the timing of the release of the funds. Funding by the GEF for the BUR within a 2-years cycle is very difficult. The procedures are heavy and lengthy such that when the funds are released, only about a year remains to conclude the report. This impacts severely on the quality of the national reports as these must be completed within relatively short time schedules to maintain the country's compliance. As the contents of the BURs do not change, it is highly recommendable that the allocated funds be put at the disposal of the country for the next report immediately after the submission of the BUR.

Implementation of the Convention is even a more gigantic task because of the significant amounts of funding required to develop and implement mitigation projects. Up to now, Namibia has not tapped much funding to support its mitigation strategy. Pledges by Annex I Parties is not yet a reality and Namibia is suffering from the impacts of climate change, experiencing now a drought running in its fourth year. There is need for these shortcomings to be corrected urgently and a list of actions requiring funding is provided in Table 5.2.

**Table 5.2 - Updated financial needs including support received and additional requirements since BUR2**

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| Preparation and submission of Fourth national communication | Approved | USD 500,000 from GEF | USD 500,000 from GEF,<br>USD 50,000 from government | USD 500,000 for preparation of appropriate land use and land cover maps for the period 1990 to 2015 |

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| Community-based Adaptation (CBA) Programme | Ongoing | USD 4,525,140 from GEF for Global project | USD 4,525,140 from GEF for Global project, USD 4,125,140 from government | To be reassessed once project is completed |
| Wind power electricity generation plan | Ongoing | Financial needs being worked out | None | Will be provided in updated NDC or BUR4 |
| Ruacana Hydro project – Installation of an additional turbine and upgrade of 3 existing ones | Completed | USD 100 million | Government funds | None |
| Plan for photovoltaics for generating electricity for the grid | Ongoing | Financial needs being worked out | None | Will be provided in updated NDC or BUR4 |
| Tsumkwe solar energy project | Completed | USD 1.5 million | Government funds | None |
| Solar (Energy) shops | Ongoing | USD 2.0 million | Government funds USD 200,000 to date | USD 120,000 annually over the next 15 years |
| REFIT Solar farms projects | Ongoing | USD 200 million | Foreign partners and Local banks – DBN, Standard Bank Namibia | To be reviewed after completion of this project |
| Fuel switching to reduce fuelwood consumption | Ongoing | USD 1.2 Billion | USD 0.6 billion already invested by government | Will be provided in updated NDC or BUR4 |
| Off grid energization master plan | Ongoing | Financial needs being worked out | None | Will be provided in updated NDC or BUR4 |
| Replace 1M incandescent lamps with compact fluorescent lamps | Ongoing | USD 1,200,000 | Nampower Government funds USD 300,000 as at end 2016 | Updated cost at USD 120,000 annually over next 7.5 years to complete the programme |
| Replace all electric water heaters by solar ones over 10 years | Ongoing | USD 55,000,000 to complete project | Government funds USD 5,000,000 approximately to date | USD 5,500,000 annually over next 10 years to provide incentive at 30% of cost |
| Solar home systems | Ongoing | USD 200,000 for next 2 years to continue programme | Government funds USD 50,000 in the past years | USD 150,000 for years 3 and 4 |
| CBEND biomass electricity generation plant | Ongoing | USD 1,200,000 | USD 900,000 as grant | Not evaluated yet. (see Mitigation chapter) |

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| Photovoltaic water pumps | Ongoing | USD 200,000 for next 2 years to continue programme | Government funds USD 50,000 in the past years | USD 150,000 for 2 years 3 and 4 |
| Biogas Fish river small CDM project from landfill and water treatment plants | Ongoing | Financial needs being updated | None | Will be provided in BUR4 or updated NDC |
| Windhoek CDM from Gammams water treatment plant | Ongoing | Financial needs being updated | None | Will be provided in BUR4 or updated NDC |
| Kupferberg CDM project from landfill gas | Ongoing | Financial needs being updated | None | Will be provided in BUR4 or updated NDC |
| Ohorongo cement using wood chips to replace coal | Ongoing | Private sector investment | None. Private sector investment | None |
| Erongo wind farm (220 kW) | Planned short term | Financial needs being worked out | None | Will be provided in updated NDC or BUR3 |
| Several 1 kW mini hydro for water pumping | Planned short term | Financial needs being worked out | None | Will be provided in updated NDC or BUR3 |
| 44 MW windfarm in Luderitz | Planned short term | Financial needs being worked out | None | Will be provided in updated NDC or BUR3 |

## 5.5 Technology Needs Assessment and Technology Transfer Needs

Mitigation of climate change rests on the adoption of the latest technologies and its smooth transfer that demands for appropriate and sufficient human and technical capacities in addition to funds. Namibia has never been able to conduct an exhaustive assessment of its technology needs and transfer for both mitigation and adaptation to climate change, notwithstanding the cross-cutting issues, due to lack of resources. This exercise has been done piecemeal within the framework of the preparation of its national communications, when identifying potential mitigation and adaptation measures. This delayed exhaustive assessment of technology needs by the country is preventing proper evaluation of vulnerability and adaptation to climate change as well as assessment of mitigation of climate change, and the associated cross-cutting issues. This partly explains the absence of national adaptation and mitigation strategies to inform the stakeholders and to develop proper implementation plans. A list of the most urgent needs related to technology, soft and hard, assessment and transfer is given in Table 5.3.

**Table 5.3 - Technology Needs Assessment and Technology Transfer needs**

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|

| Activity | Status | Support needed | Support received | Additional support needed |
|---|---|---|---|---|
| In-depth Technology Needs Assessments for mitigation and adaptation | Planned | USD 500,000 over next 2 years | Small amounts of funds from GEF allocation for NC3 | USD 500,000 for years 3 and 4 |
| Barrier removal for RE technology transfer | Planned | USD 100,000 annually over next 5 years | None | USD 500,000 |
| Wind power electricity generation plan | Planned | Potential with costing | None | Will be provided in updated NDC or BUR4 |
| Plan for photovoltaics for generating electricity for the grid | Planned | Potential with costing | None | Will be provided in updated NDC or BUR4 |
| Off grid electricity generation | Ongoing | Potential with costing | None | Will be provided in updated NDC or BUR4 |
| Photovoltaic pumps | Ongoing | Costing for territorial coverage | None | Will be provided in BUR4 |
| Energy efficient bulbs | Ongoing | Costing under way for completion of programme | None | Will be provided in BUR4 |
| Fuel switching to reduce fuelwood consumption | Ongoing | Potential and costing to be done | None | Will be provided in updated NDC or BUR4 |
| Biomass conversion to electricity | Planned | Assessment of costing to be done | None | Will be provided in updated NDC or BUR4 |
| Waste to energy | Planned | Project under development | None | Will be provided in updated NDC or BUR4 |
| Wastewater treatment | Planned | Assessment and costing | None | Will be provided in updated NDC or BUR4 |
| Biogas production and conversion to electricity | Planned | Potential and costing | None | Will be provided in updated NDC or BUR3 |
| Viable seedlings transplanting techniques for reforestation and afforestation | Planned | Costing | None | Will be provided in updated NDC or BUR3 |
| Mass transport systems | Planned | Assessment and costing | None | Will be provided in updated NDC |
| Traffic monitoring | Planned | Assessment and costing | None | Will be provided in updated NDC |
| Preparation mitigation plan including full set of comprehensive NAMAs | Planned | Assessment and costing | None | Will be provided in updated NDC or NC4 |
| Preparation of NAP including proposals for funding | Planned | Assessment and costing | None | Will be provided in NC4 or updated NDC |

# 6 Information on the level of support received to enable the preparation and submission of biennial update reports

## 6.1 Financial

The Global Environment Facility (GEF), through the UNDP country office, the implementing agency, provided funds to the tune of USD 352 000 to support Namibia prepare its Third Biennial Update Report (BUR3) for the fulfilment of its obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The government of the Republic of Namibia through its Ministry of Environment and Tourism (MET) Department of Environmental Affairs, Division of Multilateral Environmental Agreement (MEA) contributed USD 50,000 in kind to complement the funding required to complete the BUR3 project.

## 6.2 Technical

Capacity building has been a recurrent feature of the previous two BUR projects and during the preparation of the BUR3, this exercise continued with funds from the GEF and through attendance to training meetings and workshops on the subject. This filled up the need for capacity building and some initiatives, directly or indirectly have partially addressed this lack of capacity. These initiatives are provided below.

### 6.2.1 Eastern and Southern Africa Workshop on National Climate Change Reports Project Management and Regional MRV Network Development

Namibia was among the countries that benefited from this meeting which was held from 28 – 30 May 2018. The meeting was organised by UN Environment and GSP.

### 6.2.2 Hands-on training workshop on the preparation and reporting of mitigation actions for the Africa region

Namibia participated in this activity of the Consultative Group of Experts of the UNFCCC in collaboration with the GSP. The workshop took place from 21 – 24 August 2018 in Pretoria, South Africa.

### 6.2.3 GHG inventory workshop

Organized by the UNFCCC, the workshop entitled Africa Regional Workshop on the Building of Sustainable National Greenhouse Gas Inventory Management Systems, and the Use of 2006 IPCC Guidelines for National Greenhouse Gas Inventories, was held from 24 – 28 March 2018 at Swakopmund, Namibia.

### 6.2.4 BUR Champions workshop

The BUR Champions workshop took place between 04 – 07 April in Berlin, Germany and was organised by GIZ.

### 6.2.5 Livestock sector GHG inventory training

This meeting was organised by the Global research Allinace from 21 – 27 March 2018 in New Zealand.

# 7 Any other information relevant to the achievement of the objective of the Convention and suitable for inclusion in its Biennial Update Report

Climate Change is the most dangerous threat to humanity which is already bearing heavily its consequences. Eager to contribute fully in the international endeavour to combat climate change, Namibia signed the Paris Agreement on the 22 April 2016 and ratified it on the 21 September of the same year. As such, the country is preparing for the implementation of all the voluntary actions identified in its NDC to reduce emissions and increase sinks as reported in the mitigation chapter of this BUR. However, the country is facing serious challenges to implement the most important ones and only the minor activities where the country can progress alone are being realised. The full array of activities earmarked can only be possible when resources needed will be made available by the international partners. For the time being, Namibia is working on a strategy and plan to translate the intentions into project proposals for funding and eventual implementation.

Namibia has not yet identified and worked on NAMAs extensively except for one project designed on rural electrification using renewable energy in off-grid systems. The country is reviewing its mitigation assessment within the framework of the preparation of the fourth national communication and this exercise will be completed by the end of next year. Based on these results, Namibia will attempt at developing a mitigation plan in accordance with the updated national development strategies and plans, namely the National Development Plan (NDP5). The most promising and feasible measures will be identified, and NAMA projects developed on these for implementation. Key source categories, based on the latest national inventory rereport, will be prioritized. As it stands now, the objectives are to reduce emissions in the road transport, electricity production, residential, cement production, livestock, wood removals and solid waste sectors while increasing sinks in the forests and soils.

Namibia has been facing a severe problem of encroachment by invader bush in its rangeland, thereby reducing the carrying capacity and profitability of its livestock industry, a major economic engine of the country, including the rural communities and indigenous people. However, within the present context of mitigation and increase of renewable sources of energy, invader bush can be exploited sustainably for producing electricity and heat. This activity is in its infancy due to the major constraint of costs of exploitation. This avenue is being further assessed for its development to reduce dependency on fossil fuels while rehabilitating the pastureland.

Namibia is also enhancing its capacity to participate in the REDD+ programme. One of the key preparatory activity to participate in REDD, namely the development of an appropriate system to measure, report and verify (MRV) changes in forest cover and related carbon emissions, is under way within the MRV systems being implemented for reporting to the UNFCCC as detailed in the chapter thereon in this BUR. Namibia is also participating in the REDD+ capacity building project for the SADC region which aims at enhancing the mitigation capacity of its members. Furthermore, the project supports the implementation of the Protocol on Forestry and the achievement of sustainable forest management in the SADC region. The main objective is that SADC, as a region, has a standard MRV system that is compliant with the recommendations of the IPCC as well as enhanced capabilities to measure changes to forest areas, increase in biomass stocks from growth and loss of carbon stocks from deforestation and forest degradation.

Namibia cannot disregard adaptation to climate change as its consequences can be catastrophic to not only the economy but also to its citizens, especially the poorest and most vulnerable segments of the population as well as the environment and ecosystems which hosts unique biodiversity. The country is still suffering from severe water stress with a drought running over the past five consecutive years. This situation has impacted significantly on the primary sectors of the economy, namely the Agriculture sector. This sector, which was contributing more than 5% of national GDP in the past, saw its contribution regressing significantly over the 3 years. The industry's contribution to the gross domestic product (GDP) which stood at 5,3% in 2007, declined to 4% in 2008. This trend continued to reach 3.3% in 2015, and 3.4% in 2016, before increasing to 4.5% in 2017. This in turn affected the manufacturing industries based on Agriculture, threatening food security and the subsistence livelihood of the communities.

This highlights strongly the very high level of vulnerability of Namibia and the prime importance of adaptation. It is thus crucial that Namibia be supported as well as other countries in similar situations to adapt in the short term and build resilience to climate change in the mid to longer term. Such an approach will enable these countries to maintain the welfare of the communities while contributing to address the root cause of global warming through stabilization of atmospheric levels not detrimental to ecosystems and socio-economic development.

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