SOUTH AFRICA'S 2ND BIENNIAL UPDATE REPORT

OCTOBER 2017

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

SOUTH AFRICA'S 2ND BIENNIAL UPDATE REPORT

OCTOBER 2017

PREFACE

The Department of Environmental Affairs (DEA) provides this report in response to South Africa's obligation to submit a Biennial Update Report (BUR) to the United Nations Framework Convention on Climate Change (UNFCCC) in line with Articles 4 and 12 of the Convention. South Africa submitted its BUR-1 to the UNFCCC in December 2014 and is required to submit subsequent BURs every two years thereafter. This is South Africa's 2nd BUR and it was prepared in accordance with the 'UNFCCC Biennial Update Reporting Guidelines for Parties not included in Annex I to the Convention' (FCC/CP/2011/9/Add.I).

The 2nd BUR was developed internally within DEA, by the Climate Change Reporting Project team in collaboration with various stakeholders which form part of DEA's institutional arrangements. The project team and the stakeholders are acknowledged below. Capacity related challenges within DEA, affected the timely submission of this report to the UNFCCC by December 2016. Furthermore, the latest year for which data and information was presented in the most recently published National Greenhouse Gas (GHG) Inventory was 2012, as included in this 2nd BUR , and therefore the UNFCCC reporting requirement of 'including information on the inventory for the calendar year no more than four years prior to the date of submission' of its BUR-2 will not be met. South Africa is committed to meeting its reporting obligations and measures are being taken to remedy this situation. South Africa fully anticipates to submit its BUR-3 in December 2018 to be compliant.

This report is published by the Department of Environmental Affairs, South Africa. An electronic version of the report will be available on DEA's website (www.environment.gov.za) once the review process is completed.

Suggested citation:
DEA, (2017). South Africa's 2nd Biennial Update Report (2014-2016). Department of Environmental Affairs. Pretoria, South Africa.

Project Team

Management:
Jongikahaya Witi, Thapelo Letete,
Reitumetse Molotsoane, Tsepang Makholela,
Maesela Kekana

Drafting of Chapters:
Sandra Motshwanedi (Project Manager), Rebecca Ditlopo, Samuel Mabena, Phindile Mangwana, Luanne Stevens

Independent Review Team:
Mandy Momberg of CarbEnviro Services and
Ryan Nel, Shantal Beharie, Vanessa Pillay and
Louwrens van der Merwe
of GIBB (Pty) Ltd.

International Reviewer:
Rasack Nayamuth

ACKNOWLEDGEMENTS

The Department of Environmental Affairs (DEA) worked with several stakeholders in compiling South Africa's 2nd Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC). The BUR-2 is considered to be a report of the Government of South Africa. It captures South Africa's response to climate change with emphasis on climate change mitigation, following information provided in BUR-1 (submitted in 2014) and includes updated progress up to 2016. The information on the National GHG Inventory included in this report covers the period 2000 to 2012. Mitigation actions towards climate change are implemented across different government departments; state owned entities as well as the private sector. This also includes the financing for implementing the mitigation actions which are supported domestically as well as internationally though bilateral and multilateral programmes as well as foreign agreements. Domestically, the fiscal and international donations and loans are channelled through government departments and state-owned entities (including banks) and directly to the private sector, e.g. DBSA, IDC, SANEDI. Such agreements are either part of the Official Development Assistance (ODA) or Non-Official Development Assistance (Non-ODA). Information on mitigation actions and financial flows is captured and explained in detail in BUR-2. The agreement to submit BURs to the UNFCCC specifically addresses "enhanced action on mitigation" and South Africa voluntarily includes information on climate change adaptation under Chapter 7. Additional Information is provided in order to give a comprehensive overview of climate change response actions across the country.

The government of South Africa would therefore like to thank and acknowledge the following stakeholders for their assistance with data provision and development of BUR-2:

- Department of Environmental Affairs
- Department of Energy
- Department of Transport
- Department of Trade and Industry
- Department of Science and Technology
- Department of Statistics, South Africa
- National Treasury of South Africa
- Eskom
- South African National Energy Development Institute (SANEDI)
- National Cleaner Production Centre (NCPC)
- Business Unit of South Africa (BUSA)
- National Business Initiative (NBI)
- National Disaster Management Centre (NDMC)
- South African Weather Services (SAWS)
- SASOL
- South African National Biodiversity Institute (SANBI)
- Development Bank of South Africa (DBSA)
- Industrial Development Cooperation (IDC)
- Norwegian Embassy
- Embassy of Japan
- Embassy of Sweden
- Embassy of Switzerland
- Embassy of Germany
- Energy Environment Partnership and KPMG
- United States Agency for International Development (US-Aid)
- United Nations Development Programme (UNDP)
- United Nations Environment Programme (UNEP)
- United Nations Industrial Development
- Global Environment Facility (GEF)
- Gesellschaft für Internationale Zusammenarbeit (GIZ)

South Africa's Project Standing Committee (PSC) is acknowledged for the compilation of International Climate Change Reports, and the composition of the PSC is explained in detail as part of Institutional Arrangements under Chapter 1.
The government intends to build stronger institutional arrangement with all these stakeholders and many more, for continual support in data provision and collaboration for the development of future BUR's. Together, let's respond to climate change in order to protect our environmental resources for the benefit of present and future generations.

AUTHORS AND CONTRIBUTERS

REPORT OWNER:
Department of Environmental Affairs

REPORT COMPILATION:
Department of Environmental Affairs

REPORT REVIEWERS:
GIBB (Pty) Ltd with CarbEnviro Services

INTERNATIONAL REVIEWER:
UNEP

LANGUAGE EDITOR:
GIBB (Pty) Ltd with CarbEnviro Services

MINISTERIAL FOREWORD

In 2016, South Africa ratified the Paris Agreement, which brings countries into collective action to address climate change threats within the context of sustainable development and eradication of poverty. The Paris Agreement sets the goal of holding the increase in global warming to below 2 degrees Celsius and pursuing efforts to limit global temperature increase to 1.5 degrees Celsius. South Africa's ratification of the Paris Agreement sends a positive signal of our continued leadership role in ensuring the effects of climate change are addressed.

We have made considerable progress in creating an enabling environment for climate change response. The Nationally Determined Contributions (NDCs) have been submitted to the United Nations Framework Convention on Climate Change (UNFCCC) as our contribution to implementing the Paris Agreement. The NDC considers both developmental needs and climate change imperatives. It also outlines both mitigation and adaptation targets and goals. Collectively the National Development Plan and the National Climate Change Response Policy continue to be our key policies for ensuring the transition to a lower carbon economy and climate resilient society.

Twenty-three years into our democratic governance, South Africa remains committed to working constructively with national and international communities to respond to the global challenge of climate change. It is within this context, that I am pleased to present our Second Biennial Update Report to the UNFCCC.

South Africa is also committed to comply with articles 4 and 12 of the Convention through the submission of Biennial Update Reports (BURs) every 2 years and National Communications every four years. The first Biennial Update Report was submitted in December 2014 and is available on the UNFCCC and DEA websites. BUR-1 also underwent an International Consultative Analysis (ICA) Process by the UNFCCC and the summary report is available on their website. BUR-2 presents updated information, reported in BUR-1, on our national circumstance, National GHG Inventory, mitigation actions and their effects, financial resources, technology transfer, capacity building and technology support received, support received for preparing BUR-2, and measurement, reporting and verification in South Africa. BUR-2 also includes progress made in the implementation of Policies and Measures; South African Climate Change Flagship Programme; Desired Emission Reduction Outcomes, Carbon Budgets; GHG Reporting Regulations, Carbon Tax as well as the Carbon Offsetting System.

Whilst we are extremely proud of our achievements to date, we are aware of the challenges that lie ahead of us. As a developing country, our ability to respond to climate change is likely to be far slower than our developed world counterparts. We will continue to contribute our best as a country to address climate change through various interventions whilst still relying on capacity building, technical and financial assistance from the developed world.

Mrs B E E Molewa
Minister of Environmental Affairs

EXECUTIVE SUMMARY

The Republic of South Africa submits BUR-2 under the United Nations Framework Convention on Climate Change (UNFCCC). This report follows the Biennial Reporting Guidelines for Parties not included in Annex I to the Convention and therefore comprises of the following seven chapters:

I. National circumstances
II. National Greenhouse Gas Inventory
III. Mitigation actions and their effects
IV. Finance, Technology and Capacity Building Needs and Support Received
V. Support received for preparation of BUR
VI. Measurement, Reporting and Verification
VII. Additional Information

Each chapter is summarised below and highlight the progress made in South Africa's response to climate change, since reporting in BUR-1.

ES1 NATIONAL CIRCUMSTANCES

Updated information on our national circumstances includes further details on the institutional arrangements supporting international reporting, current population dynamics, domestic economy, progress made in long-term energy forecasts and the proposed energy mix and the climate impacts experienced across the country.

The South African government comprises three levels (national, provincial and local government). The institutional arrangement for climate change reporting comprises of the Parliament and Portfolio Committees, the Inter-Ministerial Committee on Climate Change (IMCCC), the Forum of South African Directors-Generals, Intergovernmental Committee on Climate Change (IGCCC), the National Disaster Management Council, MINMEC and MINTECH, the National Committee on Climate Change (NCCC) and the National Economic Development and Labour Council (NEDLAC).

The Department of Environmental Affairs (DEA) is the central coordinating and policy making authority for environmental matters in South Africa. The role of the DEA is underpinned by the Constitution of the Republic of South Africa (Act No. 108 of 1996) and the National Environmental Management Act (NEMA) (Act 107 of 1998) gives power for co-operative environmental governance. DEA is accountable for the management and coordination of all climate change related information; including mitigation, adaptation, monitoring and evaluation programmes. DEA coordinates the Project Standing Committee, established by the Director General of DEA, to assist with the compilation of National Communications (NCs), Biennial Update Reports (BURs) and National Inventory Reports (NIRs).

At a sub-national level, provincial governments are tasked with the leadership on climate change activities. The department responsible for the environmental portfolio in each province, in collaboration with other provincial departments and stakeholders, have established climate change support structures. The national programmes, plans and strategies provide strategic guidance for the implementation of climate change response actions, in place in the nine provinces, and advancements made in climate change resilience is reflects the various projects and programmes in place.

South Africa's economy is the largest in Africa; however, two structural elements of the South African economy contribute towards climate change vulnerability; the first being inequality among the people and the second is the emissions intensity of commodities produced in the country. Although, South Africa is one of the most urbanised countries in Africa, having nearly two-thirds of the population living in urban areas, the poverty levels in rural and urban areas are substantially high; with roughly 23 million people living below the upper-bound poverty line (R620 per capita per month in 2011 prices), of which 10.2 million people (roughly 20.2% of the population) live in extreme poverty, below the food poverty line (R321 per capita per month in 2011 prices). The rapid rate of urbanization due to potential economic growth and job opportunity in towns and cities are the main reason for the rural-urban migration. South Africa's greenhouse gas emissions per capital are among the highest per capita emissions in the developing world due to our reliance on a coal based energy production system. As a function of population growth trends and greenhouse gas emissions trends, South Africa's greenhouse gas emissions per capital are expected to increase between 2020 and 2025, which is in alignment with the Peak-Plateau-Decline trajectory as forecast.

South Africa's energy intensity has shown a consistent decrease over time dropping by 35.6% between 2002 and 2010 and by 39.6% between 2002 and 2013. South Africa's Integrated Resource Plan (IRP) for the period 2010-2030 incorporates a number of government objectives which includes affordable electricity, carbon mitigation, reduced water consumption, localisation and regional development, producing a balanced strategy toward diversified electricity generation sources and gradual decarbonisation of the electricity sector.

Climate change impacts experiences over recent years include drought, flooding, extreme storms and fires. In excess of R60 million rand in disaster management funds were provided for provincial and local states of disaster declared for the 2014-15 financial year.

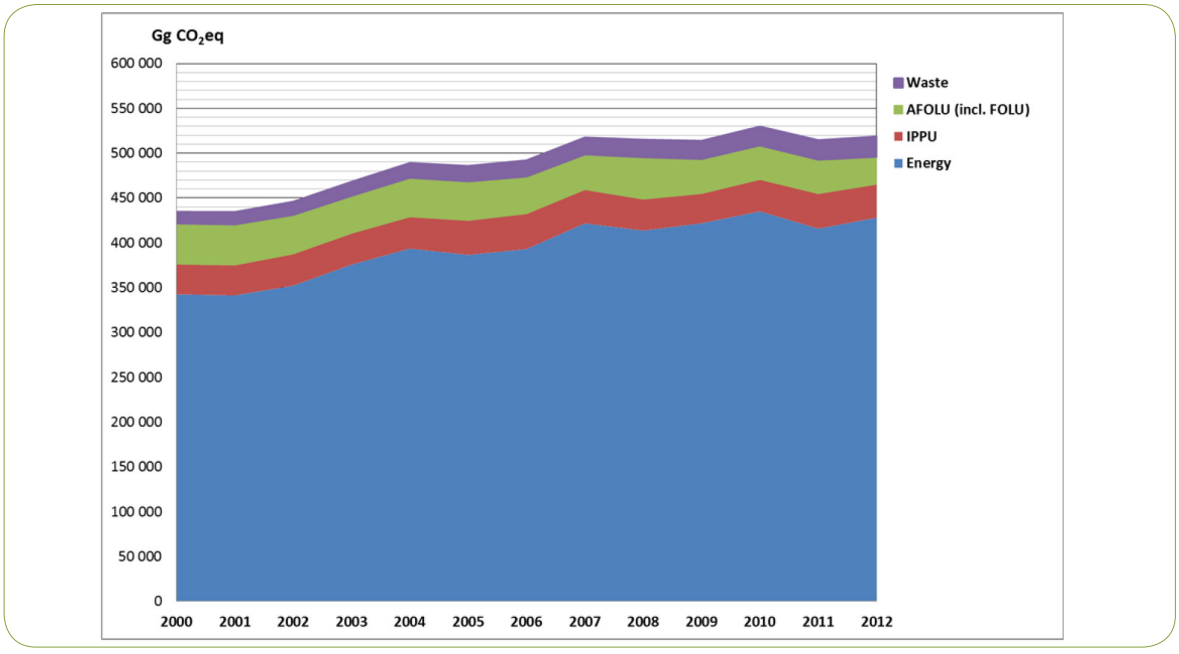


Figure ES1: South Africa's Greenhouse Gas Inventory for period 2000-2012 (DEA, 2017b).

ES2 NATIONAL GREENHOUSE GAS INVENTORY

The National greenhouse gas inventory for the period 2000 to 2012 is presented in Chapter 2 and the results are illustrated in **Figure ES1** (previous page). The annual GHG inventories for the period 2000 to 2010 were recalculated based on availability of improved activity data and updated emissions factors.

South Africa's nett GHG emissions for 2012 amounted to 518,297 GgCO2e, which includes the contribution from forestry and other land-use (FOLU), as this sector acts as a carbon sink by absorbing and holding carbon. The gross annual GHG emissions (excluding FOLU emissions) for 2012 totalled 539,112 GgCO2e. With the inclusion of FOLU, the energy sector accounted for 78.9% of the gross emissions in 2000 and this increases to 82.6% in 2012, amounting to net contribution of 428,112 GgCO2e to the 2012 GHG inventory. This showed a 25% increase in emissions from the energy sector from 2000 to 2012. The GHG emissions from the IPPU, AFOLU and Waste sectors increased collectively by 20.9% from 2000 to 2012; with emissions from the IPPU and Waste sectors showing an increase of 10.6% and 78.5% respectively, while emissions from the AFOLU sector decreased by 32.1% between 2000 and 2012.

In 2012 the greenhouse gasses which contributed to the nett national GHG inventory were CO2 (83.7%), CH4 (10.7%) and N2O (4.9%) while the contribution of F-gasses were less than 1%. The CO2 and CH4 emissions for the nett national GHG inventories (i.e. the inventories which include FOLU emissions) increased by 21.2% and 14.6% respectively between the 2000 and 2012, and showed a 23.9% and 15.1% increase respectively between the 2000 and 2012 gross national GHG inventories.

N2O emissions showed a decline of 5.6%, while PFC emissions doubled between 2000 and 2010. HFC emissions (only included from 2005) increased by 65.8% between 2005 and 2012.

The recalculation of emissions for the period 2000-2010, was conducted as improved activity data and emissions factor were available. The recalculation of the Energy emissions resulted in an increase of 1.5% and 1.6% in the 2000 and 2010 estimates respectively. The IPPU emissions were recalculated due to updates in the iron and steel production emission factors, updated ferromanganese activity data and updated ODS and zinc production data. Recalculations resulted in a 20% reduction in the IPPU GHG emissions in 2010, mostly because of the adjusted emission factor for the iron and steel production.

The recalculations performed for the AFOLU sector had the greatest impact, with changes of 50.4% and 49.6% for the 2000 and 2010 estimates respectively. The majority of these changes were due to the availability of updated land change maps and corrected HWP estimates. For the Waste sector, recalculations revealed a decrease of 1.2% in 2000 however an increase of 2.8% in 2010. These changes were as a result of the availability of updated information and statistics of waste generated and waste disposal.

ES3 MITIGATION ACTIONS AND THEIR EFFECTS

Current information on mitigation actions with quantified effects; mitigation actions without quantified effects and additional mitigation actions that were not included in BUR-1 are presented in BUR-2. Quantified effects are the GHG emission reductions and environmental and social co-benefits which have been determined or calculated.

The estimated GHG emission reductions which South Africa can achieve by 2025 and 2030 are between 398 Mt CO2e and 614 Mt CO2e, while South Africa has committed to reduce GHG emissions by 34% and 42% below business-as-usual emission levels, by 2020 and 2025 respectively. In an effort to reduce emissions, South Africa has implemented many mitigation projects and programmes that have aided in reducing GHG emissions, and the steady trend in greenhouse gas reduction achieved is illustrated in **Figure ES2** (below). Additionally, there are policies and plans in place to promote the reduction of GHG emissions. For example, the carbon tax, carbon offsets, desired emission reduction outcomes (DEROs) for sectors, company level carbon budgets as well as regulatory standards and controls for GHG pollutants and emitters.

The total cumulative reduction in GHG emissions achieved since 2000 is determined as 315.7 MtCO2e, 451.7 MtCO2e and 593.4 Mt MtCO2e by 2010, 2012 and 2014 respectively, as illustrated in **Figure ES2** (below). The largest contributor to climate change mitigation is energy efficiency projects, which accounted for 82% of the reduced emissions. Additional environmental benefits of these mitigation programmes are the estimated 770,000 tons of sulphur dioxide (SO2), 400,000 tons of nitrogen oxides (NOx), 30,000 tons of Particulate Matter (PM) and 14 million tons of ash avoided as a direct result of implementing these mitigation programmes. Furthermore, more than 128,000 litres of water and 49 million tonnes of coal have been saved. Socio-economic benefits include over 40,500 jobs created by 2014.

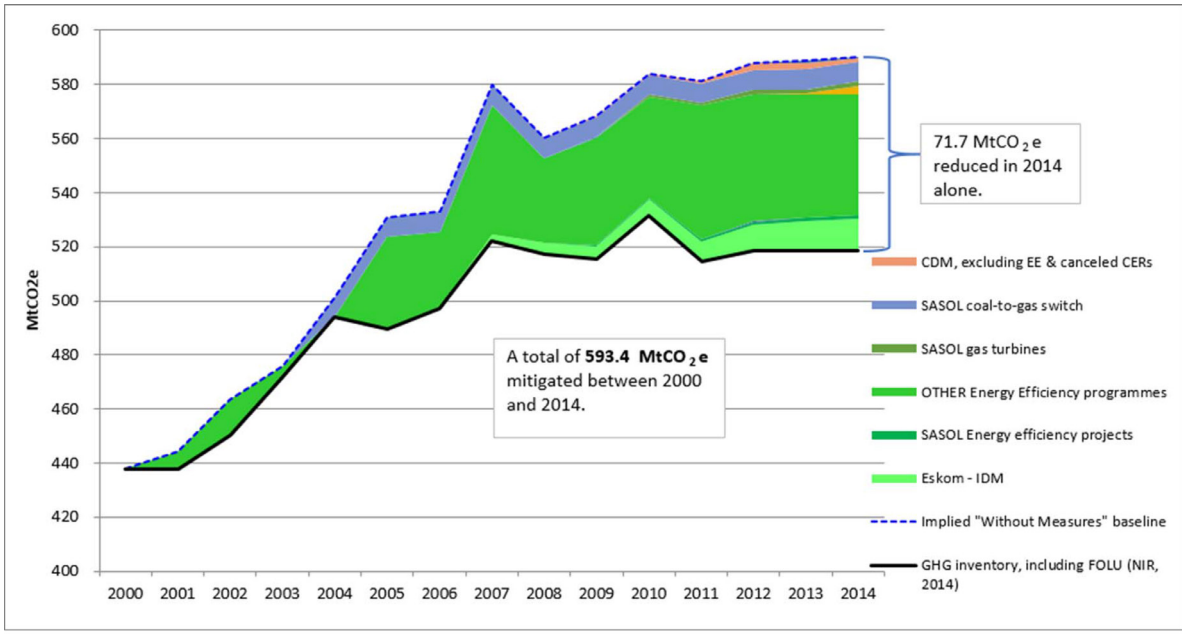


Figure ES2: South Africa's annual emissions reduction for period 2000-2014 (DEA, 2017b)

ES4 FINANCE, TECHNOLOGY AND CAPACITY-BUILDING NEEDS AND SUPPORT RECEIVED

In an effort to reduce GHG emissions and implement climate change mitigation, financial support is needed to fund and implement these programmes. For the period 2000-2014, South Africa received international bilateral and multilateral support to the tune of USD 3,273.5 million; of which USD 294.7 million and USD 2,978.8 million were the form of grants and loans of respectively, as illustrated in **Figure ES3** (below).

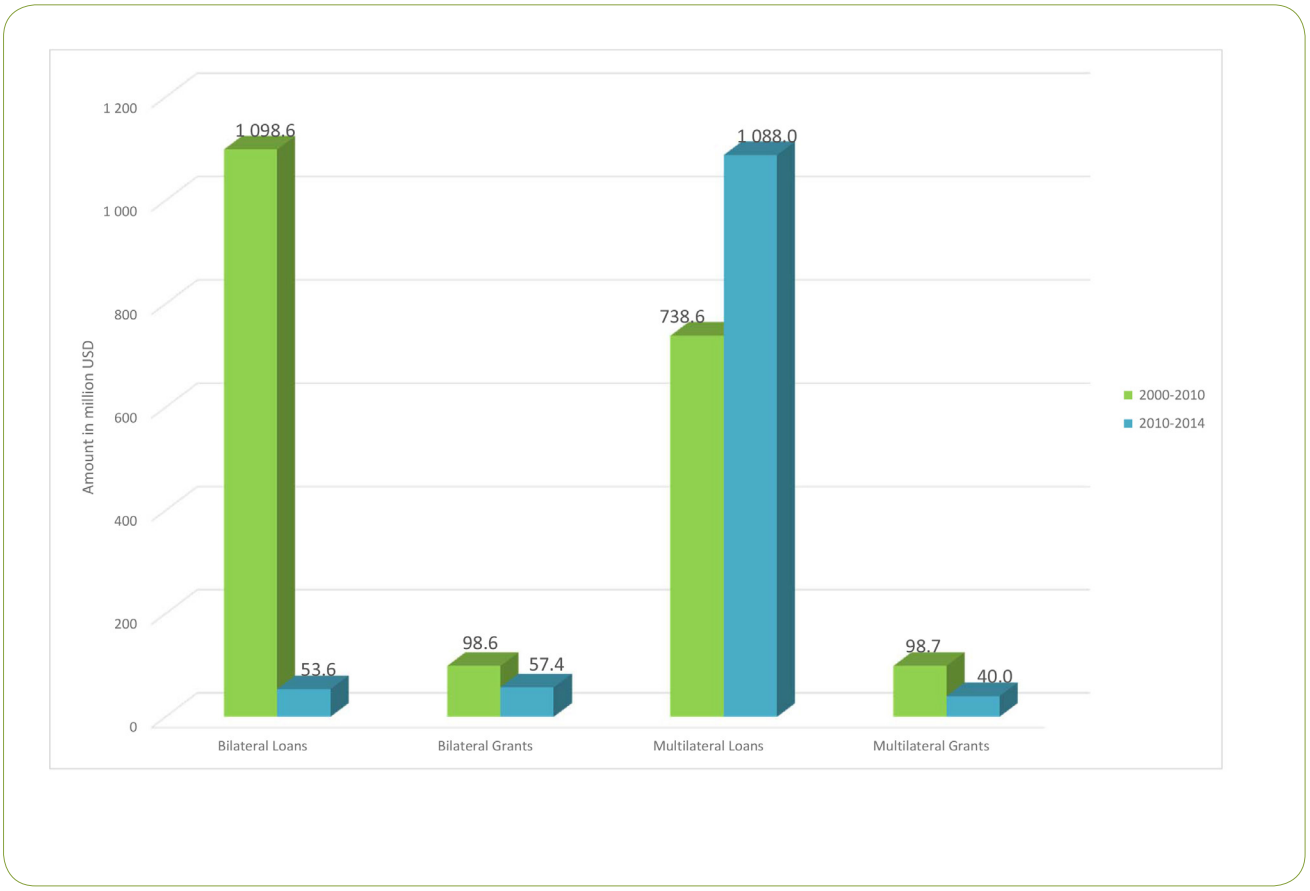


Figure ES3: International financial support received from South Africa for period 2000-2014 (DEA, 2017b)

Apart from international funding received for mitigation, South Africa is also committed to investing finance into climate change programmes. For the period 2008-2014, the South African Government invested approximately USD 11.7 billion in the form of grants and USD 71.8 million in the form of loans to fund climate change programmes.

Besides financial support, South Africa also received non-monetised support such as capacity building and technical support from developed countries. However, a key challenge for maintaining continued climate change mitigation and adaptation actions is to catalyse the financing of and investment towards a low-carbon and a climate-resilient economy. Therefore, continued support is still needed.

ES5 SUPPORT RECEIVED FOR PREPARATION OF BUR

The Global Environmental Facility was instrumental in providing funding for preparing BUR-2, which was compiled by the Chief Directorate for Climate Change Monitoring and Evaluation, within the Department of Environmental Affairs.

Part of the funding provided by GEF was used to appoint two contract staff to compile BUR-2 while the quality control of BUR-2 was undertaken by external service providers. There were many challenges and constraints experienced most of them related to the data collection process.

ES6 MEASUREMENT, REPORTING AND VERIFICATION IN SOUTH AFRICA

South Africa is developing a comprehensive National Climate Change Response Monitoring and Evaluation System which will include the current National Climate Change Response Database (NCCRD), the National Greenhouse Gas Inventory System (NGHGIS) and will serve as a data and information coordination network. The 'Monitoring' component encompasses measurement, reporting and verification (MRV), while 'Evaluation' includes impact analyses and assessments of implementation.

The approach for tracking the transition to a lower-carbon economy is achieved by monitoring and measuring specific data and indicators on a country level, sectoral-, sub-sectoral- and entity levels and also for individual response measures. The transition towards a climate resilient future is tracked by monitoring climatic and atmospheric conditions, climate impacts and risks, changing vulnerability levels and climate impacts stressors and by tracking and understanding the effectiveness of adaptation programmes and projects. Tracking climate finance is achieved through a top-down and bottom-up approach by collecting information through funder or implementation agencies, and at the implementation level of the individual response measures.

Monitoring and measurement tools include the NCCRD, the National Atmospheric Emissions Inventory System (NAEIS) embedded within the broader South African Air Quality Information System (SAAQIS). The NAEIS is a web-based portal through which mandatory reporting of priority air pollutants and GHG emissions, from regulated facilities, takes place. The NAEIS is currently structured to capture reporting from the Energy, Industrial Processes and Product Use (IPPU) and Waste sectors, while MRV of the Agriculture, Forestry and Other Land Use (AFOLU) sector is a separate subset of the web-based climate change M&E system. The NAEIS provides a reporting platform which supports South Africa's reporting obligations to the UNFCCC, provides data and information for the National GHG Inventory, and will serve as a basis for confirming the carbon tax liabilities of entities. A National GHG Improvement Programme (NGHGIP) is currently underway to address challenges affecting the accuracy and completeness of the inventory.

ES7 ADDITIONAL INFORMATION

This chapter provides a description of the activities that South Africa has undertaken in an effort to address climate change, which have not been reported in the 2nd BUR. A brief overview of the additional details is illustrated in Table ES1.

Additional actions undertaken to address a changing climate in South Africa, which was not presented in Chapters 1-6 of BUR-2, is presented in Chapter 7 and gives a brief background and overview of the initiatives and describes the process approach and progress made, to follow on from information presented in BUR-1.

South Africa submitted intended nationally determined contribution (INDC) to the UNFCCC in 2015 which elaborate on mitigation and adaptation responses as well as climate finance contribution and needs. The mitigation component (M-NDC), the adaptation component (A-NDC) and the support component of the NDC (S-NDC) are discussed in some detail through the key Flagship Programmes.

South Africa envisages scaling-up M-NDCs through the successful implementation of mitigation Flagship Programmes which include Renewable Energy, Energy Efficiency and Energy Demand Management, Carbon Capture and Storage, Transport, Waste Management, and Vertically-Integrated Nationally Appropriate Set of Mitigation Actions (V-NAMAs). The Nationally Appropriate Mitigation Actions (NAMAs) are one of the cornerstones of international climate negotiations. In the South African context, there is a complete overlap in the thematic areas included in NAMAs and those comprising the National Climate Change Near-term Priority Flagship Programmes, which is made up of 43 distinct components in total. The priority areas for climate change mitigation actions are illustrated in **Figure ES4** (below).

Figure ES4: South Africa's Expanded Climate Change Response Priority Areas (DEA, 2016e)

The adaptation component of our nationally determined contributions (A-NDC) include six goals, namely; developing a National Adaptation Plan; integrating climate considerations into national development, sub-national and sector policy frameworks; building institutional capacity for climate change response planning and implementation; developing an early warning, vulnerability and adaptation monitoring system for key climate vulnerable sectors and geographic areas; the development of a vulnerability assessment and adaptation needs framework; and the communication of past investments in adaptation for education and awareness as well as for international recognition. The development of South Africa's National Adaptation Strategy (NAS) is currently underway and envisaged to be completed by March 2018. The NAS will provide a National Adaptation Plan to the UNFCCC, in order to meet our reporting obligations.

Climate change capacity building and environmental awareness initiatives in South Africa include the Let's Respond Toolkit, the 2050 Pathway Calculator, and Partnership for Market Readiness (PMR) support to build readiness capacity for implementing the carbon tax. The Let's Respond Toolkit was designed as a means of integrating climate change adaptation into local level (municipal) Integrated Development Planning. The 2050 Pathway Calculator is an interactive web-based tool which enables both experts and non-experts to view the inter-relationship between the economy and energy systems. This tool allows users to select energy pathways and trajectories and to view the consequences of their choices; by seeing the benefits of choosing an energy efficient and low-carbon energy pathway. The PMR agreed to provide technical support for evaluating the economic modelling work completed by National Treasury; determining the linkages and potential interaction between different government policies including the carbon tax, Integrated Resource Plan (IRP) and carbon budgets as proposed in the National Climate Change Response White paper; the development of a domestic offset system which could be expanded as a regional scheme; and to explore alternatives for CDM programme given the restrictions post 2012 on SA's ability to access carbon market from the EU ETS . Technical assistance was also provided through the PMR on setting emissions intensity benchmarks for the South Africa carbon tax.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

ADA	Austrian Development Agency
AFDB	African Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
BMU	Bundesministerium für Umwelt (Federal Ministry for the Environment)
BRT	Bus Rapid Transport
BUR	Biennial Update Report
BUSA	Business Unity South Africa
CBM	Coal Bed Methane
CCS	Carbon Capture Storage
CDM	Clean Development Mechanism
CH4	Methane
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2e	Carbon Dioxide equivalent
COGTA	Cooperative Governance and Traditional Affairs
COP	Conference of the Parties
CPI	Consumer Price Index
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power Plant
CSP	Climate Support Programme
DAFF	Department of Agriculture, Forestry and Fisheries
DAO	Desired Adaptation Outcomes
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DECC	Department of Energy and Climate Change
DEROs	Desired Emission Reduction Outcomes
DF	Default Factor
DFID	Department for International Development
DMR	Department of Mineral Resources
DOE	Department of Energy
DOM	Dead organic matter
DSM	Demand Side Management
DST	Department of Science and Technology
dti	The Department of Trade and Industry

DWA	Department of Water Affairs
EEDSM	Energy Efficiency and Demand Side Management
EELN	Energy Efficiency Leadership Network
EEP	Energy and Environment Partnership
EETMS	Energy Efficiency Target Monitoring System
EF	Emission Factor
EIB	European Investment Bank
EMS	Energy Management Standards
EPWP	Expanded Public Works Programme
ESCOs	Energy Service Companies
ESO	Energy Systems Optimisation
FAO	Food and Agriculture Organization
FFA	Forest Fire Association
GCRP	Global Change Research Plan
GDP	Gross Domestic Product
GEEF	Green Energy Efficiency Fund
GEF	Global Environment Facility
Gg	Gigagram
GHG	Greenhouse Gas
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GS	Gold Standard
GTL	Gas-to-Liquid
GWH	Gigawatt hour
GWP	Global Warming Potential
HFCS	Hydrofluorocarbons
HSRC	Human Sciences Research Council
HWP	Harvested wood products
IDC	Industrial Development Corporation
IDM	Integrated Demand Management
IEP	Integrated Energy Plan
IMCCC	Inter-Ministerial Committee on Climate Change
IGCCC	Inter-Governmental Committee on Climate Change
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IPGP	Institut de Physique du Globe de Paris

IPPs	Independent Power Producers
IPPU	Industrial Process and Product Use
IPTN	Integrated Public Transport Network
IRP	Integrated Resource Plan for Electricity
ITS	Intelligent Transport System
LDC	Least Developed Country
LTAS	Long Term Adaptation Scenarios
LTMS	Long Term Mitigation Scenarios
M&E	Monitoring and Evaluation
MPA	Mitigation Potential Analysis
MRV	Measurement, Reporting and Verification
MW	Megawatt
MWH	Megawatt hour
N2O	Nitrous Oxide
NAEIS	National Atmospheric Emission Inventory System
NBI	National Business Initiative
NCCC	National Climate Change Committee
NCCRD	National Climate Change Response Database
NCCRP	National Climate Change Response Policy
NCPC	National Cleaner Production Centre
NDMC	National Disaster Management Centre
NEES	National Energy Efficiency Strategy
NEM:AQA	National Environment Management: Air Quality Act
NERSA	National Energy Regulator of South Africa
NIBS	National Industrial Biofuels Strategy
NOWCS	National Organic Waste Composting Strategy
NRCS	National Regulator for Compulsory Specifications
NRF	National Research Foundation
NT	National Treasury
NTCSA	ational Terrestrial Carbon Sinks Assessment
NWIBR	National Waste Information Baseline Report
ODA	Official Development Assistance
ODS	Ozone Depletion Substance
PFCs	Perfluorocarbons
PMR	Partnership for Market Readiness
POA	Programme of Activities
PRASA	assenger Rail Agency of South Africa

PSEE	Private Sector Energy Efficiency
PSC	Project Steering Committee
QA	Quality Assurance
QC	Quality Control
REDISA	Recycling and Economic Development Initiative of South Africa
REIPPP	Renewable Energy Independent Power Producer Programme
SA	South Africa
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SAEON	South African Environmental Observation Network
SAGEN	South African-German Energy Programme
SANBI	South African National Botanical Institute
SANEDI	South African National Energy Development Institute
SANERI	South African National Energy Research Institute
SARB	South African Reserve Bank
SAWS	South African Weather Service
SF6	Sulphur Hexafluoride
SO2	Sulphur Dioxide
SSN	South-South-North
Stats-SA	Statistics South Africa
TJ	Terajoule
TM	Tier Method
TNA	Technology Needs Assessment
TUT	Tshwane University of Technology
UFS	University of the Free State
UKZN	University of KwaZulu-Natal
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UP	University of Pretoria
USAid	United States Agency for International Development
USD	United States Dollar
VCS	Verified Carbon Standard
V-NAMA	Vertically-Integrated Nationally Appropriate Mitigation Action
VOCS	Volatile Organic Compounds
WEM	With Existing Measures
WOM	Without Measures
WRI	World Resources Institute
ZAR	South African Rand

1. NATIONAL CIRCUMSTANCES

1.1 INTRODUCTION

The Republic of South Africa signed the United Nations Framework Convention on Climate Change (UNFCCC) in June 1993 and ratified it in August 1997. The fundamental objective of the UNFCCC is to achieve stabilisation of the concentration of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The South African National Climate Change Response Policy (NCCRP) White Paper (DEA, 2011a) regards climate change as one of the greatest threats to sustainable development and commits South Africa to strengthen and ensure full implementation of the Convention.

The NCCRP states that South Africa "*shall monitor and periodically report to the international community the country's Greenhouse Gas (GHG) emissions, steps taken and envisaged to implement the UNFCCC and any other information relevant to the achievement of the objective of the UNFCCC including information relevant for the calculation of global emission trends*".

In 2014, South Africa submitted its first Biennial Update Report (DEA, 2014b) to the UNFCCC which underwent the International Consultation and Analysis (ICA) technical assessment in Bonn, Germany from 18 to 22 May 2015.

The information reported in BUR-2 on national circumstances is an update of that reported in BUR-1 and therefore information on the geographic profile and general climatic conditions for South Africa are not repeated in this document. The information on national circumstance, institutional arrangements, population dynamics, economy, energy and climate impacts that follow are considered to be additional to that presented in BUR-1.

1.2 INSTITUTIONAL ARRANGEMENTS

South Africa has three levels of government (national, provincial and local). The autonomy of each of the levels of government is guaranteed by the Constitution of the Republic of South Africa (RSA, 1996). The integration of climate change planning and action between the different levels of government is directed by the NCCRP (DEA, 2011a). Domestic institutional arrangements in place to address climate change response actions in South Africa are highlighted below:

Table 1: Domestic institutional arrangements to address climate change response actions

Structure	Function
Parliament and Portfolio Committees .	• Oversee the implementation of the NCCRP • Review legislation to support the NCCRP • BURs and National Communication reports are submitted to the committee for their approval
The Inter-Ministerial Committee on Climate Change (IMCCC)	• Executive (Cabinet) level committee that will coordinate and align climate change response actions with national policies and legislation • IMCCC shall oversee all aspects of the implementation of the NCCRP • The Minister of the Environment will chair the IMCCC
Forum of South African Directors- General clusters	• South African Director-General clusters based on their different mandates will guide NCCRP actions
Intergovernmental Committee on Climate Change (IGCCC)	• Operationalise cooperative governance • Consists of the relevant national and provincial departments and organised local government

National Disaster Management Council	• Responsible for ensuring that the National Framework for Disaster Risk Management provides clear guidance across all spheres and sectors of government for managing climate change-related risk • Ensuring that an effective communications strategy is in place for early warnings to vulnerable communities
MINMEC and MINTECH	• Facilitate a high level of policy and strategy coherence among the three spheres of government • Guide climate change work across the three spheres of government
National Committee on Climate Change (NCCC)	• Consult with stakeholders from key sectors that impact on or are impacted by climate change • Advises on matters relating to national responsibilities • Advises on the implementation of climate change-related activities
National Economic Development and Labour Council (NEDLAC)	• Forum where government comes together with organised business, labour and community groupings on a national level • Ensure that climate change policy implementation is balanced and meets the needs of all sectors of the economy

1.2.1 The Role of the Department of Environmental Affairs

The Department of Environmental Affairs (DEA) is the central coordinating and policy making authority with respect to environmental conservation and protection in South Africa. DEA has the mandate through the National Environment Management: Air Quality Act (NEM: AQA) (RSA, 2004) to formulate, coordinate and monitor national environmental information, policies, programs and legislation related to climate change. The work of DEA is underpinned by the Constitution of the Republic of South Africa (RSA, 1996) and all other relevant legislation and policies applicable to government to address environmental management, including climate change.

DEA is responsible for co-ordination and management of all climate change-related information such as mitigation, adaption, monitoring and evaluation programs. Preparation of National Communications (NCs), Biennial Update Reports (BURs) and the National Inventory Reports (NIRs) is coordinated by the Chief Directorate: Climate Change Monitoring and Evaluation which falls under the Climate Change and Air Quality Management Branch in DEA. A standing Project Steering Committee (PSC) has been established by the Director General of the DEA to assist the authors in providing oversight on the compilation of these reports; including reviewing and providing inputs on technical information to ensure the reports reflect the national circumstances.

The PSC is chaired by DEA and comprises officials from the following national departments: Department of Environmental Affairs, Department of International Relations and Cooperation, Department of Science and Technology, Department of Transport, Department of Energy, Department of Mineral Resources, Department of Trade and Industry, Department of Education, Department of Economic Development, Department of Human Settlements, Department of Agriculture Forestry and Fisheries, Department of Public Enterprises, Department of Rural Development and Land Reform, Department of Cooperative Governance and Traditional Affairs, Department of Health, Department of Water Affairs, National Treasury, The Presidency and the National Disaster Management Centre. The NCs, BURs and NIRs are endorsed by the PSC before they are submitted to Cabinet for approval. Once the reports are approved by Cabinet they are submitted to the UNFCCC by the Chief Directorate: International Climate Change Relations and Negotiations, which presides as South Africa's Climate Change Focal Point.

1.2.2 Provincial and Local Government

On a sub-national level, the provincial departments responsible for the environment have been tasked to lead climate change responses in collaboration with their respective environmental departments and other provincial entities. To assist with this, the majority of the lead departments have established provincial climate change structures to provide a forum for provincial stakeholders to jointly learn about climate change and co-ordinate their respective climate change responses. The nine provinces are taking actions to address climate change responses and the provincial development priorities related to climate change are reflected in **Table 2,** and include those reported in Table 15 of South Africa's 1st BUR (DEA, 2014b).

South Africa's Local Government Association (SALGA) is mandated to support, represent and advise local government on issues pertaining to governance at community level. The role of local government in South Africa is critical because municipalities are the window for coordinated implementation within communities. The local sphere is the most appropriate level to create public awareness and assist communities to build a better and more sustainable environment, and enhance resilience. District and Local Municipalities are undertaking Climate Vulnerability Assessments under the guidance of DEA and SALGA.

Table 2: Provincial development priorities related to climate change

Province	Development Priorities related to climate change
Gauteng	Mitigation
	Cleaner production initiatives (Industry, Commerce and Mining)
	Energy efficient and safe cook stoves
	Energy efficiency in public buildings
	Energy efficient low-cost housing
	Renewable energy projects
	Compressed natural gas fuel for vehicles
	Waste Management initiatives such as Waste Recycling, Reduction and Reuse
	Agricultural practices that reduce methane emissions
	Disaster risk planning and reduction
	Adaptation
	Water – develop and maintain efficient and secure water management systems
	Urban development and infrastructure – regulation and implementation of land-use planning and spatial development
	Agriculture and food security- Urban agriculture initiatives such as food gardens and support climate resilient agriculture and agro-processing
	Conservation of natural resources and biodiversity areas

Western Cape	Mitigation
	Energy efficiency
	Development of renewable and alternate sustainable energy resources
	Effective waste management strategies
	Cleaner fuel programmes for households and transport
	Transition towards a low carbon agriculture sector
	Soil carbon sequestration
	Energy Efficiency at farm level (reduced fossil fuel consumption and use of grid electricity)
	Stimulate and incentivise local technology innovation for climate resilience
	Adaptation
	Effective land use and land care
	Protection, maintenance and enhancement of natural resources
	Climate Resilient low carbon agricultural sector
	Effective climate disaster risk reduction and management for agriculture
	Strengthen monitoring, data and knowledge management and sharing, and lead strategic research for climate change and agriculture
Kwa-Zulu Natal	Mitigation
	Wave power to create renewable electricity, thereby displacing coal-based grid electricity
	Biodiesel production
	Carbon capture and storage
	Upscaling energy efficiency as a short- and medium-term mitigation option
	Commercial and Residential energy efficiency programmes
	Energy Efficiency and Energy Demand Management Flagship Programme
	Adaptation
	Catchment management (e.g. removal of invasive alien species)
	Capacity building and awareness of the value of using biodiversity in assisting societal adaptation to the adverse impacts of climate change
	Expanded rainwater harvesting, water storage and conservation techniques, water reuse, desalination, water-use and irrigation efficiency

Eastern Cape	Mitigation
	Clean Energy Promotion (hydropower and wind)
	Renewable and nuclear electricity generation targets
	Generation of renewable energy from waste and woody biomass.
	Reduction in organic waste to landfill
	Methane use or destruction
	Green transport and transport systems
	Energy efficiency standards for industrial equipment and processes
	Enabling environment for investment and use of clean energy
	Establish a carbon price through escalating the CO_2 tax, or alternative market mechanisms
	Industrial policies for energy efficiency
	Promote development of Green Industries and support domestic industries in emerging sectors
	Adaptation
	Resilience to the effects of sea level rise, storm surges, flooding and sea temperatures rise (fisheries)
	Disaster management and improved response to the impacts of extreme coastal events
	Water resources management
	Early implementation of water restrictions during extended periods of drought
	Improved wildfire prevention and suppression
	Societal adaptation to human health impacts from temperature increases
	Food security programmes, through small-scale farming and homestead agricultural production
	Climate Change Acclimatization and Resilience in provincial food security programmes
	Conservation Cropping Practices
Limpopo	Mitigation
	Clean energy and energy efficiency
	Sustainable waste management practices
	Sustainable production and consumption
	Non-motorised transport
	Implementation of eco technologies
	Strengthening provincial recycling programmes
	Energy saving in commercial building sector
	Adaptation
	Disaster risk reduction and management
	Water management
	Resource conservation and management
	Climate Smart agricultural programmes and water efficiency in agriculture
	Raise performance and efficiency of water service delivery for domestic use
	Green economy plan, focused on economic systems and the integrity of ecosystems

Mpumalanga	Mitigation
	Forestry and carbon sequestration
	Green Economy plans
	Technology development initiatives
	Energy Efficiency and Renewable Energy
	Agricultural efficiency and renewable energy
	Exploration of the feasibility of carbon capture and storage
	Adaptation
	Enhanced use of ecological infrastructure to create buffers for climate resilience
	Enhanced Sustainable Livelihoods
	Natural Resource Management
	Integrated Rainwater harvesting to combat drought effects
	Research related to global climate change, energy and climate science
North West Province	Mitigation
	Alternative uses of energy sources in communities and household levels (e.g. Solar PV)
	Awareness campaigns on energy savings
	Renewable Energy Strategy
	Understanding, Creating Awareness, and Managing agricultural and biomass burning
	Energy Audits
	Adaptation
	River Health Programmes
	Alien Invasion Programmes
	Agriculture master plan
	Dam Remediation programmes
	Rapid Road Transport Improvements (BRT systems) and public transport systems
	Disaster Risk Reduction
Northern Cape	Mitigation
	The Biodiversity and Red Meat Initiative
	The Third Planet Enterprise wind energy project
	Eskom's two hydro-power generation stations on the Orange River
	Concentrated Solar Power (CSP) plants
	Adaptation
	Namaqualand Wilderness Initiative: Building resilience and adapting to climate change
	Rain water harvesting initiatives
	Water conservation, demand management, recycling and artificial recharge
	Use boreholes as a temporary measure since ground water impacted by current drought
	Disaster Risk Reduction and Early Warning Systems

Free State	Mitigation
	Waste Management to manage methane greenhouse gas issues Research on methane gas currently undertaken at 2 landfill sites Green Economy Projects (solar geysers and lights in townships) Cleaning and Greening Initiatives Solar Energy Initiatives Solar geysers and lights in townships Eco-schools and Environmental Management Letsatsi solar energy plant
	Adaptation
	Rain water harvesting initiatives Water quality monitoring Drought and flood relief programmes for farmers (e.g. encourage water conservation, demand management, recycling and artificial recharge, and boreholes as a temporary measure) Eco schools and promotion of environmental management

1.2.3 Progress made in sector related climate change responses

South Africa's response to climate change needs to consider both development needs and climate change imperatives (DEA, 2011a). The National Development Plan (NPC, 2011), Sustainable Development Action Plan (2011) and New Growth Path – Green Economy Accord (2011) inform development priorities and the National Climate Change Response Policy (DEA, 2011a) call for the integration of sector-related climate change responses into the relevant sector planning processes and their developmental policies and measures (DEA, 2011a). Where cross-cutting climate change responses are called for, the NCCRP provides for their inclusion in, and consideration by, the relevant National, Provincial and/or Local planning regime as well as coherent alignment with the relevant policies and legislation. Advancements made in sector climate change response through the development of numerous national programmes, plans and strategies, are reflected in **Table 3** below:

Table3: Sectoral climate change programmes, plans and strategies

Institution	Sectoral programmes, plans and strategies
Department of Agriculture, Forestry and Fisheries	• Draft Climate Change Sector Plan for Agriculture, Forestry and Fisheries (2015) • Draft Sectoral Cold Spell Management Plan (2015) • Climate Change Adaptation and Mitigation Plan for South African Agriculture, Forestry and Fisheries Sectors (CCAMP) under development • Strategic Plan for DAFF 2013/14 to 2017/18 (2013)
Department of Energy; ESKOM	• Draft Integrated Energy Plan for South Africa (2016) • Draft Integrated Resources Plan for South Africa (2016) • Draft Post-2015 Energy Efficiency Strategy (NEES) (2016) • National Energy Efficiency Strategy (NEES), with targets until 2015 • DoE Environmental Management Plan for 2015-2020 3rd Ed. (2016) • State of Renewable Energy in South Africa (2015) • Draft Regulations on Registration, Reporting on Energy Management and Submission of Energy Management Plans (2015) • Energy Efficiency Target Monitoring System (EETMS) • Integrated Demand Side Management (IDM) Programme • Diversification of electricity generation sources: Renewable Energy Independent Power Producer Procurement (REIPPP) Programme • Diversification of electricity generation sources: South African Wind Energy Programme (SAWEP) • National Industrial Biofuels Strategy (NIBS) (2007) • Draft position paper on South African Biofuels Regulatory Framework (2014)
Department of Environmental Affairs; South African Weather Services (SAWS); South African Earth Observation Network (SAEON); South African Biodiversity Institute (SANBI); Development Bank of Southern Africa (DBSA)	• National Environmental Management: Air Quality Act No 39 of 2004 (NEM:AQA) • National Framework for Air Quality Management in South Africa • Air Quality Offset Guidelines (2016) • Draft Regulations on Pollution Prevention Plans (2016) • Draft Regulation on GHG emissions reporting (2016) • Draft Declaration of Greenhouse Gases Priority Air Pollutants (2016) • Environmental Implementation Management Plan (EIMP) for 2015-2020 • Climate Change Adaptation Plans for South African Biomes (2015) • Revised National Biodiversity Strategy and Action Plans and the Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation (EbA) in South Africa (2015) • Strategic Plan for Measurement, Reporting and Verification: AFOLU Sector 2016 to 2020 • EIA Guidelines for Renewable Energy Projects (2015) • Mitigation Potential Analysis for South Africa (2014) • Biodiversity Sector Climate Change Response Strategy (2014) • Southern Ocean Carbo – Climate Observatory (SOCCO) • draft South Africa's National Adaptation Strategy (2016) • Updating the Technology Needs Assessment (for completion by 2017) • Long-Term Adaptation Scenarios (2013) • Green Economy Model (2013)
Department of Health; Human Sciences Research Council (HSRC)	• National Climate Change Health and Adaptation Plan 2014–2019 (NCCHAP) • Department of Health Environmental Management Plan (2016)
DRDLR Strategic Plan for 2015-2020	• Department of Rural Development and Land Reform (DRDLR) • Climate Change Adaptation Sector Strategy for Rural Human Settlements (2013) • Draft Regulations for Spatial Planning and Land Use Management Act (2014)

Department of Science and Technology (DST); Council for Scientific and Industrial Research (CSIR); National Research Foundation (NRF).	• Global Change Grand Challenge (GCGC) National Research Plan • 10-Yr Innovation Plan under the Global Change Research Plan (GCRP) • South African Risk and Vulnerability Atlas (2010) • Climate Change Vulnerability Analysis (2014/15) • Technology Needs Assessment
Department of Water and Sanitation (DWS); Water Research Commission (WRC)	• National Water Resource Strategy, Second edition (2013) • Climate Change Response Strategy for Water Resources in South Africa (2014)
Ministry of Cooperative Governance & Traditional Affairs (COGTA)	• Disaster Management Amendment Act 2015 (Act no 16 of 2015)
Department of Transport	• National Transport Master Plan 2050; • Minimum Requirements for the Preparation of Integrated Transport Plans (2016); • Roads Policy for South Africa, draft Green paper (2016); • Draft Green Transport Strategy 2016-2021 (2016) • National Land Transport Strategic Framework (2015); • Draft National Rail Policy Green Paper (2015) • PRASA National Strategic Plan (2012); • Non-Motorised Transport Policy (2012); • Transnet Long-term Planning Framework (2012); • Road Freight Strategy for South Africa (2011); • Transport Action Plan (2010); • Public Transport Strategy (2007); • National Transport Policy White Paper (1996)
Department of Trade and Industry (dti)	• Industrial Policy Action Plan (IPAP) 2012/13 – 2014/15; • dti Environmental Implementation Plan for 2015-2020 4th Ed. (2017) • National Industrial Policy Framework (NIPF) (2007);

1.3 POPULATION

According to mid2014 population estimates, South Africa's population was estimated to be 54 million (Stats-SA, 2014a). South Africa's population pyramid according to age and gender is presented in **Figure 1** below. The population is distributed along the horizontal axis, with males shown on the left and females on the right. Approximately fifty-one per cent (27.64 million) of the population is female (Stats-SA, 2014a). The youngest age group is at the bottom and the oldest is at the top. About 30.0% of the population is younger than 15 years and approximately 8.4% (4.54 million) is 60 years or older.

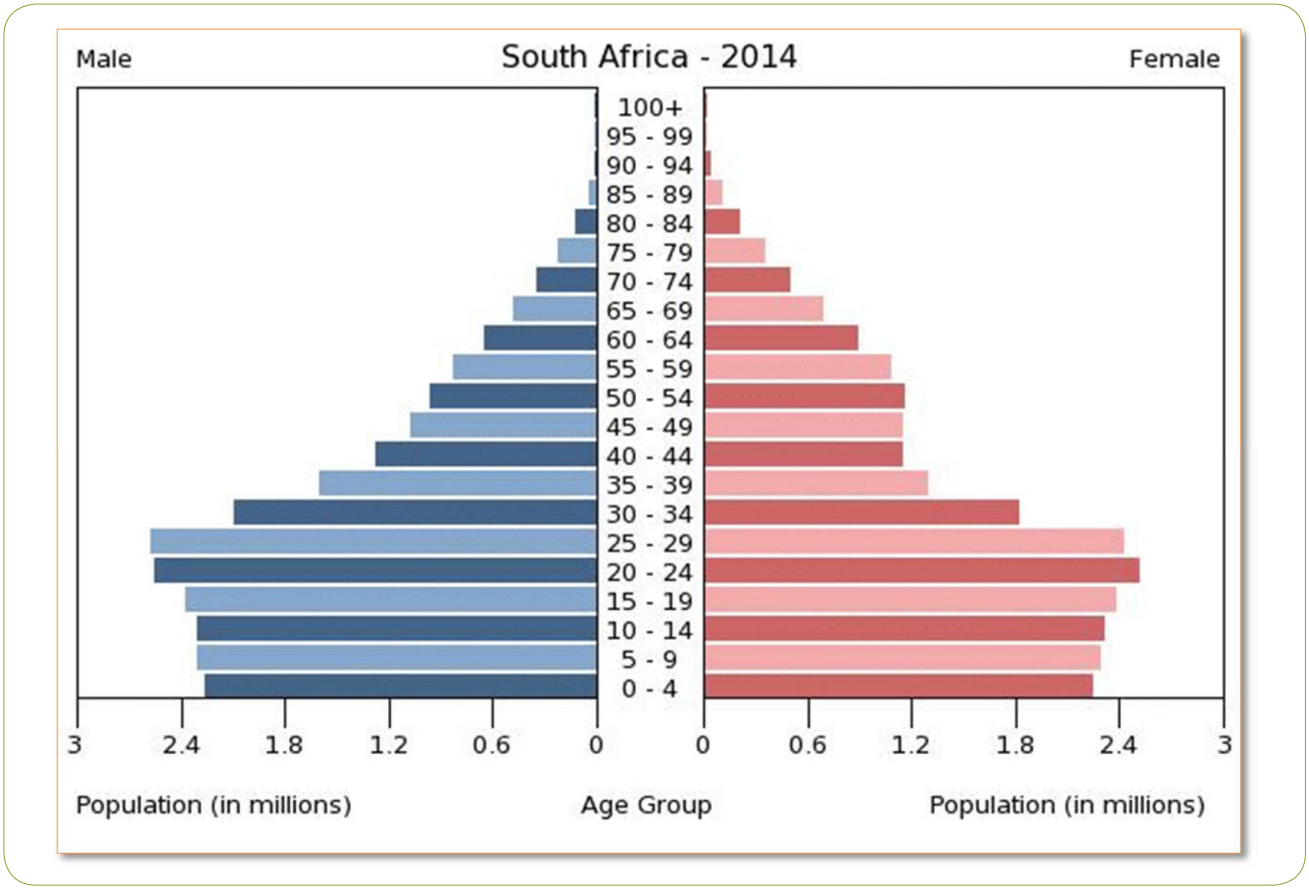
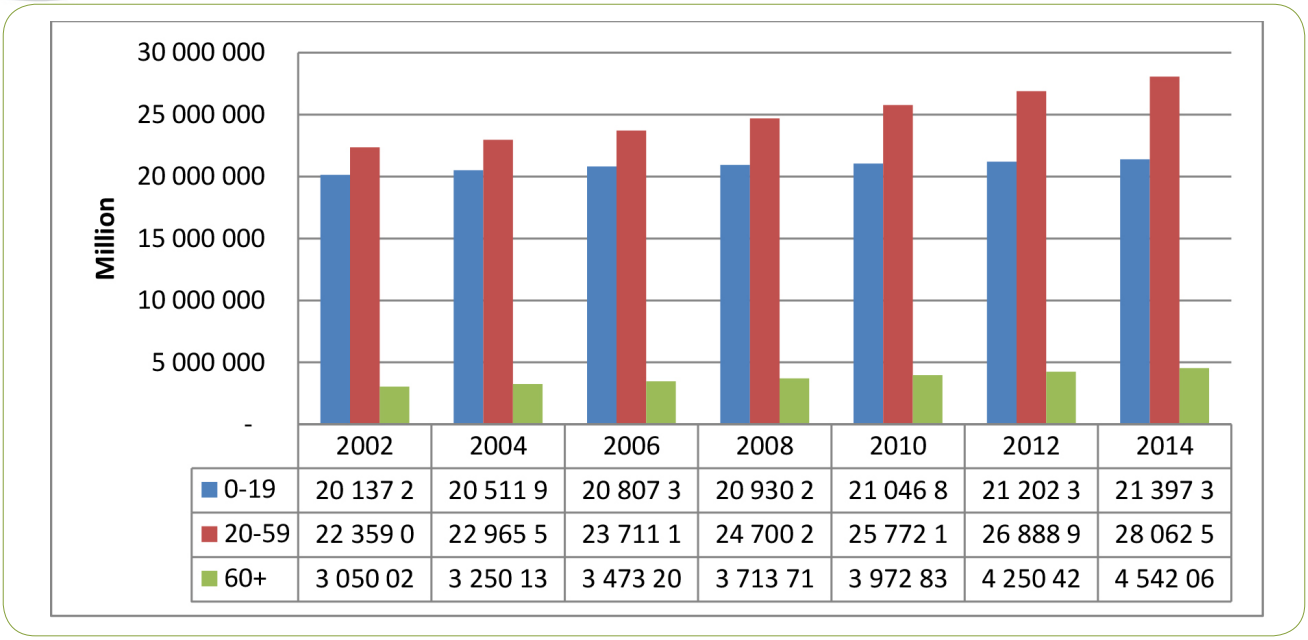


Figure 1: South Africa's population pyramid for the year 2014 (Stats-SA, 2014a)

The growth of population is dependent on fertility, mortality and migration. Currently international immigration is the main driving force behind South Africa's population growth (Turok, 2012). Between 2002 and 2014, fertility has declined from an average of 2.79% children per woman to 2.57% children (Stats-SA, 2014a). This may be due to the development of the country, and use of birth control and family planning. Infant mortality has declined from an estimated 58 per 1000 live births in 2002 to 34 per 1000 live births in 2014. The estimated overall population growth rate increased from approximately 1.27% for the period 2002–2003 to 1.58% for 2013–2014 (Stats-SA, 2014a).

The graph below, indicating the overall population by age group, shows that South Africa's population is dominated by the age group of 19-60 years followed by the 0-18 years group.



	2002	2004	2006	2008	2010	2012	2014
0-19	20 137 2	20 511 9	20 807 3	20 930 2	21 046 8	21 202 3	21 397 3
20-59	22 359 0	22 965 5	23 711 1	24 700 2	25 772 1	26 888 9	28 062 5
60+	3 050 02	3 250 13	3 473 20	3 713 71	3 972 83	4 250 42	4 542 06

Figure 2:South Africa's population by age group from 2002-2014. (Stats-SA, 2014a)

South Africa is one of the most urbanised countries in Africa, with nearly two-thirds of the total population living urban areas (Turok, 2012). Economic opportunity is the main reason for rural-urban migration. **Figure 3** below shows the percentage distribution of the provincial share of the total population. Gauteng has the largest share of the population followed by Kwa-Zulu Natal and the Eastern Cape Province. Approximately 23.9% of South Africa's population lives in Gauteng Province, while the Northern Cape Province has the smallest population representing of 2.2% of the population in 2014 (Stats-SA, 2014a).

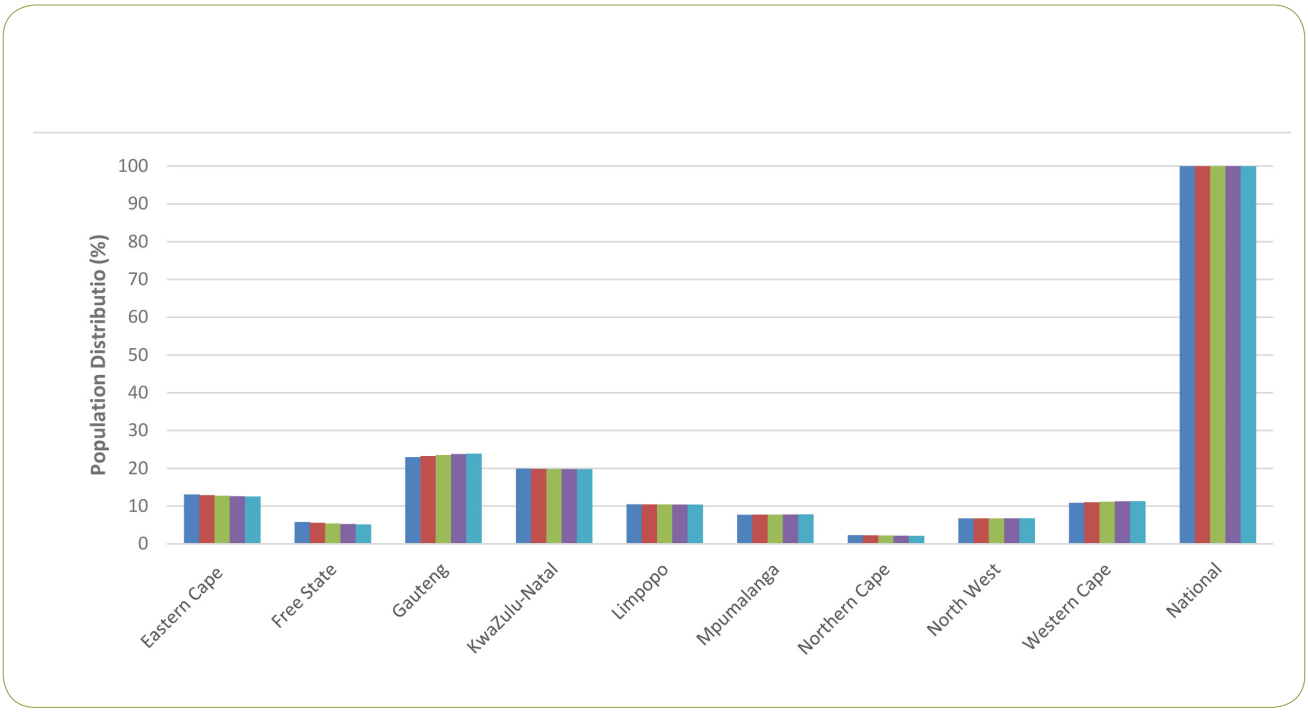
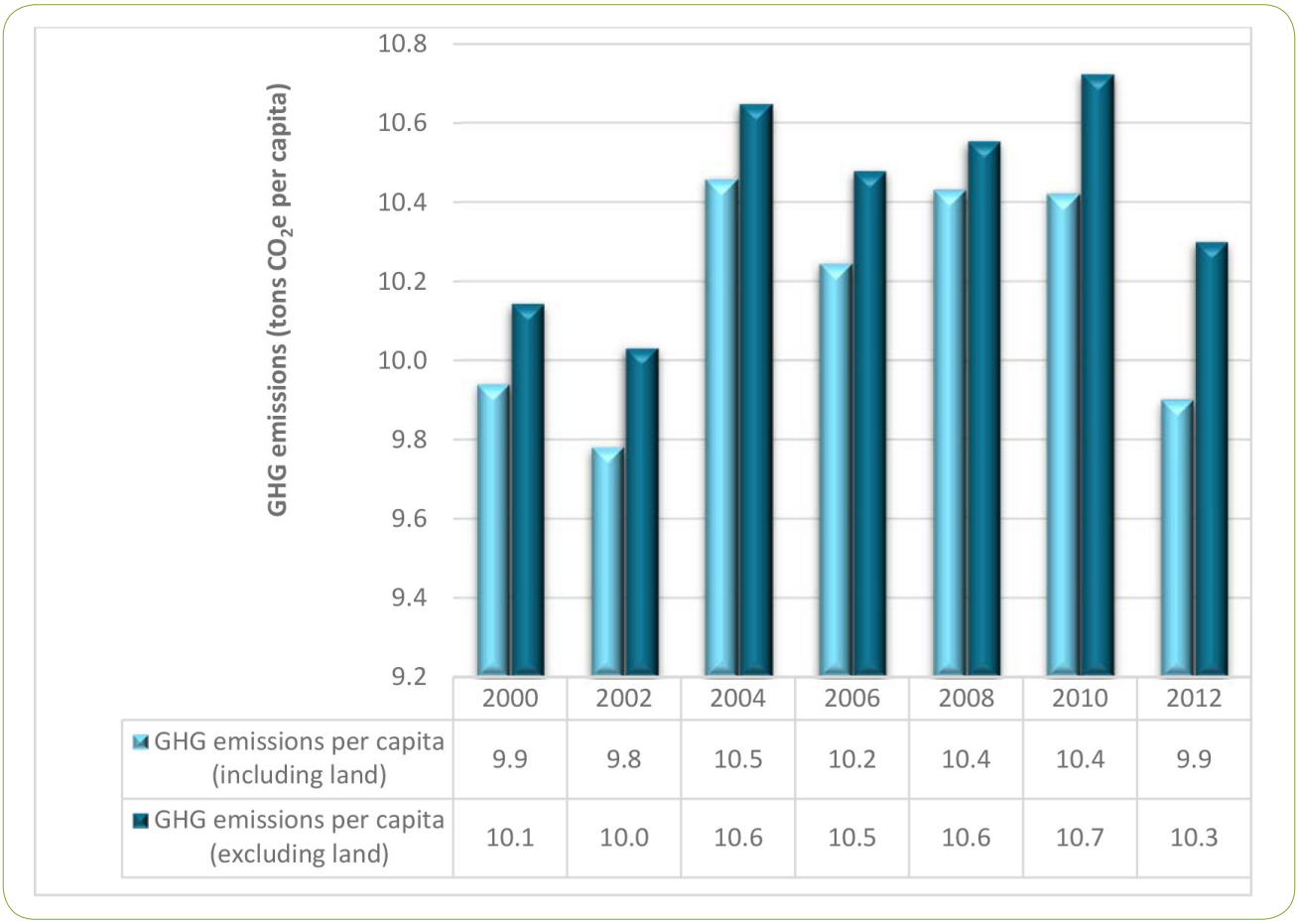


Figure 3:Provincial distribution of the total population(Stats-SA, 2014a)

The South African GHG emissions per capita (including land) averages 10.7 tons CO2e over the period 2000 to 2012 and is among the highest per capita emissions in the developing world due to our reliance on a coal based energy production system. The GHG emissions per capita is a function of South Africa's population growth trends and GHG emission reduction initiatives and is reliant on the economic development taking place. The upward trends in South Africa's GHG emissions are expected to increase between 2020 and 2025, which is in alignment with the Peak-Plateau-Decline trajectory (DEA, 2011a). The graph in **Figure 4** below indicates GHG emissions per capita for the period 2000-2012, as adjusted by the recalculations in the 2012 National GHG Inventory Report (DEA, 2017b).



	2000	2002	2004	2006	2008	2010	2012
GHG emissions per capita (including land)	9.9	9.8	10.5	10.2	10.4	10.4	9.9
GHG emissions per capita (excluding land)	10.1	10.0	10.6	10.5	10.6	10.7	10.3

Figure 4:GHG emissions per capita (Stats-SA, 2014a)(DEA, 2017b)

The National Climate Change Response White Paper (DEA, 2011a) has prioritized the water, health and human settlements as key sectors that would be negatively affected by climate change. The South African Risk and Vulnerability Atlas (DST, 2010) concludes that the three major environmental consequences of climate change are increased drought, floods and water pollution. One of the challenges South Africa is facing is that regions with higher climate risks are often those with the highest concentration of human population. This presents new challenges for disaster risk management, development planning and climate change adaptation in urban areas (DST, 2010).

Furthermore, where population growth rate is highest, such as in Gauteng, Kwa-Zulu Natal and Eastern Cape Provinces, there also tends to be a greater number of people living in poverty. Detrimental impacts are also exacerbated in overcrowded conditions where competition for resources is higher, particularly within informal 'squatter' settlements. Climate change is expected to intensify existing water scarcity pressures in these areas, which will worsen current water quality and sanitation challenges (DST, 2010).

Although the South African government has made important pro-poor investments and has a social protection system aimed at reducing social inequalities, important disparities remain. Climate change could magnify the impacts on those who are already more vulnerable and whose adaptive capacity is lower, particularly on children and younger population who lack resilience capacities.

1.4 ECONOMY

South Africa is a significant industrial and economic power with the largest economy in Africa and in 2013 was classified by the World Bank as an "upper-middle income country" (GCIS, 2013). In its 2013/14 Global Competitiveness Report, The World Economic Forum ranked South Africa second in the world for the accountability of its private institutions, and third for its financial market development (GCIS, 2014). The main features of the SA economy are shown in **Table 4** below.

Table 4: Features of the South African Economy (CIA, 2015)

Feature	Detail
Gross Domestic Product(GDP)	USD 313 billion in 2015 (31st in the world)
GDP Growth	+1.3% in 2015
Per Capita GDP	USD 13.400 in 2015 (118th in the world)
GDP by sector	Agriculture: 2.4% Industry: 28.9% Services: 68.7% South Africa has a well-developed mining, transport, energy, manufacturing, tourism, agriculture, commercial timber and pulp production, service sectors, and it is a net exporter of energy, food, telecommunications, and other services to neighbouring countries.
Consumer Price Index (CPI) Inflation	4.5% (2015)
Population below poverty line	35.2% in 2012
Labour Force	21.09 million
Unemployment	25%
Exports	USD 81.63 billion (2015)
Main export partners (2015)	China: 11.3% United States: 7.3% Germany: 6.0% Namibia 5.2% Botswana 5.2% Japan: 4.7% United Kingdom: 4.3% India 4.2%
Imports	USD 84.33 billion (2015)
Main import partners	China: 17.6% Germany: 11.2% United States: 6.7% Nigeria 5.0% India: 4.7% Saudi Arabia: 4.1%
Public Debt	44.4% of GDP (2015)

There are two structural elements of the South African economy which contribute significantly to the country's vulnerability to climate change. The first is the high levels of inequality in the economy and the second is the emission intensity of the commodities produced in the country. In terms of GDP growth rate for the period 2000-2014, there has been a fluctuating trend in the country's growth (see **Figure 5**). South Africa's economy grew by 2.2% in 2013 and by 1.5% in 2014 and the nominal gross domestic product at constant 2010 market prices was estimated at R3.8 trillion for the year 2014 (Stats-SA, 2014b).

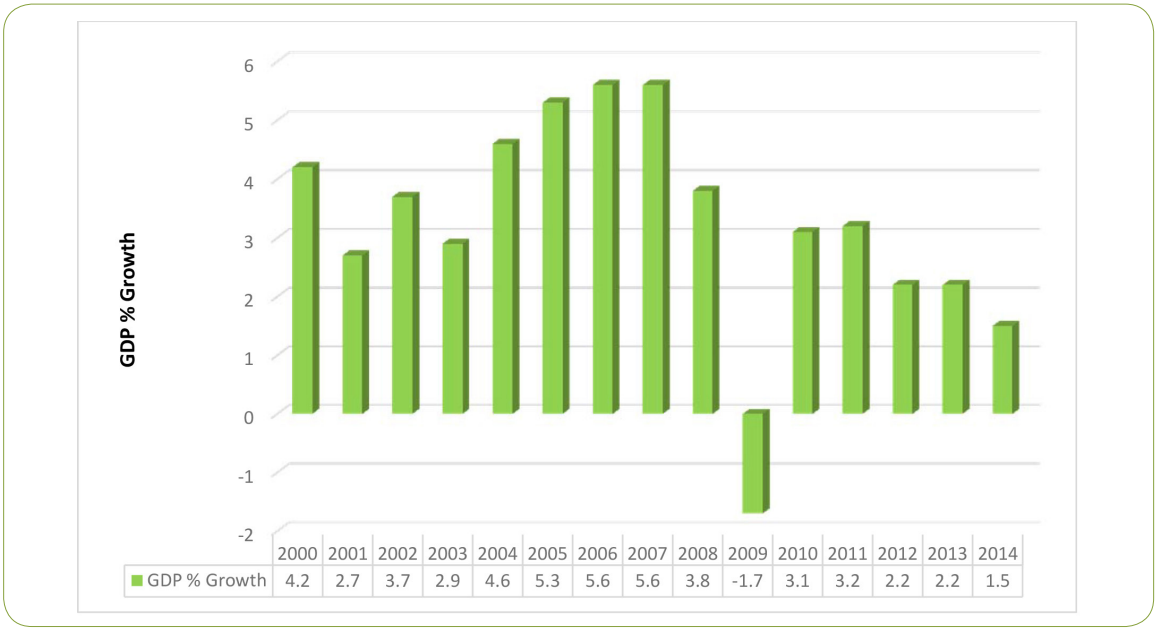


Figure 5:South Africa's GDP percentage change, 2000 - 2014 (Stats-SA, 2014b)

South Africa has a well-developed mining, transport, energy, manufacturing, tourism, agriculture, commercial timber and pulp production, service sectors, and it is a net exporter of energy, food, telecommunications, and other services to neighbouring countries. The industry that grew the fastest in 2014 was agriculture, expanding by 5.6%, with construction coming in second place at 2.9%.

Economic activity within the mining and electricity industries decreased by 1.6% and 0.9% respectively, while manufacturing showed very little change for the year as a whole. (Stats-SA, 2014b). **Figure 6** below presents South Africa's GDP change by industry at constant 2010 prices over the period 2010 to 2014.

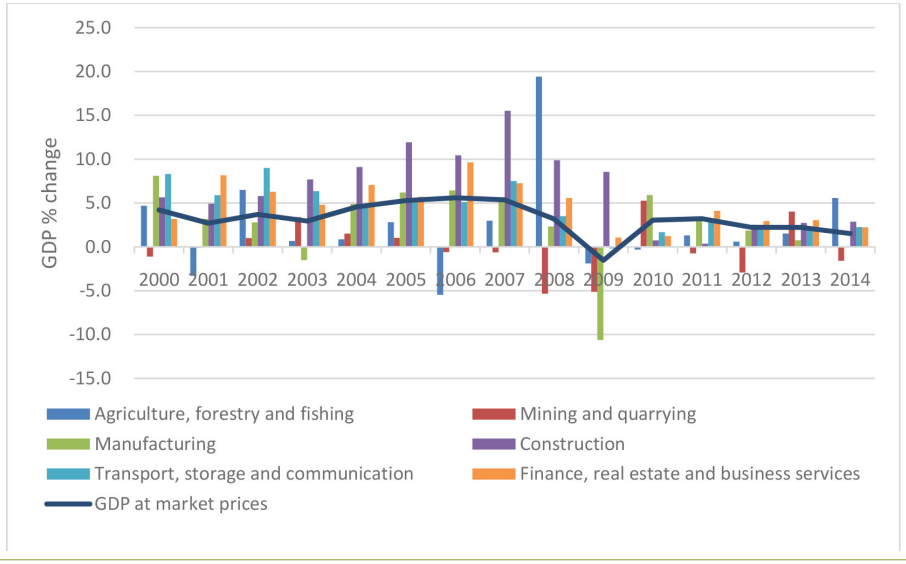


Figure 6:South Africa's GDP change by industry (Stats-SA, 2014b)

South Africa's National Development Plan (NPC, 2011) identifies human development as a critical part of inclusive growth and acknowledges its inadequate improvement in relation to education, health and safety. On the Human Development Index (HDI) scale, South Africa appears in the 119th position out of 188 countries on the UN list for 2015 (CIA, 2015). The HDI is a geometric mean of normalized indices for three key dimensions of human development, namely a long and healthy life, access to knowledge and a decent standard of living (UNDP, 2016). The country has seen a steady increase in its HDI value since 1990, moving up 7.2% from 0.621 in 1990 to 0.666 in 2014. Compared to the average HDI (of 0.63) for other countries in the medium human development category, SA's HDI of 0.666 is above average, as depicted in **Figure 7** below.

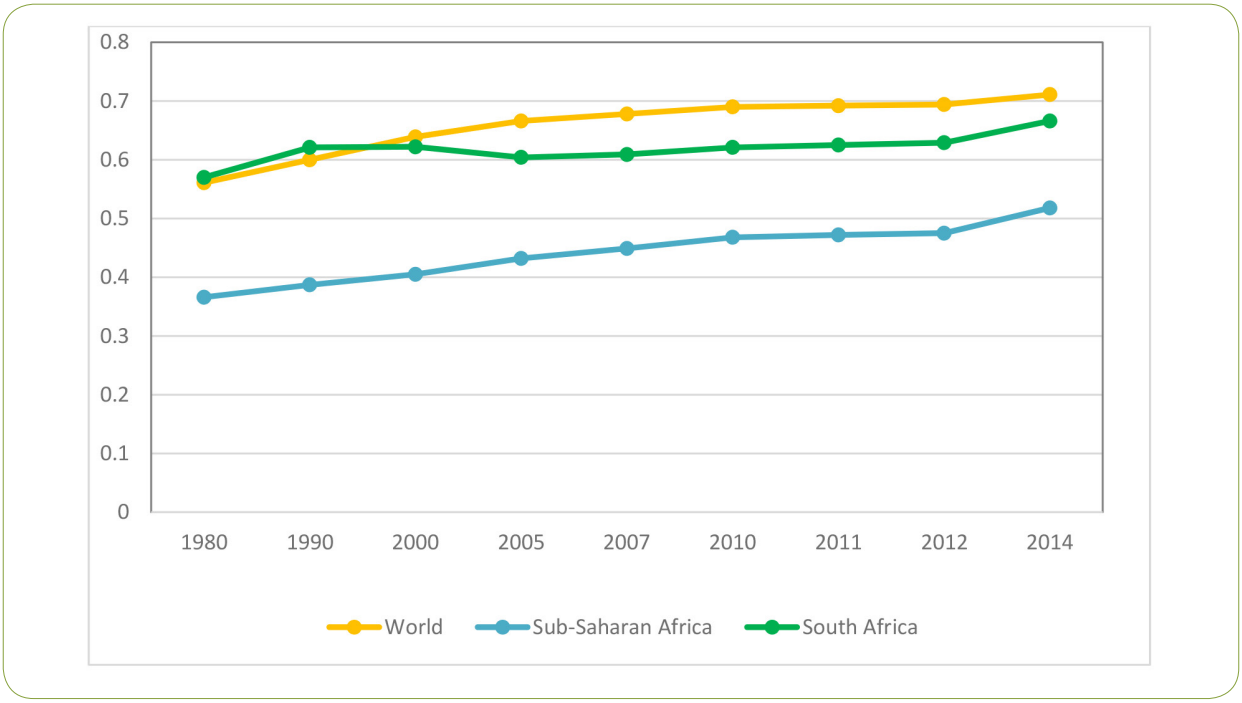


Figure 7: South Africa Human Development Index (UNDP, 2015)

1.5 ENERGY

The inequality in the economy (discussed under section 1.4 above) and the emission intensity of the commodities produced in the country are the two structural element of the economy which contribute significantly to South Africa's vulnerability to climate change. South Africa has traditionally been a major supplier of mineral commodities globally and the total energy consumption per unit of GDP is about 50% higher than the world's average. The high level is due to significant energy intensive industries and the grade of coal used in the energy supply system. South Africa's total energy supply (in Terajoules) includes domestic energy production and energy imports of coal, crude oil, electricity, gas to users, hydro, nuclear, petroleum products and renewable energy from geothermal, solar and waste, but the 2013 value for renewable energy excludes energy from waste (Stats-SA, 2017).

Energy intensity per GDP, at constant 2010 prices, has shown a consistent decrease over time, dropping by 35.6% between 2002 and 2010 and 39.6% between 2002 and 2013. The energy intensity decreased from 4.72 Megajoules per Rand in 2002 to 3.48 Megajoules per Rand in 2010 and to 3.33 Megajoules per Rand in 2013. **Figure 8** represents South Africa's energy intensity in Megajoules per US Dollar, by applying the 2010 Rand-Dollar exchange rate, as determined from the weighted daily average rates published by the South African Reserve Bank (SARB). Weights are based on the banks' daily foreign exchange transactions at approximately 10:30 am daily (SARB, 2014).

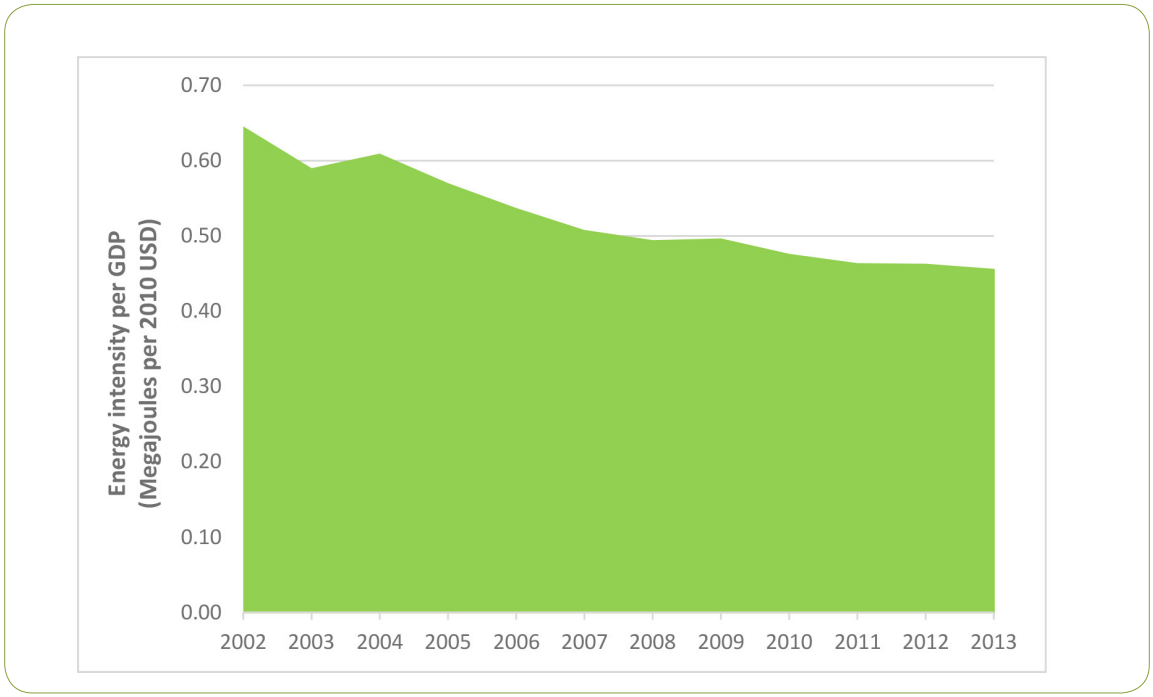


Figure 8: South Africa's energy intensity per GDP (2002-2013)(Source: Compiled from (Stats-SA, 2014b); (Stats-SA, 2017); and (SARB, 2014)).

South Africa's Integrated Resource Plan (IRP) for the period 2010-2030 (DoE, 2011) was promulgated in March 2011 and undergoes periodic revision by the Department of Energy (DoE). The draft revised IRP (DoE, 2016b) is currently undergoing the public comment phase prior to being submitted to Parliament for Cabinet approval, which is expected later in 2017. The 2011 IRP incorporated a number of government objectives, including affordable electricity, carbon mitigation, reduced water consumption, localisation and regional development, producing a balanced strategy toward diversified electricity generation sources and gradual decarbonisation of the electricity sector in South Africa.

South Africa's energy demand forecast per sector, presented in Figure 16 in BUR-1, applied in developing the initial IRP in 2011, which also identified the preferred generation technologies required to meet expected growth in demand up to 2030. This projected demand growth is illustrated by the red line in **Figure 9** below. In revising the IRP in 2016, the DoE took cognisance of changes in South Africa's electricity landscape over the past three years; in particular, in electricity demand and the underlying relationship with economic growth, new technology developments and fuel options (locally and globally), revised scenarios for carbon mitigation strategies, the impact of electricity supply up to 2050 and the affordability of electricity. The revised draft IRP applies the "High less energy intense energy demand" forecast (see **Figure 9** below), as developed by the CSIR, for developing the base case. The High less energy intensity forecast uses an annual average energy growth of 2.17% while the Low forecast uses an annual average energy growth rate of 1.31% resulting in a difference of 156TWh between the High and Low forecasts by 2050 (DoE, 2016b).

Technology data from an independent study was applied by the DoE in updating the IRP. The various scenarios developed to inform policy adjustments included carbon budget as an instrument to reduce GHG emissions, primary fuel price tipping point (coal, gas and nuclear), low demand trajectory, embedded generation (rooftop PV), enhanced energy efficiency, low Eskom plant performance, regional options (hydro, gas), indigenous gas, un-constrained renewable energy, new technology (storage), electricity network implications, and additional sensitivity analysis (DoE, 2016b). The 'Peak-Plateau-Decline' (PPD) total GHG emission reductions targeted by the NCCRP (DEA, 2011a) were applied by the DoE to inform optimal energy mixes.The PPD upper limit was applied to develop the Base Case, Green Shoots and Resource Constrained scenarios while the PPD lower limit is applied to the Environmental Awareness Scenario. The CO2 emission profiles in all scenarios fall well within the specified emission limits and this is attributable to the inclusion of externality costs associated with carbon and other pollutants as part of the technology and fuel costs. The proposed electricity generation mix for each scenario is presented in **Figure 10** below, and will be finalised once the stakeholder engagement phase is concluded and Cabinet approval is granted.

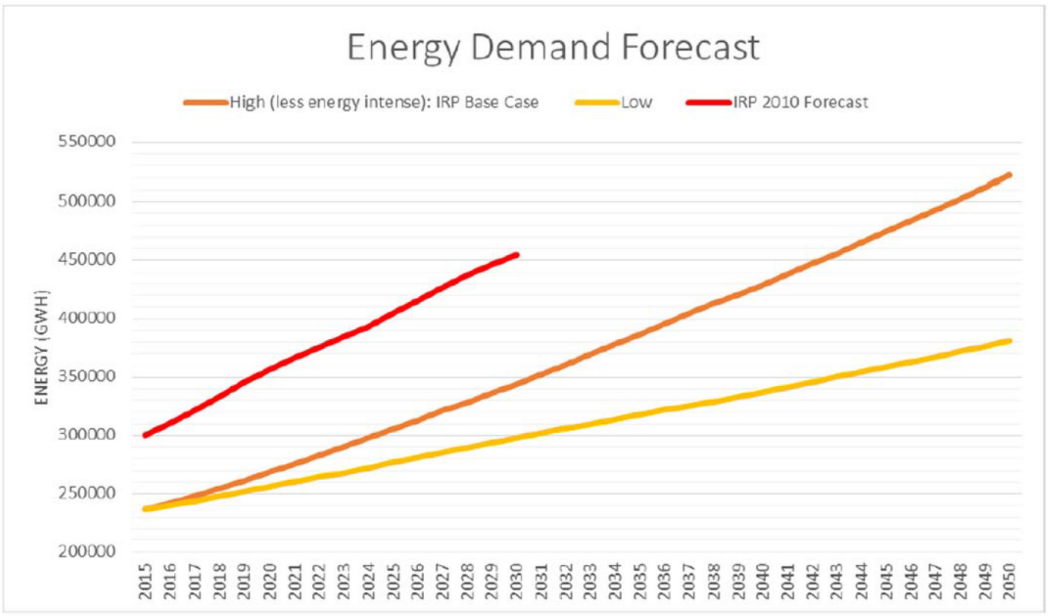


Figure 9: South Africa's energy demand forecast (DoE, 2016a)

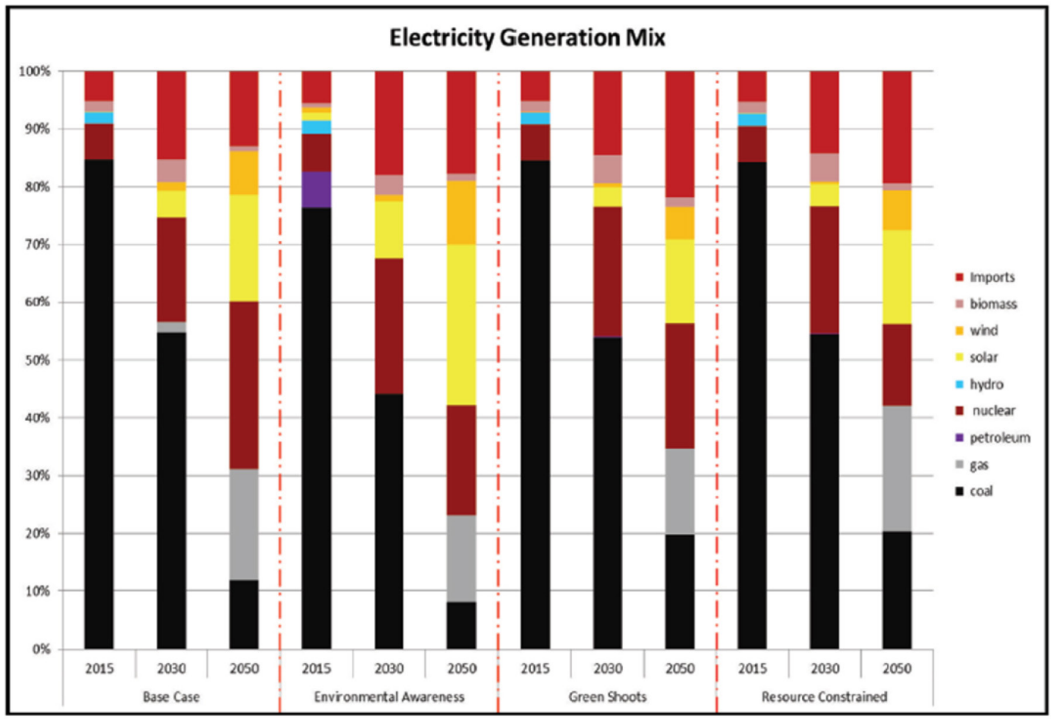


Figure 10: South Africa's proposed electricity generation mix (DoE, 2016a)

The proposed primary energy feedstock mix for liquid fuel production for the four modelled scenarios is presented in **Figure 11** below.

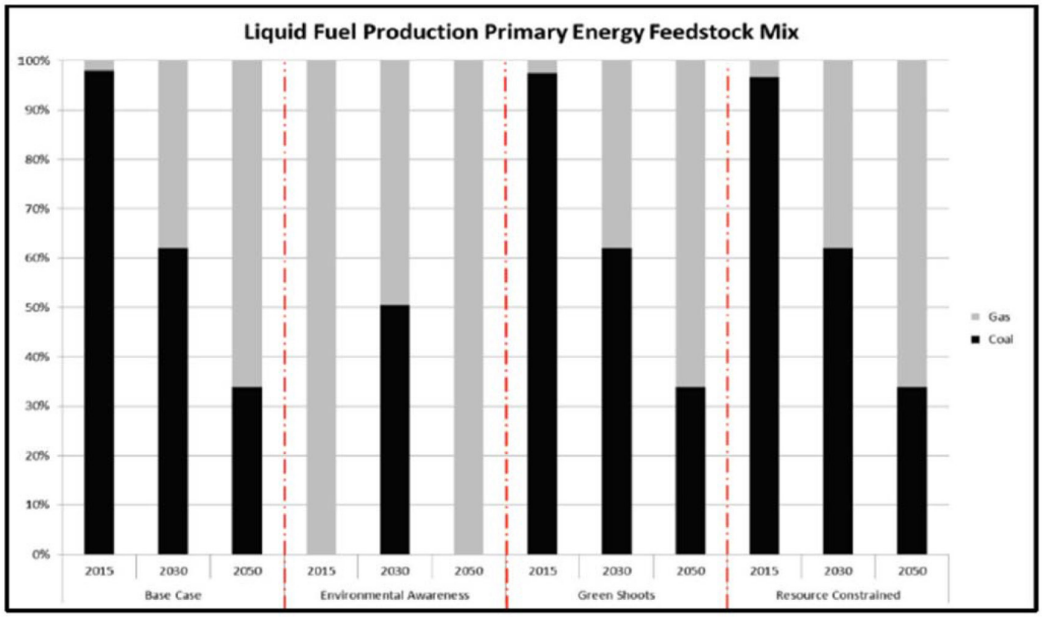


Figure 11: South Africa's proposed Liquid fuel production primary energy feedstock mix (DoE, 2016a)

The draft IRP (2016) proposes diversifying South Africa's energy mix, so that reliance on a single or a few primary energy sources is reduced, and advises that the technology mix for electricity production should take into consideration the roles different technologies play in providing baseload and peaking power. The draft IRP (2016) proposes that coal will continue to play a role in providing energy in the future, but to be limited to electricity generation; as alternative and more economically viable options such as gas and crude oil exist, for the production of liquid fuels. Coal will continue to provide baseload power in the foreseeable future, but will be displaced substantially over time by a diverse mix of energy carriers including solar, wind, nuclear and gas. These alternatives reduce GHG emissions and other pollutants, help to improve security of supply and in most cases, lower the cost of providing energy when externality costs are accounted for. In the modeled scenarios, coal and gas feature as primary energy feedstocks in all sectors. For electricity generation, coal constitutes close to 90% of the primary energy mix in 2015 in all scenarios. The use of coal declines to below 35% of the primary energy mix by 2050 in the Green Shoots and Resource Constrained scenarios, and to below 20% of the primary energy mix in the Base Case and Environmental Awareness scenarios. Nuclear fuel constitutes over 20% of the primary energy mix from 2030 onwards in all scenarios. In terms of liquid fuels, the primary energy mix is dominated by coal and gas, with gas becoming the more prominent energy carrier in the future.

1.6 CLIMATE

A comprehensive overview of South Africa's prevailing climatic conditions was presented in BUR-1, while BUR-2 reports on the adverse climate change impacts and natural disasters experienced since 2014. Natural disasters South Africa is generally exposed to include drought, flooding, extreme storms and fires. Economic losses from weather-related and climate-related disasters have increased, with the greatest impact felt strongly in developed countries (IPCC, 2012). Furthermore, more than 95% of deaths from natural disasters take place in developing countries (COGTA, 2015). The National Disaster Management Centre (NMDC) Annual Report for 2014/15 (NDMC, 2015) reported the following declared disasters:

- Floods: During March 2014, severe flooding occurring in the Mpumalanga province caused significant damages to municipal infrastructure, provincial roads and bridges as well as houses, requiring R61,025,000 to repair. A provincial state of disaster was declared in Mpumalanga as the municipalities in the province were unable to cope with the effects of the floods;

- Floods: During March 2014, Limpopo Province experienced heavy rain which resulted in significant floods throughout the Lephalale, Bela-Bela, Thabazimbi, Modimolle, Mogalakwena and Mokgopong Local Municipalities within Waterberg District Municipality, causing widespread damage to private and public infrastructure, the environment, as well as roads infrastructure. A local state of disaster was declared by the Waterberg District Municipality on 24 March 2014 and an amount of R9,802,410 was made available to repair the flood damaged infrastructure;

- Drought: During 2014 and 2015 the KwaZulu-Natal Province received below normal rainfall and as a result the water level in various catchment areas were affected. Severe drought conditions were experienced across nine district municipalities and it was estimated that more than 80% of boreholes in the communities had dried up. A provincial state of disaster was declared by KwaZulu-Natal, and the costs of providing emergency disaster relief, in the form of boreholes, amounted to R24, 664,860. Detailed information on the drought phenomena in South Africa is available in South Africa's 2nd Annual Climate Change Report. (DEA, 2017a);

- Intense wild fires: significant damages caused to agricultural infrastructure (grazing land, water infrastructure, homesteads, sheds and livestock) amounting to R10,200,000 in Harry Gwala District Municipality, KwaZulu-Natal. A local state of disaster was declared by Harry Gwala District Municipality on 29 October 2014; and

- Intense wild fires: significant damages caused to 93,531 ha of natural grazing land, homesteads, sheds and livestock, farming infrastructure and water infrastructure, in Mohokare (Xhariep District Municipality), Dihlabeng and Maluti a Phofung municipalities (Thabo Mofutsanyane District Municipality) in the Free State Province during August and September 2014. A provincial state of disaster was declared by the Free State Province and emergency disaster relief amounted to R15,790,824 to provide animal feed in the form of fodder.

To address the adverse effects of natural disasters, recent changes have been made through the Disaster Management Amendment Act 2015 (Act no 16 of 2015) to cement the concept of climate change impacts and risks in legislation. The contents of disaster management plans have been expanded to include conducting disaster risk assessments for functional areas, mapping risk areas and communities vulnerable to disasters and providing for measures to reduce the risk of disaster through adaptation to climate change and developing of early warning mechanisms. The Act further requires that the respective organs of state must indicate how they will invest in disaster risk reduction and climate change adaptation, including ecosystem and community based approaches (COGTA, 2015).

1.7. NATIONAL AND REGIONAL PRIORITIES AND CIRCUMSTANCE RELATED TO CLIMATE CHANGE

South Africa indicated in the Intended Nationally Determined Contribution (INDC) (DEA, 2015c) that our national response considers both development needs and climate change imperatives. South Africa faces the challenge of climate change as a developing country, with overriding priorities to eliminate poverty and eradicate inequality. Sustainable economic development, improving basic education, health and social welfare and many other basic needs such as access to food, shelter and modern energy services all contribute to eliminating poverty and eradicating inequality. In addition, the acute energy challenges South Africa faces further hampers economic development. Therefore, in the short-term (up to 2025), South Africa faces significant rigidity in its economy and any policy-driven transition to a low-carbon and climate-resilient society must take into account and emphasise its overriding priority to address poverty and inequality.

South Africa's climate change response actions are, inter alia, guided by the environmental right set out in section 24 of the Constitution of the Republic of South Africa and the National Development Plan (NDP) (NPC, 2011), which provides a '2030 vision' to guide the country's sustainable development trajectory, where poverty is eliminated and inequalities are reduced by 2030. The implementation of the 2030 NDP vision is also included in the National Climate Change Response Policy (NCCRP, 2011), climate-compatible sectoral plans and the National Sustainable Development Strategy. Climate-compatible sectoral plans include the Integrated Energy Plan (IEP) (DME, 2003a) (DoE, 2013); (DoE, 2016a), the Integrated Resource Plan (IRP) (DoE, 2011); (DoE, 2016b), industrial policy action plans (IPAP) and the new growth path (NGP), as well as the National Climate Change Adaptation Strategy and Action Plan, which is under development and which will be integrated into sector plans.

South Africa's INDC (DEA, 2015c) elaborates on six goals to achieve the adaptation component of our nationally determined contributions; underpinned by key elements of adaptation planning, costing of adaptation investment requirements, equity, and means of implementation. While the mitigation component commits to contributing to the global effort to mitigate climate change, in line with the principle of common but differentiated responsibilities and respective capabilities, by moving from a "deviation from business-as-usual" form of commitment and adopting a peak, plateau and decline in GHG emissions trajectory range of between 398 Mt CO2e and 614 Mt CO2e, by 2025 and 2030, to enable South Africa's greenhouse gas emissions to peak between 2020 and 2025, plateau for approximately a decade and decline in absolute terms thereafter.

A summary of South Africa's financial investment for addressing climate change response actions is provided in the INDC (DEA, 2015c), along with indicative scales of finance and investment required for both adaptation and mitigation, based on analyses of specific sectors and initiatives. The finance and investments are required to enable and support the deployment of low-carbon and adaptation technologies as well as building the capacity to govern, regulate, install and operate these technologies.

2. NATIONAL GREENHOUSE GAS INVENTORY

This chapter presents an update of South Africa's National Greenhouse Gas (GHG) Inventory, covering the period 2000 – 2012. This inventory was compiled in accordance with the IPCC 2006 Guidelines for National GHG Inventories and covers four sectors, namely:

- Energy;
- Industrial Process and Product Use (IPPU);
- Agriculture, Forestry and Other Land Use (AFOLU); and
- Waste.

A summary of South Africa's 2000 – 2012 GHG emission trends by gas and by sector is presented below. The full GHG Inventory for 2000 – 2012 is available in South Africa's 5th National GHG Inventory and comprehensive information is provided in the GHG National Inventory Report for 2012 (DEA, 2017b).

The greenhouse gases reported on include Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs). A number of new developments and improvements have been incorporated into this inventory and the 5th National GHG Inventory has started to apply an uncertainty assessment by sector. This chapter discusses the uncertainties identified in the Energy and IPPU sectors. A summary of each sector is provided, with details of trends, methodologies, data and recalculations performed within each sector.

2.1. EVOLUTION OF SOUTH AFRICA'S GHG INVENTORY

As part of our reporting obligations under the UNFCCC, South Africa prepared its first National GHG Inventory for 1990 in 1998. **Figure 12** below shows the evolution of South Africa's National GHG Inventory over the years.

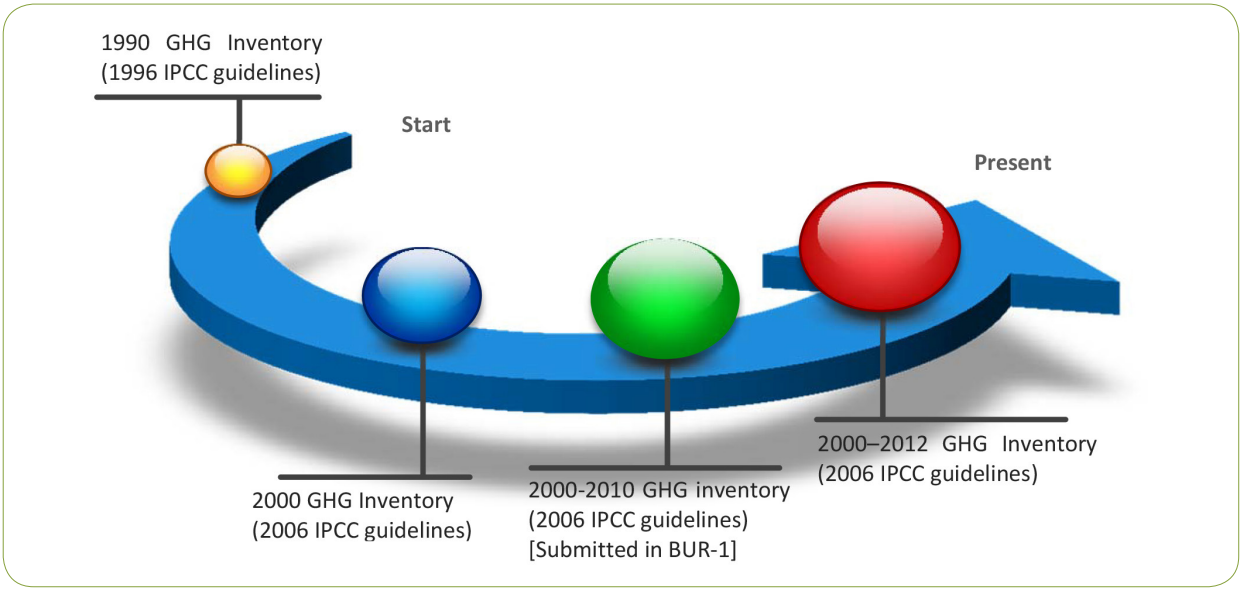


Figure 12: The evolution of submitted GHG inventories over the years

The GHG inventories since 2000 have been compiled and updated to provide a more consistent time series, applying the 2006 IPCC guidelines. This allows for a better analysis of the emission trends and recalculations of the time-series whenever improved activity data or emission factors become available. The data from the 1990 and the 1994 GHG Inventories are not included in the trend analysis, as the previous version of the 1996 IPCC guidelines were applied and this hampers data comparability and consistency in reporting over time.

2.2. INSTITUTIONAL ARRANGEMENTS

The institutional arrangements for compiling the National GHG Inventory, were presented in BUR-1 (DEA, 2014) and **Figure 13** (below) presents an update of the institutions which contribute to the preparation of the National GHG Inventory. In addition to the roles and responsibilities of the institutions described in BUR-1, **Table 5**(below) records the roles and responsibilities of those institutions not mentioned previously.

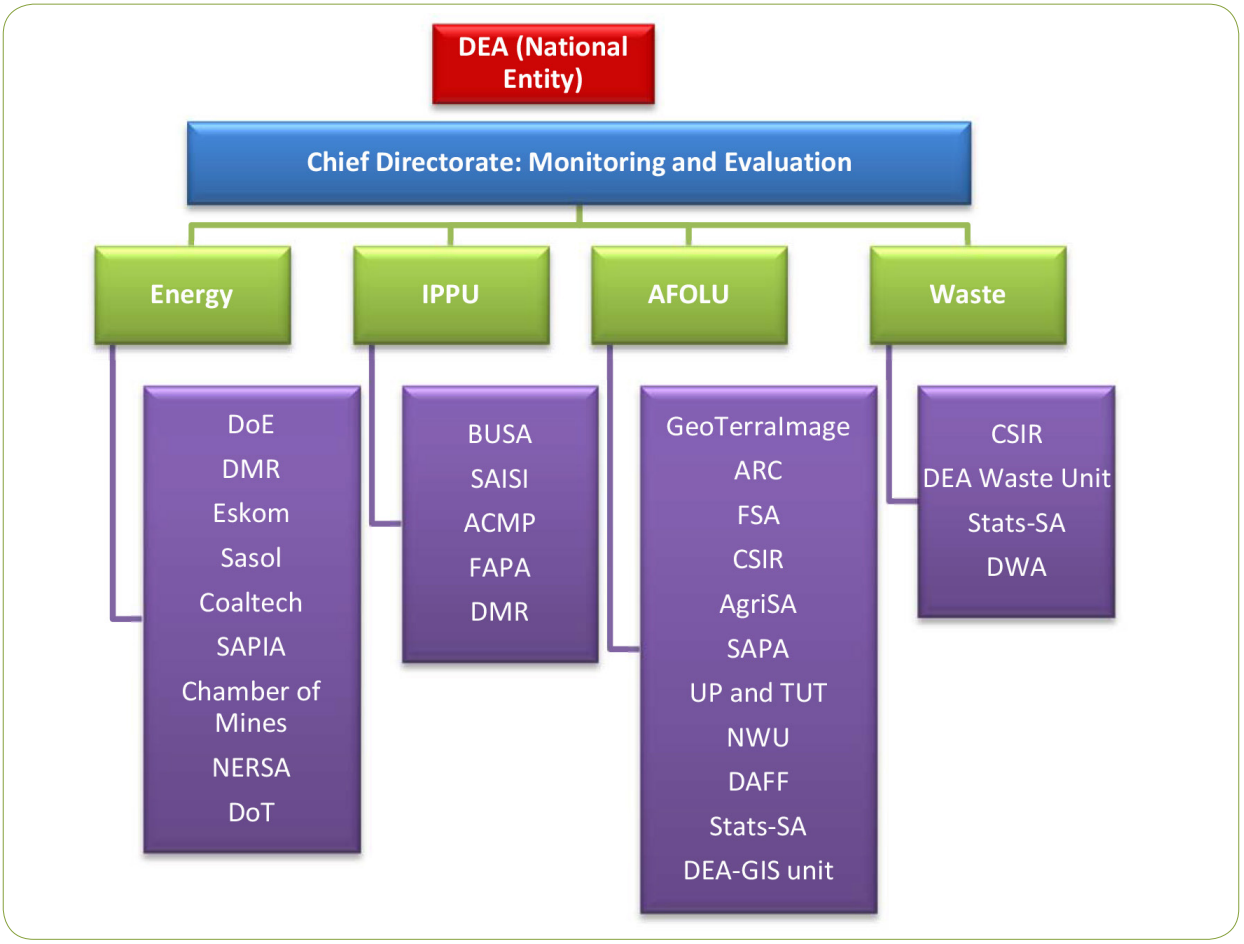


Figure 13: Institutional arrangements for national GHG inventory preparation

There is currently no legal mechanism to formalize information flows through this institutional arrangement to ensure consistent and sustainable data input for the GHG inventory. This is currently being addressed though the development of GHG reporting guidelines under the existing National Environmental Management Act: Air Quality (Act No. 39 of 2004, as amended) and the National GHG System described in more detail in section 6.1.1 (below). The National Greenhouse Gas Emissions Reporting Regulations were published in April 2017, thereby officially launching the company level GHG reporting program in South Africa.

Table 5: Roles and Responsibilities for institutions not previously included in BUR-1

Ministry / Agency	Role
South African Poultry Association (SAPA)	Provides poultry population data
Council for Scientific and Industrial Research (CSIR)	Provides carbon data and technical support when compiling GHG emissions for land
North-West University (NWU)	Provides burnt area data and support for the compilation of the AFOLU sector inventory
Statistics South Africa (Stats-SA)	Provides statistical data
Department of Science and Technology (DST)	Develops various energy programmes and initiatives (renewable energy, energy efficiency, solar and transportation). The HySA Systems is one of three national Competence Centres initiated by the Department of Science and Technology's National Hydrogen and Fuel Cells Technology Flagship Project – also known as Hydrogen South Africa (HySA).
Chamber of Mines	Coordinating the collation and analysis of greenhouse gas emission data for its members (1)
ESKOM	Primary Electricity producer in South Africa; Eskom generates approximately 95% of the electricity used in South Africa and approximately 45% of the electricity used in Africa.(2)
SASOL	Primary liquid and gas fuel producer in South Africa. Sasol develops and commercialise technologies, builds and operates world-scale facilities to produce a range of high-value product stream, including liquid fuels, chemicals and low-carbon electricity (3)
Provincial Environmental Departments	Provinces: provides GHG information on Section 21 Listed Activities regulated in terms of the Air Quality Act; and on point, non-point and area sources of pollution.
Municipalities	Municipalities: provides GHG information on Section 21 Listed Activities regulated in terms of the Air Quality Act; and Metropolitan Municipalities also provides GHG information on point, non-point and area sources of pollution.

(1) http://www.chamberofmines.org.za/work/environment

(2) http://www.eskom.co.za/OurCompany/CompanyInformation/Pages/Company_Information.aspx

(3). http://www.sasol.com/about-sasol/company-profile/overview

2.3. OVERVIEW OF THE 2000 – 2012 NATIONAL GHG INVENTORY

Since the submission of BUR-1, South Africa's National GHG Inventory has been updated as follows:

1. GHG inventories for the years 2011 and 2012 have been calculated and added to the time-series; and
2. Recalculations for GHG inventories of 2000 – 2010 undertaken due to availability of improved activity data and emission factors. Section 2.3.4 below gives full details of the recalculations. Due to these recalculations, the GHG inventory values for the period 2000 – 2010 differ from the values submitted in BUR-1 for the same period.

This section presents a summary of the latest GHG inventory and the full details are reported in South Africa's 2012 GHG National Inventory Report (DEA, 2017b) which accompanies the 5th National GHG Inventory.

South Africa's nett GHG emissions for 2012 amounted to 518,297 GgCO2e, which includes the contribution from forestry and other land-use (FOLU), as this sector acts as a carbon sink by absorbing and holding carbon. The gross annual GHG emissions (excluding FOLU emissions) for 2012 totalled 539,112 GgCO2e. **Table 6** presents South Africa's nett National GHG Inventory disaggregated by sector, for a selected number of years. With the inclusion of FOLU, the energy sector accounted for 78.9% of the nett emissions in 2000 and this increased to 82.6% in 2012, amounting to 428,112 GgCO2e of the 2012 nett GHG inventory. This showed a 25% increase in emissions from the energy sector from 2000 to 2012. The GHG emissions from the IPPU, AFOLU and Waste sectors increased collectively by 20.9% from 2000 to 2012; with emissions from the IPPU and Waste sectors showing an increase of 10.6% and 78.5% respectively, while emissions from the AFOLU sector decreased by 32.1% between 2000 and 2012.

Table 6: Trends and levels in nett GHG emissions (Including FOLU) per sector for 2000, 2010, 2011 & 2012 (DEA, 2017b)

Sector	2000	2010 GgCO2e	2011	2012	Percentage change between 2000 and 2012
Energy	342,592	435,117	415,843	428,112	25.0%
IPPU	33,563	35,463	38,888	37,129	10.6%
AFOLU	45,860	38,456	38,376	31,128	-32.1%
Waste	12,288	20,354	21,151	21,928	78.5%
TOTAL	434,304	529,391	514,257	518,297	19.3%

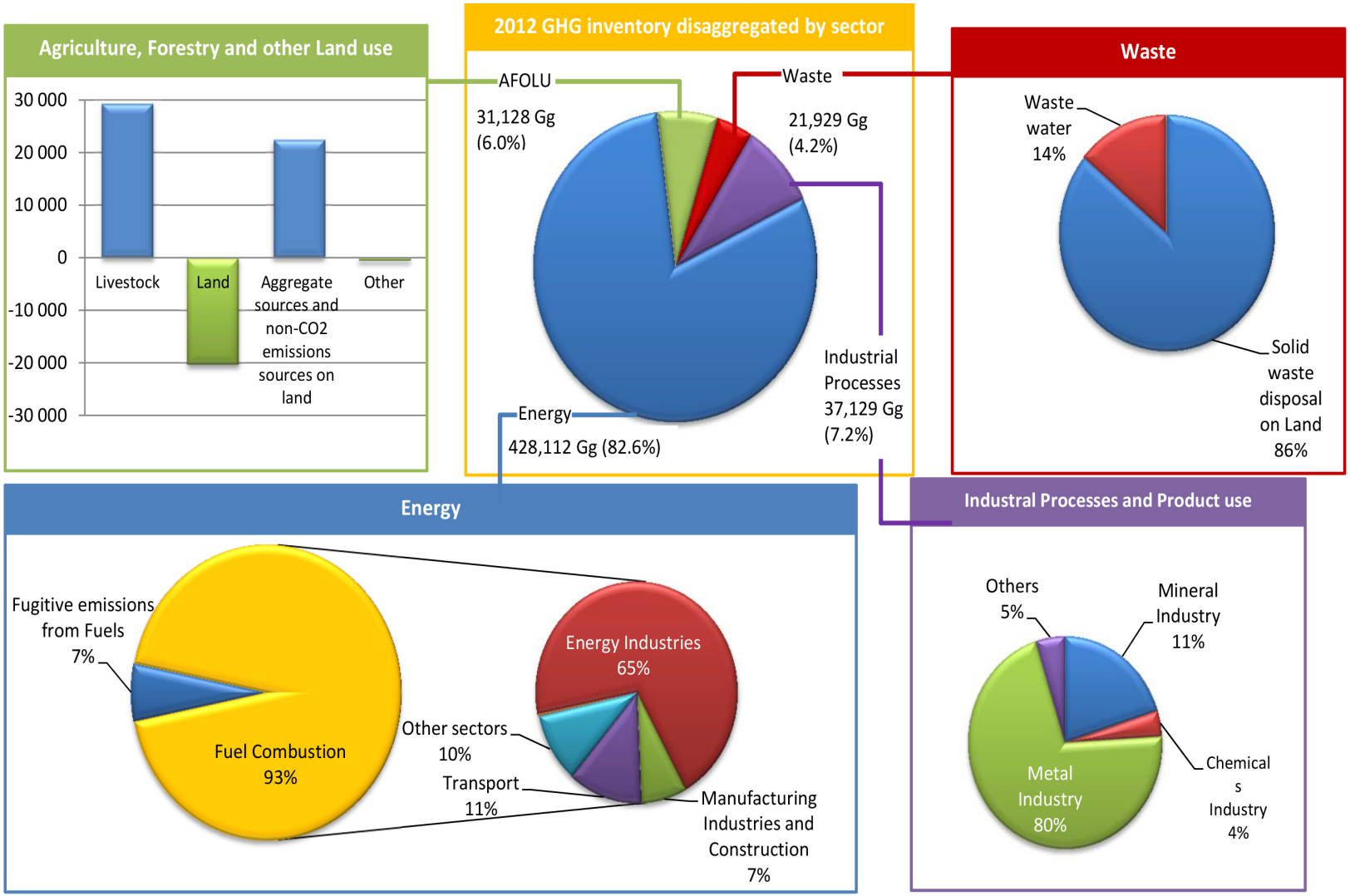


Figure 14: South Africa's 2012 National GHG Inventory (nett emissions) disaggregated by sector (DEA, 2017b)

2.3.1 GHG emission trends and time-series

South Africa's National GHG Inventory time series from 2000 to 2012 is presented graphically in **Figure 15** (below) and shows a steady increase in trend, with annual declines in absolute emissions of 0.7% between 2004 and 2005 and 1.6% between 2007 and 2008, as well as the highest decrease of 2.7% recorded between 2010 and 2011. These declines are largely attributed to a reduction in fuel combustion activities and fugitive emissions; showing a direct correlation with the decrease in GDP reported for the Mining and Manufacturing sectors over these periods, as shown in **Figure 14** (above) which depicted South Africa's GDP per sector. Total nett GHG emissions trends showed an increase of 16.21% over this period, rising from 434,304 GgCO2e in 2000 to 518,297 GgCO2e in 2012 (DEA, 2017b).

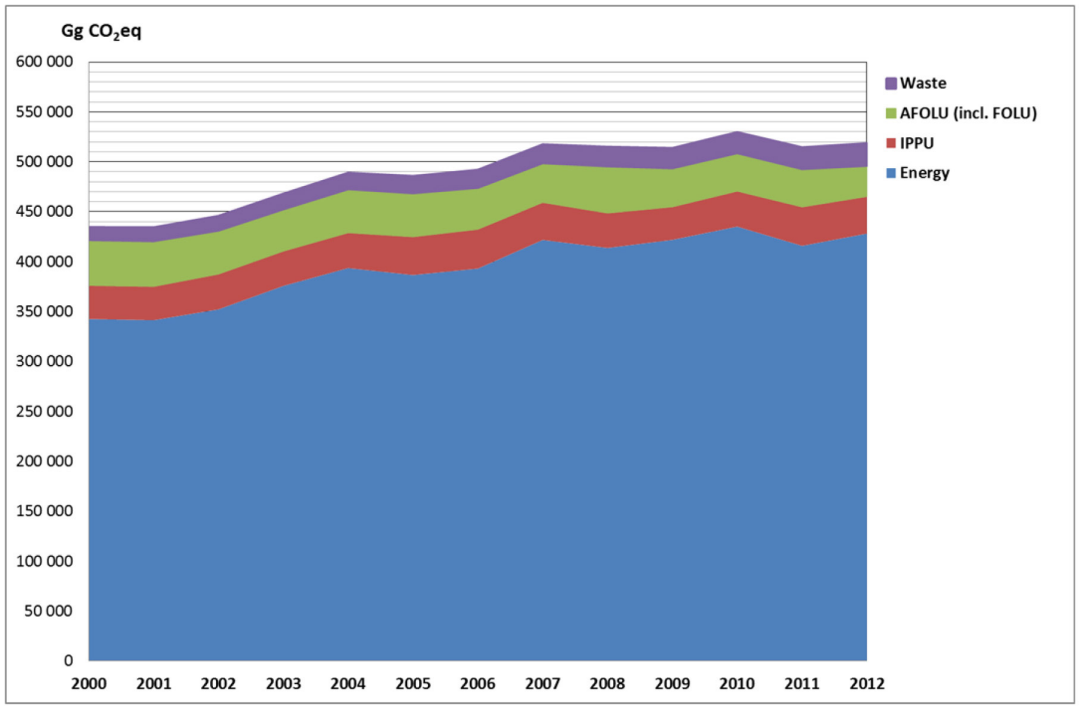


Figure 15: South Africa's nett GHG inventory time-series 2000-2012, disaggregated by sector (DEA, 2017b)

The energy sector contributed 77.3% of the total gross GHG inventory (excluding FOLU emissions) in 2000 and this increased to 79.4% in 2012 (see **Figure 16** below). There was a general increase in the energy sector contribution; however slight declines were evident in 2001, 2005 and 2006. The AFOLU sector (excluding FOLU emissions) is the second-largest contributor, followed closely by the IPPU sector. The AFOLU sector made up 12.3% of the gross GHG emissions in 2000, which declined to 9.6% in 2012, while in 2000 the IPPU sector contributed 7.6% to the gross GHG emissions, which subsequently declined to 6.9% in 2012. The IPPU sector showed an increase in emissions between 2000 and 2006, followed by a decline between 2007 to 2009 as well as in 2012. The AFOLU sector showed a general decline in GHG emissions, with small annual increases (of less than 5%) in 2002, 2006, 2008, 2010 and 2011.The Waste sector showed a steady increase in its contribution from 2.8% in 2000 to 4.1% in 2012. The inclusion of the FOLU component results in the total nett GHG emissions decreasing to 518,297 GgCO2e in 2012. This also changed the contribution from the Energy, IPPU, AFOLU and Waste sectors to 82.6%, 7.2%, 6.0% and 4.2%, respectively, in 2012 (see **Figure 17** below).

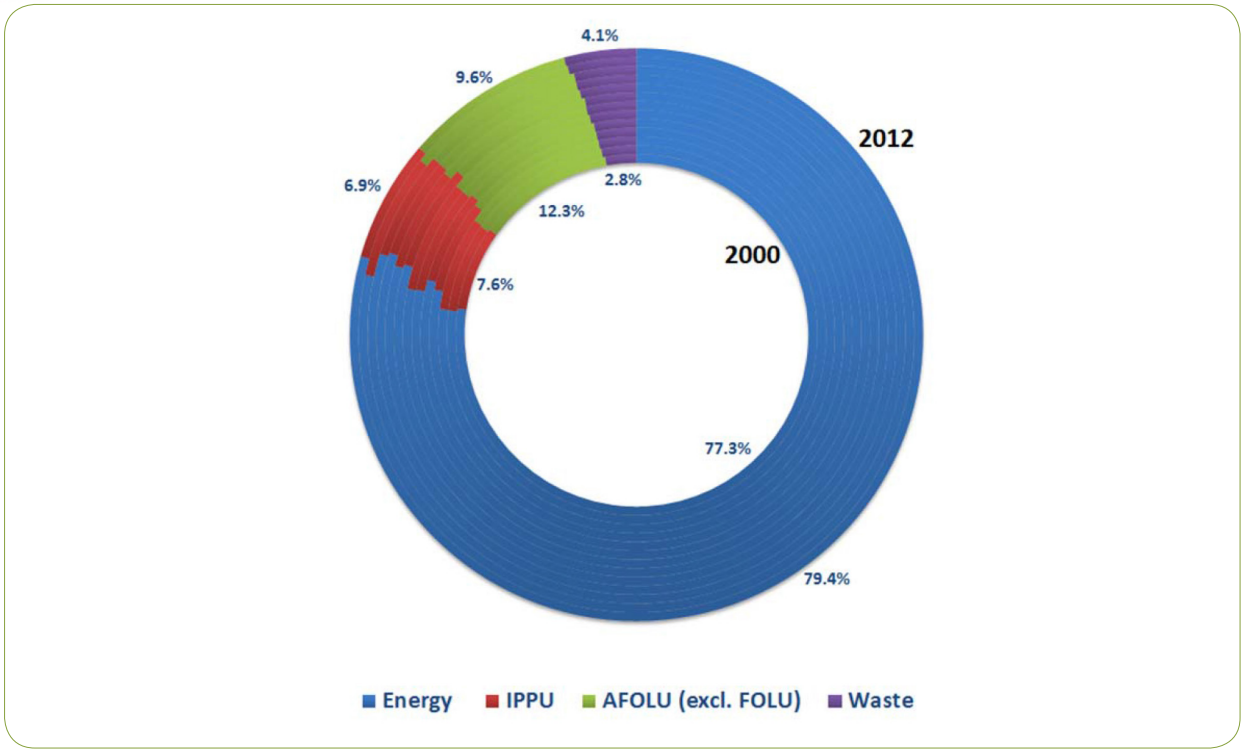


Figure 16: Distribution of gross GHG emissions for South Africa (2000 – 2012), disaggregated by sector (DEA, 2017b)

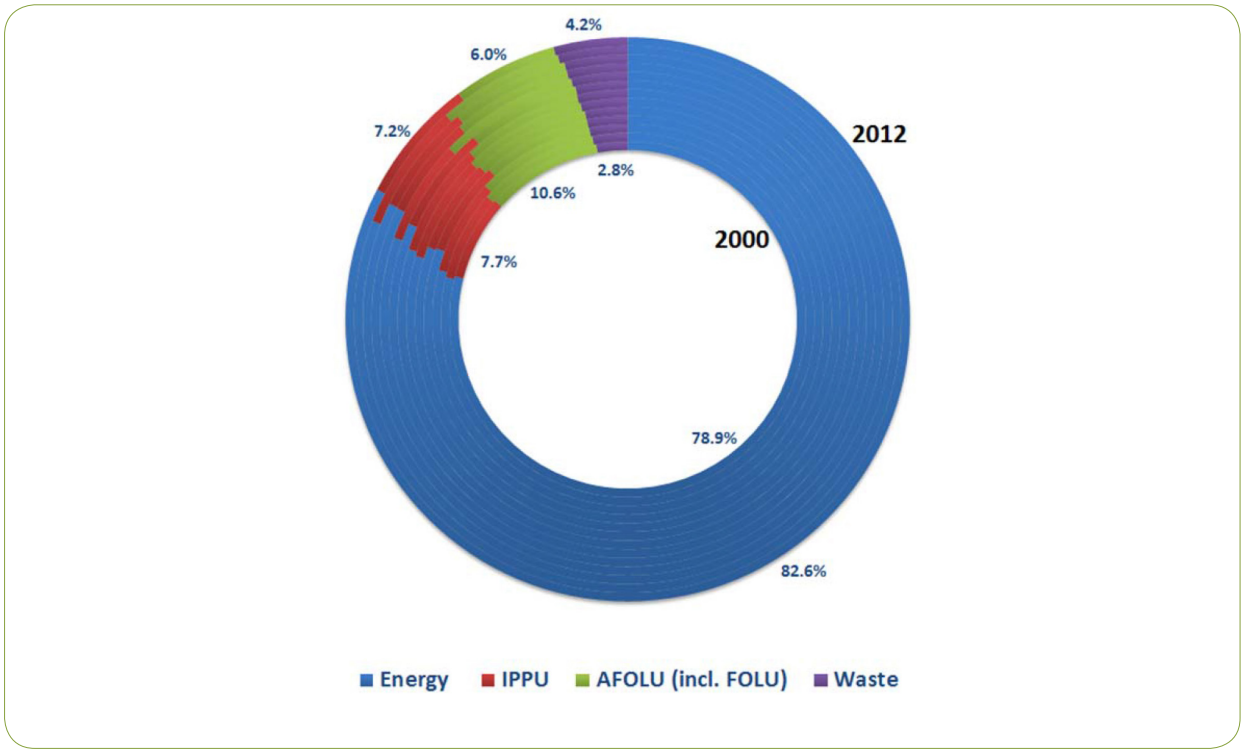


Figure 17: Distribution of nett GHG emissions for South Africa (2000 – 2012), disaggregated by sector (DEA, 2017b)

2.3.2 Overview of greenhouse gas emission estimates and trends

According to the 2012 GHG National Inventory Report (DEA, 2017b), South Africa's nett GHG emissions in 2012 were predominantly CO2 (83.7%), followed by CH4 (10.7%) and N2O (4.9%), with F-gases contributing less than 1% to the National GHG Inventory. The CO2 and CH4 emissions contributing to the nett National GHG Inventories (i.e. the inventories which include FOLU contributions) increased by 21.2% and 14.6% respectively for 2000 and 2012, and showed a 23.9% and 15.1% increase respectively in the 2000 and 2012 gross National GHG Inventories (i.e. the inventories excluding the FOLU contribution). N2O emissions showed a decline of 5.6%, while PFC emissions doubled between 2000 and 2010. HFC emissions (only included from 2005) increased by 65.8% between 2005 and 2012.

2.3.3 Other indicators of South Africa's transition to a lower-carbon economy

South Africa's carbon intensity of the economy has dropped steadily over the past decade and this is largely due to growth in the services and financial sectors, a decline in the manufacturing sector and stagnation in the mining sector (DEA, 2017b).

The 2008 global economic crisis has had an impact on the carbon-intensity of the national energy supply even though there is generally stagnation elsewhere in the time series due to an unchanged energy supply mix (DEA, 2017b). The emissions intensity trend between 2000 and 2012 is shown in **Figure 18** below.

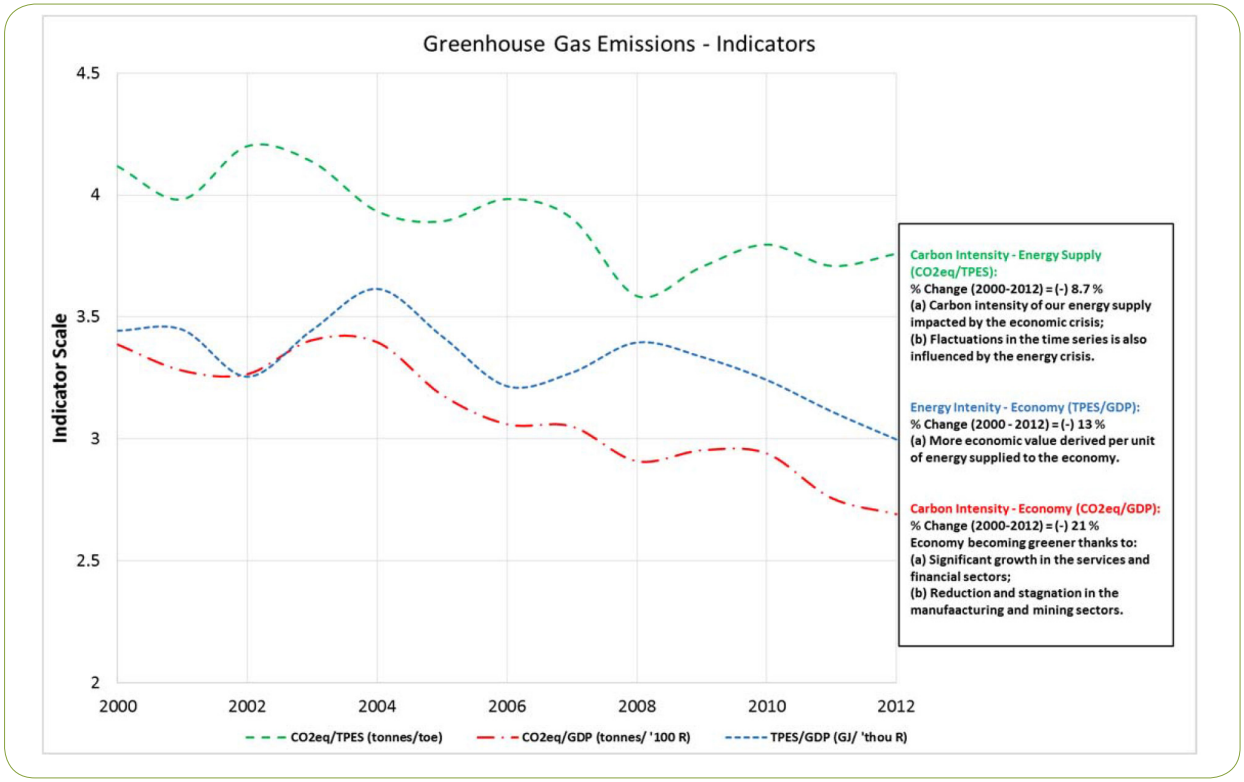


Figure 18: South Africa's emissions intensity between 2000 and 2012 (DEA, 2017b)

2.3.4 Recalculations

In the past year, various improvements have been made to the National GHG Inventory due to the incorporation of more detailed activity data and updated emission factors. For the Energy sector, country-specific CO2 emission factors were incorporated, and these changes led to a 1.5% and 1.6% change to the 2000 and 2010 estimates, as shown in **Table 7** below (DEA, 2017b). This translated to a 1.3% increase in the nett national nett total for 2010.

Table 7: Energy sector GHG emission recalculations for 2000 and 2010.

		Initial	Recalculated	% change	% impact on national total (incl. FOLU)
		emissions (Gg O2e)			
Energy	**2000**	337 381	342 592	1.5%	1.2%
	2010	428 368	435 117	1.6%	1.3%

The IPPU emissions were recalculated due to updates in the iron and steel production emission factors, updated ferromanganese activity data and updated Ozone Depleting Substances (ODS) and zinc production data (DEA, 2017b).

The recalculation resulted in a 20% reduction in the GHG emissions from the IPPU sector in 2010 (see **Table 8** below); mostly because of the adjusted emission factor for the iron and steel production calculations.

Table 8: IPPU sector GHG emission recalculations for 2000 and 2010.

		Initial	Recalculated	% change	% impact on national total (incl. FOLU)
		emissions (Gg O2e)			
IPPU	**2000**	44 907	33 563	-25.3%	-2.6%
	2010	44 350	35 463	-20.0%	-1.7%

The 2012 NIR reports significant updates made in the AFOLU sector calculations (DEA, 2017b). In the Agriculture sector, small corrections were made to beef cattle and poultry population and data and emissions from game on privately owned land was included. In the section on Land Use, new land cover maps with higher resolution were introduced, and emissions from 'Dead Organic Matter (DOM) and other lands' were included. The methodology to determine soil carbon was corrected to incorporate soil types and land change over the full 20 years, while data for 'Harvested Wood Products' (HWP) was updated based on the IPCC's revised Supplementary Methods and Good Practice Guidelines (IPCC, 2014). For 'Biomass burning' the burnt area data was intersected with the new landcover map which led to small changes in emissions from burning biomass. The GHG emissions for the period 2000 to 2012 were recalculated using the updated activity data and emission factors so as to present a more consistent time series.

The recalculations performed for the AFOLU sector had the largest impact on the total emissions (see **Table 9** below) with a 50.4% and 49.6% increase for 2000 and 2010, respectively. The majority of these changes were due to the availability of updated land change maps and corrected HWP estimates. These increases impacted the national nett total by a 3.5% and 2.4% increase in 2000 and 2010, respectively.

Table 9: AFOLU sector GHG emissions recalculations for 2000 and 2010.

		Initial	Recalculated	% change	%impact on national total (incl. (incl. FOLU)
		emissions (GgCO2e)			
Total AFOLU	**2000**	30 496	45 860	50.4%	3.5%
	2010	25 713	38 456	49.6%	2.4%
3A Livestock	**2000**	31 118	31 162	0.1%	0.0%
	2010	28 986	30 245	4.3%	0.2%
3B Land	**2000**	-18 492	-8 517	53.9%	2.3%
	2010	-33 224	-14 876	55.2%	3.5%
3C Aggregated sources and non-CO2 emissions on land	**2000**	23 656	23 526	-0.5%	-0.0%
	2010	22 802	23 577	-3.4%	-0.1%

The 2012 NIR reports that recalculations of the 2000 GHG emission for the Waste sector led to a reduction of 1.2% of the annual estimates for 2000, but the estimates for 2010 increased by 2.8%, as shown in **Table 10** below (DEA, 2017b).

These changes were as a result of the availability of updated information and statistics of waste generated and waste disposal.

Table 10: Waste sector GHG emissions recalculations for 2000 and 2010.

		Initial	Recalculated	% change	% impact on national total (incl. FOLU)
		emissions (Gg O2e)			
Waste	**2000**	12 433	12 288	-1.2%	-0.03%
	2010	19 806	20 354	2.8%	0.11%

Source specific recalculations were performed for the Waste sector for the period 2000 to 2012 due to the following changes:

- Population statistics for the period 2002-2012 were based on new information available from the 2011 National Census conducted by Stats-SA;
- Percentage of waste generated that is disposed to solid waste disposal sites was reviewed and updated based on the 2012 National Waste Information Baseline Report (NWIBR) (DEA, 2012a);
- The waste generation rate for municipal solid waste was reviewed based on new information sourced from the NWIBR. The new waste generation rate is based on provincial weighted average for waste generation rate. This rate was assumed constant for the entire time period; and
- The generation rate for industrial waste was reviewed based on GDP data reported by Stats-SA, as well as industrial waste tonnage rates available from the NWIBR for the year 2011. This rate was assumed constant for the entire time period.

2.3.5 Quality control and Quality Assurance (QA/QC)

Quality controls applied for determining the National GHG Inventory include generic quality checks of the calculations, data processing, completeness and applicable documents. The Quality Assurance was conducted by independent external reviewers, not involved in the compilation of the inventory, to ensure an unbiased review. The external reviewers determined that the results of the annual inventories, emission factors and assumptions applied as well as the methodologies used were reasonable. The independent review process followed is depicted in **Figure 19** below (DEA, 2017b).

Furthermore, a public review process was undertaken to supplement the external review, by publishing the draft GHG National Inventory Report in a Government Gazette for stakeholder engagement. Comments received from the public were considered during the independent review process. Findings and recommendations from the independent reviewer were used to refine the 2012 GHG National Inventory Report.

Currently, DEA is preparing a revised 3-year supplementary improvement plan to address recommendations from the independent review process. Some of the current projects listed in the Greenhouse Gas Improvement Programme (GHGIP) are due to findings from a previous review undertaken for the 2000-2010 National GHG Inventory.

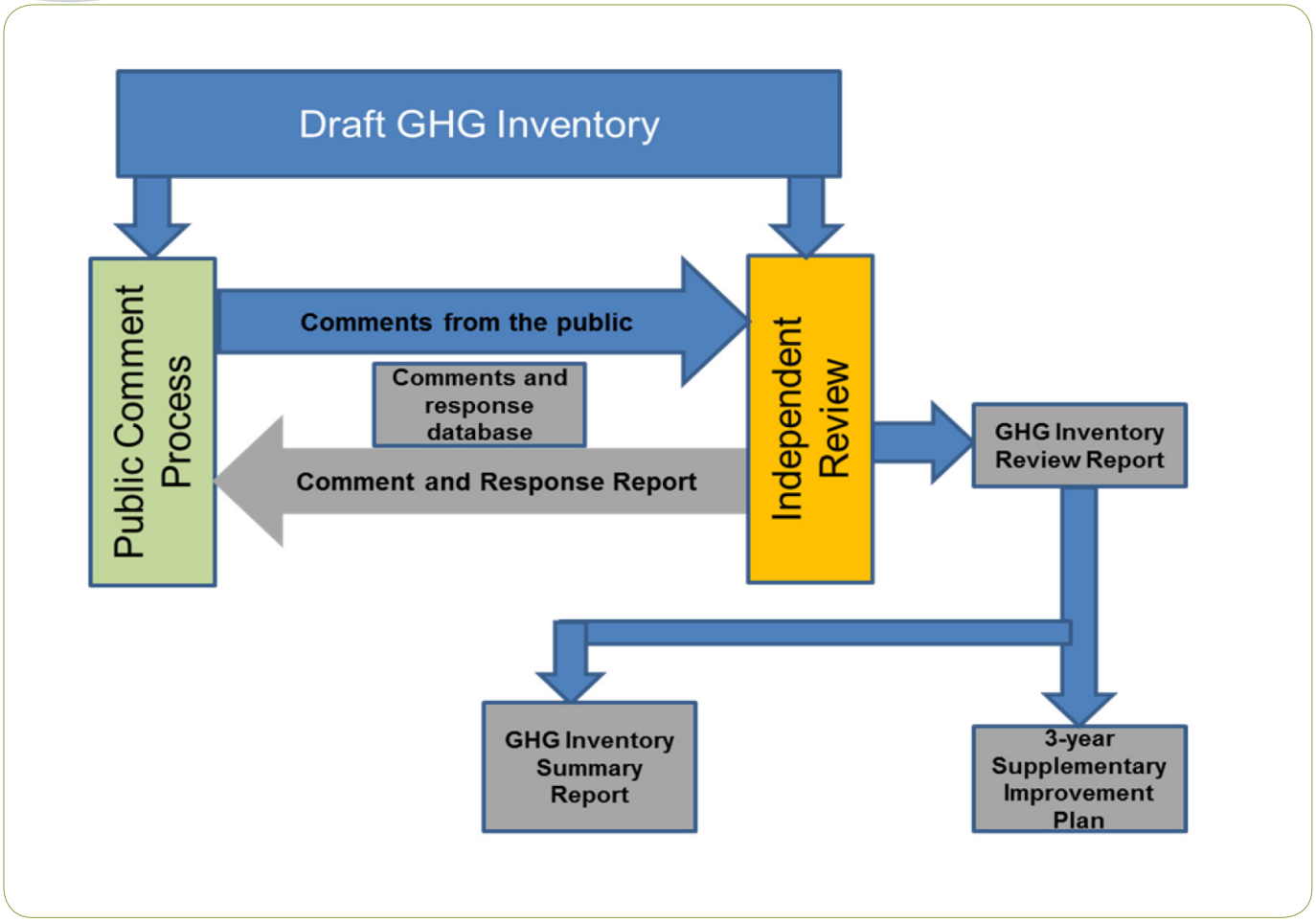


Figure 19: The independent review process for the 2000 – 2012 National GHG Inventory (DEA, 2017b)

In addition to the IPCC 2006 Guidelines for National GHG Inventories (IPCC, 2006), South Africa has adopted the internationally accepted validation and verification procedure for GHG assertions for corporate reporting of emissions, which have been adopted locally (SANS:ISO 14064-1), and for emission estimation linked to voluntary market schemes (SANS:ISO 14064-2). A GHG assertion is defined as a declaration or factual and objective statement made by a person or persons responsible for the greenhouse gas inventory and the supporting GHG information. These standards[1] provide for data documentation and audits as part of a quality management system.

In the South African context, QA/QC measures are defined by Part 3 of the South African National Standard for Greenhouse Gases: Specification with guidance for the validation and verification of greenhouse gas assertions (SANS:ISO 14064-3:2006). This standard specifies the requirements for selecting GHG validators/verifiers, establishing the level of assurance, objectives, criteria and scope, determining the validation/verification approach, assessing GHG data, information, information systems and controls, evaluating assertions, and preparing validation/verification statements.

1 All SANS:ISO standards are available on https://store.sabs.co.za/catalogsearch/result/?q=14064

2.4. THE GHG IMPROVEMENT PROGRAMME (GHGIP)

South Africa strives to continuously improve its National GHG Inventory. The National Greenhouse Gas Improvement Programme (GHGIP) comprises a series of sector-specific projects that target improvements in activity data collection, country-specific methodologies and emission factors used.

2.4.1 Energy Sector

In accordance with the 2006 IPCC Guidelines the energy sector covers two categories, fuel combustion activities and fugitive emissions from fuels. The projects under the energy sector focus on moving to higher tier methodologies which include development of country-specific emission factors and enhancements on bottom-up collection of activity data. Research in the energy sector has focussed on developing country specific emission factors (EFs). GHG emission calculations from the electricity sector improved through the development of country specific EFs for stationary combustion of fuels in the electricity generation sector (DEA, 2016a). This study conducted direct measurements on some boilers at Sasolburg and Secunda coal and gas power plants and applied the Tier 2 and 3 IPCC methodologies to determine EF for these power plants. The outputs of the two methods were compared to provide cross-checks of the calculated EFs. The study also applied Tier 2 IPCC methodology to estimate the country specific EF for electricity produced by ESKOM. It recommended that further measurements and calculations be carried out at other plants and that more professionals should be trained in EF determination to maintain continuity.

Other projects that have been completed include the development of country specific EF for coal mining, including emissions from abandoned mines and spontaneous combustion; development of higher tier methodologies to estimate fugitive emissions from processing of fuels through a detailed life-cycle emissions analysis coupled with a material balance approach; and an economy wide fuel consumption survey to determine the split in consumption between the energy carrier and the sectors' demand. **Table 11** presents some of the projects under implementation as part of the GHGIP.

Table 11: GHGIP projects completed for the Energy sector.

Project	Objective	Partner	Donor	Outcome	Status	Time-lines
Country-specific CO2, CH4 and N2O emission factors from power generation and stationary combustion	To develop emission factors for stationary combustion using the main electricity producer and other independent power producers as a pilot	ESKOM, SASOL	BMUB-GIZ	Emissions from key sectors based on country-specific information (DEA, 2016a)	Completed	2014-2015
Country-specific CH4 and CO2 emission factors for coal mining;						
Emissions from abandoned mines and spontaneous combustion	To develop country-specific emission factors for domestic coal mining	Coaltech		Emissions from coal mining are based on domestically developed methodologies and emission factors	Completed	2011-2014
Bottom-up Gas-to-liquids (GTL)						
Coal-to-liquids (CTL)	Use of higher-tier methodologies for the estimation of fugitive emissions from processing of fuels	PetroSA, SASOL		Detailed life-cycle emissions analysis coupled with material balance approach	Completed	2013-2015
Economy-wide fuel consumption survey	Analysis of fuel consumption by energy carrier and demand-side sector	GIZ				

GHGIP projects currently underway, through support from donor funding are presented in **Table 14** below.

2.4.2 Industrial Processes and Product Use (IPPU) Sector

The GHGIP projects for the IPPU sector focussed on moving to higher Tier methodologies which includes the development of country-specific emission factors and enhancements on bottom-up collection of activity data. A study is being completed on the implementation of a Tier 3 IPPC method for estimating process emissions from aluminium production. A sector-specific CO2 EF for ferroalloy production is also being determined currently. A survey on HFC consumption has been commissioned and this aims to assess baseline data on the current use of HFC's in South Africa. Completed GHGIP projects for the IPPU sector, are reflected in **Table 12.**

Table 12: GHGIP projects completed for the IPPU sector

Project	Objective	Partner	Outcome	Status	Timelines
Bottom-up methodologies for Aluminium production	Implementation of a tier-3 IPCC methodology for estimation of process emission from aluminium production	BHP Billiton	GHG emission from aluminium production based on plant-specific data	Completed	2011-2014

GHGIP projects currently underway, through support from donor funding are presented in Table 14 below.

2.4.3 Agriculture, Forestry and Other Land Use (AFOLU) Sector

The improvements to GHG inventory data and information for the AFOLU sector mainly involved the use of updated land cover maps to identify the emissions and sinks with consideration of South Africa's circumstances and landscapes. The GHGIP projects in the AFOLU sector focussed on improving activity data collection for the sector. In order to determine the impacts of land use change on the GHG inventory, good land-use change maps at the national level are required. Presently many maps are only available at the provincial level and these are often compiled at different scales, years and make use of different classifications, as the development of maps is often project specific and created on demand. Recently land cover maps, and subsequent land-use change maps, were developed for 2001, 2005 and 2010. These were based on lower resolution MODIS data. Improvements in this sector therefore included the development of a higher resolution national land cover change map (based on Landsat data) for the period 1990 and 2013. The other focus for the GHGIP includes the collection of more detailed data on cropland management.

In addition to the GHGIP, the Tshwane University of Technology (TUT) together with the University of Pretoria (UP) conducted research and measurements to develop country specific EFs for the livestock sub-sector. Country specific EFs for enteric fermentation and manure management for all livestock have been developed (Du Toit et al. (2013a-d); as in (DEA, 2017b)) and incorporated into the inventory. In addition, UP is currently measuring direct CH4 and N2O emissions from manure management on cattle feedlots and dairy and pig farms. There is also a collaborative project between the Paper Manufacturers Association of South Africa (PAMSA), the University of Stellenbosch and the Institute of Commercial Forestry Research (ICFR) on carbon sequestration in plantation forests. This research investigates techniques used to estimate carbon sequestration at the Tier 2 level and provides detailed activity and EF data for plantations. The University of the Witwatersrand is also involved in research determining country specific EFs for the Waste sector. Projects completed under the GHGIP programme for the AFOLU sector are presented in **Table 13** below:

Table 13: GHGIP projects completed for the AFOLU sector

Project	Objective	Donor	Outcome	Status	Timelines
Strategic Climate Policy Fund	Improvement of the Greenhouse Gas Emissions Inventory for the Agricultural Sector	DEA	Planned improvements for livestock production, agricultural soils, and biomass burning (DEA, 2016b).	Complete	2014-2015
National Land-Cover Maps	To develop national land cover maps for two-time steps (1990, 2013)	Department for International Development (DFID) –UK	Emissions and Sinks are estimated based on accurate and consistent land cover data	Completed	2014-2015
Croplands Management survey	The collection of crop management data for various agricultural crops to estimate GHG emissions and sinks at national level	United Nations Environmental Programme (UNEP)	Data available on the application of fertilizer per commodity crop; irrigation practices; application of lime; application of organic matter; management of crop residue; cropping systems; tillage practice and area under cultivation.	Completed	2014-2015
National Climate Change Monitoring and Evaluation system of the AFOLU Sector	A study to inform design, development and implementation of M&E for the AFOLU sector	DEA	AFOLU M&E System for cost effective MRV and annual reporting of AFOLU GHG inventory (DEA, 2015a)	Completed	2014-2015

2.4.4 GHGIP projects under implementation

The Department of Environmental Affairs is implementing five GHGIP projects in the Energy, IPPU and Waste sectors which are donor funded, as presented in **Table 14.**

Table 14: GHGIP Project under implementation

Project	Objective	Partner	Donor	Outcome	Status	Timelines
Development of the National GHG Inventory System	The implementation of a national system for the sustainable management of the GHG emissions inventory compilation.	Norwegian Embassy and Norwegian Environmental Agency	Norwegian Embassy and Norwegian Environmental Agency	A national system with elements necessary to compile annual GHG emissions inventories, such as institutional, legal and procedural arrangements.	Under Implementation	2015-2017
Sector-specific CO2 emission factors for Ferroalloy production – (Ferrochrome)	GHG emissions from ferrochrome production are based on locally derived CO2 emission factors.	Xstrata (Glencore), United Nations Environmental Programme (UNEP)	United Nations Environmental Programme (UNEP)	Emissions from key sectors based on country-specific information	Under Implementation	2014-2016
Survey on HFC consumption	To collect, summarise and present in a written report all relevant technical, commercial and baseline data on the current use of Hydro fluorocarbons (HFCs)	United Nations Environmental Programme.	United Nations Environmental Programme.	HFC application at a sectoral level	Under implementation	2015-2016
Country-specific CO2 emission factors for Road transportation	Development of country-specific CO2, CH4 and N2O emission factors	Department of Transport (DOT) and United Nations Environmental Programme.	United Nations Environmental Programme	Road transport related GHG emissions informed that are reflective of national circumstances	Conceptualization	2016-2017
Development of Source Specific Activity Data for the Waste Sector	The improvement in the estimation of GHG emissions from the waste sector.	United Nations Environmental Programme.	United Nations Environmental Programme	Bottom-up country specific information for the estimation of GHG emissions from the waste sector	Under Implementation	2016-2017

As indicated in the table above, these GHGIP projects are all anticipated to be completed by 2017.

3 MITIGATION ACTIONS AND THEIR EFFECTS

Key mitigation actions implemented by government (national, provincial and municipal levels), private sector and non-profit organisations in South Africa are discussed below. This chapter firstly reflects on the progress made and impact of the mitigation actions that were reported in BUR-1 and then presents mitigation actions not reported previously.

The section is separated into 3 components as follows:

a) Update on mitigation actions with quantified effects;
b) Update on mitigation actions without quantified effects; and
c) Additional mitigation actions not included in BUR-1.

3.1 UPDATE ON MITIGATION ACTIONS WITH QUANTIFIED EFFECTS

Through the National Climate Change Response Monitoring and Evaluation System (M&E System), South Africa is continuously striving to quantify the effects of mitigation policies, strategies and actions implemented in the country. This section presents the mitigation actions for which mitigation effects and sustainable development co-benefits have been quantified. The description of these mitigation actions; including the nature and objective of the responses, progress made, their coverage (i.e. type of instrument, sectors and gases), the proposed time-horizon of each action and the estimated emission reductions achieved are presented in **Table 15** below.

A summary of the cumulative GHG emission reduction over time is given in **Table 16** below and presented graphically in **Figure 20** while the methods and assumptions applied to quantify the GHG emission reduction effects are presented in **Table 17**. Additional information on the sustainability co-benefits of each project are shown in **Table 16**.

3.1.1 Progress in implementation

A qualitative assessment of progress made in implementing the mitigation actions reported in BUR-1 is presented in **Table 15** (below) and the estimated emission reductions for each action are presented for the date ranges available, and as specified in the table. The cumulative emission reductions achieved, presented in **Table 16,** were determined by extrapolating available data for the selected date ranges, and through applying a conservative approach of assuming the emission reductions achieved in the most recent year that data was available for (i.e. without applying any exponential growth). Therefore, the mitigation effects presented for South Africa are potentially underestimating the real impact and benefit.

Table 15: Implementation progress of actions whose mitigation effects have been estimated

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Energy efficiency	National Energy Efficiency Strategy (NEES) (DoE, 2005), the draft Post-2015 NEES (DoE, 2016c); the White Paper on Energy Policy (DME, 1998); and the South African National Building Regulations (Dti, 2011)	The NEES, approved by Cabinet in 2005, sets energy intensity reduction target for various sectors, as reflected in the 1st BUR. The National Building Regulations requires all buildings to receive at least 50% of their water heating requirements from renewable sources. The South African National Standards 10400-XA Energy usage in buildings is currently under development. The DoE's Energy Efficiency Target Monitoring System (EETMS) established in 2014, tracks progress, informs future targets and showed that results for 2015 exceeded the set targets for most sectors. The draft Post 2015 NEES proposes the following reduction targets for 2030 based on the 2015 baseline: Public Buildings (50%); Municipal Services (20% in energy intensity, and 30% in fossil fuel intensity of fleet vehicles; Residential sector (33% due to new household appliances purchased and 20% improvement in average energy performance); Commercial sector (37%); Industry and mining (16%); Agriculture (electricity saving of 1PJ through officially projects); Transport Sector (20% in average vehicle energy intensity (MJ/km); and Production and distribution (10PJ of electricity derived from grid-connected cogeneration plants by 2030, average total electricity distribution loss below 8% and average non-technical losses below 0.5%).	Regulatory / Existing measure	Department of Energy	Current, since 2001. The first EETMS report was released in 2014 covering the period 2001–2011.	CO2	319 MtCO2e (from 2001 to 2011); A total of 1,970 Peta-Joules of energy were saved in the industrial, commercial, public services and residential sectors over this time.
Energy Efficiency	Integrated Demand Management (IDM) Programme	The IDM covers a range of funding and awareness programmes, which promote energy efficiency and load management.	Economic / Existing measure; more than 5,000 projects implemented	Eskom	Current, from 2004; but additional IDM projects were put on hold in 2015.	CO2	56.8 MtCO2e. (2004-2014), 58.945 GWh electricity saved.

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Energy Efficiency	Municipal Energy Efficiency and Demand Side Management (EEDSM)	The EEDSM programme is a grant fund disbursed to 68 municipalities since 2009, to implement energy efficient retrofits within the municipal infrastructure. The cumulative energy saved as a result of the programme based on projected targets is approximately 1.8 PJ, mainly through street lighting retrofits (DoE, 2016c).	Economic / Existing measure	Department of Energy	Current, from 2009	CO2	0.3 MtCO2e. (2010-2014), 5000 GWh of electricity saved over this time through the EEDSM programme.
Energy Efficiency	Industrial Energy Efficiency Improvement (IEEI) Project	The NCPC develops programmes that reduce pollution and improve resource efficiency in the private sector. The NCPC has identified programmes with a total potential saving of R65 million.	Economic / Existing measure	Department of Trade and Industry; National Cleaner Production Centre (NCPC)	Current from 2010	CO2	1.3 MtCO2e. (2010-2014), 1,342 GWh of electricity saved over this time.
Energy Efficiency	SASOL energy efficiency projects	Since 2003 SASOL has implemented a series of energy efficiency programmes, including waste energy utilization, steam compressor upgrades and heat recovery, new energy efficient equipment, and process improvements.	Economic / Existing measure; 8 projects implemented.	Sasol	Current, from 2003	CO2	5.9 MtCO2e. (2008-2014).
Electricity generation-renewable energy	2003 White Paper Renewable Energy (DME, 2003b), Renewable Energy Independent Power Producer Procurement (REIPPP) Programme (DoE, 2016d)	The Minister of Energy determined that 3,725 MW was required from renewable energy sources during the first phase of the REIPPP programme, to ensure the continued uninterrupted supply of electricity. By March 2015, four bidding windows had been completed, totalling 92 projects with a combined generation capacity of 6,327 MW. By mid-2015 projects with a generation capacity of 1,860 MW had been built and a total of 4.3 TWh of electricity has been produced since 2013.	Economic / Existing measure	Department of Energy, National Energy Regulator of South Africa (NERSA), Eskom, Independent Power Producers (IPPs).	Current, from 2010 to 2030	CO2, CH4, N2O	3.1 MtCO2e. (2013-2014) 3,270 GWh electricity generated.

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Adminis-tering gov-ernment agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Electricity generation	Eskom Open Cycle Gas Turbines (OCGT)	Between 2007 and 2014 a total of 7,827 net GWh of electricity was generated from Eskom's OCGT plants	Economic / Ex-isting measure	Eskom	Current, from 2006	CO2, CH4, N2O	0.9 MtCO2e. (2006-2014), 7,827 GWh electricity generated.
Electricity generation	Sasol Gas Turbines	Energy security: SASOL installed 420 MWs of combined cycle gas turbines between 2010 and 2011.	Economic / Ex-isting measure	Sasol	Current, since 2010	CO2	6.2 MtCO2e. (2010-2014), determined 16,071 GWh electricity generated from the in-stalled capac-ity.
Industrial Feed & Fuel Switch	Sasol Coal-to-Gas switch	From 2004 Sasol, together with its partners, have invested in natural gas; including in wells, a central processing and an-865 kilometre cross-border pipeline that delivers natural gas from gas fields in Mozambique to Sasol's operations in Secunda and Sasolburg. The project included the switching the Sasolburg facility to gas from coal as its primary feedstock and the conversion of the Secunda operations to utilise gas as a supplementary feedstock to coal.	Economic / Ex-isting measure	Sasol	Current, since 2004	CO2	80.9 MtCO2e. (2004-2014).

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Industrial Feed & Fuel Switch	Compressed Natural Gas (CNG) industry fuel switch	To provide an economical and eco-friendly energy, by suppling natural gas to CNG refuelling stations, gas distribution networks, industries and power generation systems, and to customers who are not on the existing gas network. CNG is transported by road to customers not on the existing gas pipeline and CNG equipment, advice and support provided to help industrial users and transport owners convert to natural gas. The pilot project, a bakery (using 1,2M litres of paraffin per year) was converted to CNG.	Economic / Existing measure	CNG Holdings	Current, from March 2014	CO2	0.008 MtCO2e (Mar-Dec 2014).
Energy, IPPU, AGOLU, Waste	The Green Fund (DEA, 2016f); (DBSA, 2013); (DBSA, 2016)	The Green Fund supports projects which reflect national policy priorities and focus on sectors promising high impact and potential for scale up in three funding windows: Green Cities and Towns; Low Carbon Economy; and Environmental and Natural Resources Management. By August 2015, the Green fund had a portfolio of 19 active projects, representing an investment commitment totalling R530 million. Information regarding the mitigation actions of these specific projects are included in the sections indicated: Bio-Waste Treatment and Combined Heat and Power Facility (section 3.3.1 below); Organic Waste Treatment to Energy Project (section 3.3.1 below); and Waste Beneficiation Centre (section 3.3.4 below).	Economic / Existing measure	Department of Environmental Affairs; Development Bank of Southern Africa	Current, since 2012	CO2, CH4	0.02 MtCO2e
Transport	Introduction of green cars to the Department of Environmental Affairs' vehicle fleet	Electric vehicles with zero-emission used by the Department of Environmental Affairs to phase out fossil fuel vehicles. The DEA started its green cars pilot programme in 2011 with three vehicles. By 2015 eight green cars, one fast charging station and two slow charging stations made up the fleet.	Economic / Existing measure	Department of Environmental Affairs	Current, from 2011	CO2, CH4, N2O	0.000004 MtCO2e (Mid2012 to 2014).

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Transport	Compressed Natural Gas (CNG) industry fuel switch & CNG vehicle fuel switch	To provide an economical and eco-friendly energy, by suppling natural gas to CNG refuelling stations, gas distribution networks, industries and power generation systems, to customers who are not on the existing gas network. The programme started in March 2014 with the focus on: Developing a Mother Station & 15 Industrial Customers; Industrial Fleet Conversion and in-house filling stations; Establishment of 5 CNG Filling Stations, capable of servicing 3000 vehicles per day (in Langlaagte, Dobsonville, Soweto, Rustenburg and Mamelodi); Budgeted to convert 1000 minibus taxis; and Facilitated & trained independent companies to establish 3 Workshops for CNG conversion of vehicles. (Randburg, Langlaagte and Soweto) and potentially 2 additional workshops in Pretoria and Rustenburg. Short-term target: 600 vehicles and 1000 minibus taxis converted by Jan 2015, using 330,000 litres gas/month; Medium term targets: 14000 vehicles converted, 28 CNG Filling facilities, 28 Conversion workshops, 7,700,000 Litres equivalent of gas (295,000 GJ) per month dispensed.	Economic / Existing measure	CNG Holdings	Current, from March 2014	CO2	0.0027 MtCO2e over 10 months (Mar-Dec 2014). Estimating 165,896 MtCO2e over a 10-year period; assuming 23-27% emission reduction per vehicle, retrofitting 100 busses and 100 taxis, equating to a value of approx. R25 million worth in carbon credits.
Transport	Transnet Road-to-Rail modular shift	Transnet's most significant energy efficiency gains have been made in freight rail as the new locomotive technology, with regenerative braking capability, was introduced into operations. Transnet's Market Demand Strategy focuses on increasing rail's market share from 23% in 2011/2012 to 35% by 2018/19. Transnet's Sustainability Report (2015) shows a group weighted energy efficiency (electricity and fuel) year-on-year improvement of 1.09% and a carbon emission intensity (kgCO2/ton) reduction year-on-year improvement by 5.61%. The Mitigation Potential Analysis (MPA) undertaken by DEA in 2014, identified the shift of freight from road to rail as a high priority greenhouse gas mitigation measure, with the potential to save almost 3,000 kilotons of carbon dioxide equivalents (ktCO2e) per year by 2050 (approximately 0.66% of the total mitigation potential in South Africa). (DEA, 2014c); (DEA, 2014h).	Economic / Existing measure	Transnet	Current, from 2011	CO2	1.7 MtCO2e (2011-2014)

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Energy Production and Transport	National Industrial Biofuels Strategy (NIBS) (DoE, 2007), a draft position paper on South African Biofuels Regulatory Framework (DoE, 2014b), Income Tax Act (Section 12B).	The aim of this strategy is to create a market for biologically produced fuels, to be used as a blending component in petrol/diesel production. The NIBS adopts a short-term focus and aims to achieve 2% penetration of biofuels in the national liquid fuel supply, which is equivalent to 400 million litres per annum. Since the publication of the 2007 Industrial Biofuels Strategy, small-scale biofuels producers have emerged in large numbers in South Africa. It is estimated that a total of 6.1 million litres of biodiesel and 15.1 million litres of bioethanol were consumed as fuel for vehicles between 2008 and 2012. Draft regulations regarding the mandatory blending of biofuels with petrol and diesel will require all licensed petroleum manufacturers to purchase biofuels exclusively from licensed biofuel manufacturers. A tax incentive is in place in the form of an accelerated depreciation allowance of 50:30:20 per cent over three years for plant and equipment used to produce biofuels (section 12B of the Income Tax Act).	Regulatory / Adopted	Department of Minerals and Energy	Current, Petro-diesel since 2008, Ethanol since 2009	CO2	0.00053 Mt-CO2e (2008-2011)
Extended Public Works Programme (EPWPs)	Working for Ecosystems, LandCare and Working for Energy EPWPs	This purpose of this programme is to develop and implement labour intensive programmes with strong environmental and socio-economic benefits. The Working for Energy project focuses on interventions aimed at demand-side management and the provision of electricity from biomass-based resources, while the Working for Ecosystems and LandCare programmes plant over 700,000 trees between 2013 and 2014 and restored over 500ha in the Eastern Cape Thicket restoration project.	Economic / Existing measure	Department of Energy along with SANEDI, Department of Environment Affairs along with SANBI.	Current, since 2008	CO2	0.057 Mt-CO2e (2013-14)
Renewable Energy	Clean Development Mechanism (CDM) projects and programmes for electricity generation from renewable resources (wind, solar, hydro).	This purpose of this programme is to develop and implement labour intensive programmes with strong environmental and socio-economic benefits. The Working for Energy project focuses on interventions aimed at demand-side management and the provision of electricity from biomass-based resources, while the Working for Ecosystems and LandCare programmes plant over 700,000 trees between 2013 and 2014 and restored over 500ha in the Eastern Cape Thicket restoration project.	Economic / Existing measure	Department of Energy along with SANEDI, Department of Environment Affairs along with SANBI.	Current, since 2008	CO2	0.057 Mt-CO2e (2013-14)

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Generation	Clean Development Mechanism (CDM) project for energy efficiency	Verified GHG emission reductions achieved by Non-Annex 1 Parties to the UNFCCC. By December 2016, 57 projects in the country and 35 Programmes of Activities involving South Africa had been registered under CDM. Of these, twenty-four (24) were renewable energy projects and three (3) Programme of Activities registered for wind, solar and hydropower projects. However, only two renewable energy projects and one programme had achieved verified emission reductions by 2016. In 2014, the UNFCCC issued 112,373 CERs for a hydropower project and a solar water heater programme for emission reductions achieved in the 1st commitment period (2008-2012) by a hydropower project and a solar water heater programme. These same projects/programmes received 80,697 CERs collectively for the 2nd commitment period to date (Jan 2013 to Dec 2014). In 2014 voluntary cancellation of these carbon credits (i.e. 193,070 CERs) took place.	Economic / implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Issuance since 2014	CO2, CH4,	+0.2MtCO2e (2008-2014) -0.2MtCO2e (2014)
Energy Efficiency	Clean Development Mechanism (CDM) projects activities switching from coal to natural gas	To reduce GHG emissions due to changes in industrial processes leading to more efficient use of energy. One EE project, registered since 2007, has achieved 648,606 CERs in the 1st commitment period and no CERs have been issued for the 2nd commitment period to date (between 2013 and 2014).	Economic / Implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Implemented since 2007	CO2	0.6MtCO2e

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Fuel Switch: coal to natural gas or biomass	Clean Development Mechanism (CDM) projects activities for nitrous oxide emission reduction	To reduce GHG emissions due to burning coal in industrial processes by switching feedstock to natural gas or biomass. Four (4) natural gas switch and two (2) biomass switch projects, registered since 2006 have achieved verified emission reductions, with the first project being verified in 2008. The UNFCCC issued 292,641CERs for the 1st commitment (2008-2012) and no CERs have been issued for the 2nd commitment period to date (between 2013 and 2014). (http://cdm.unfccc.int/Projects/projsearch.html). In 2013, voluntary cancellation of 80,220 carbon credits took place.	Economic / Implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Implemented since 2006	CO2	0.2MtCO2e (2008-2016) -0.08MtCO2e
Nitrous Oxide Emission Reduction	Clean Development Mechanism (CDM) projects activities for nitrous oxide emission reduction	To reduce nitrous oxide emissions in the explosive and fertiliser production process. Five South African nitrous oxide abatement projects have been registered under the Clean Development Mechanism, and emission reductions from 4 projects were verified up to 2014. The first project, registered in 2007, had its first emission reductions verified in 2008. GHG Emission reductions achieved up to 2014 for the 1st commitment (2008-2012) resulted in the UNFCCC issuing 5,985,867 CERs for nitrous oxide abatement and 136,811 CERs for the 2nd commitment period to date (between 2013-2014). (http://cdm.unfccc.int/Projects/projsearch.html). In 2012, voluntary cancellation of 1,000 carbon credits took place to offset the carbon footprint of delegates from the Project Developer Forum (PDF) travelling to the UNFCCC Climate Conference in Doha COP18/CMP8.	Economic / Implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Implemented, since 2007	N2O	+6.1 MtCO2e (2008-2014) -0.001 MtCO2e (2008-2014)

Theme	Name of Policy/ Instrument / Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Estimated emission reductions (MtCO2e)
Mine Methane Capture	Clean Development Mechanism (CDM) project for mine methane capture and utilization	To capture and utilize methane emissions in a gold mine in South Africa. The project was registered in 2011 and the first emission reductions were verified in 2014. GHG Emission reductions achieved up to 2014 for the 1st commitment (2008-2012) resulted in the UNFCCC issuing 36,010 CERs and no CERs have been issued for the 2nd commitment period to date (between 2013-2014).	Economic / Implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Implemented since 2011	CH4	0.04MtCO2e (2008-2014)
Methane Emissions from Waste Water and Landfills	Clean Development Mechanism (CDM) projects for the capture and utilization of landfill gas	To capture and utilize or flare methane emissions from landfill sites and waste water treatment plants in South Africa. Six (6) LFG and one (1) WWT projects, registered since 2006 have been issued with CERs, with the first emission reductions verified in 2009. GHG Emission reductions achieved up to 2014 for the 1st commitment (2008-2012) resulted in the UNFCCC issuing 1,661,126 CERs and 30,096 CERs for the 2nd commitment period to date (between 2013 and 2014). Between 2009 and 2014 voluntary cancellation of 8,388 carbon credits issued for the 1st commitment period and 3,246 carbon credits issued for the 2nd commitment period took place. The Mitigation Potential Analysis (MPA) undertaken by DEA in 2014, determined that if all technically available mitigation potential in the waste sector were to be implemented, then GHG emissions could be reduced by 9,977 ktCO2e in 2020; 22,122 ktCO2e by 2030 and 39,658 ktCO2e by 2050 (DEA, 2014i).	Economic / Implemented	United Nations Framework Convention on Climate Change (UNFCCC), Designated National Authority (DNA), Designated Operational Entities (DOEs), Private sector	Current, Implemented since 2011	CO2, CH4	+1.7MtCO2e -0.01MtCO2e

3.1.2 Mitigation effects (2000 – 2014)

By 2010, an estimated running total (from 2000) of 315.7 MtCO2e emissions had been prevented from entering the atmosphere through the mitigation actions included in the analysis. The results show that the GHG emission reduction trend is growing steadily over time as more programmes to mitigate climate change are being implemented. The annual emission reductions from these mitigation programmes were estimated at 66.7 MtCO2e/yr., 69.3 MtCO2e/yr., 70.0 MtCO2e/yr. and 71.7 MtCO2e/yr. for 2011, 2012, 2013 and 2014 respectively, bringing the total estimated cumulative emission reductions since 2000 to 451.7 MtCO2e and 593.4 MtCO2e by 2012 and by 2014 respectively. The cumulative effects of the key mitigation actions in South Africa, for which data are available, are listed in ***Table 16***, while **Figure 20** illustrates the emission reductions achieved over this period.

Energy efficiency has been the largest contributor to climate change mitigation in the country, accounting for 83%, 83% and 80% of emission reductions achieved in 2010, 2012 and 2014 respectively, and 82% overall. The Energy Efficiency Target Monitoring System(EETMS), maintained by the DoE, encompasses all energy efficiency measures implemented under the National Energy Efficiency Strategy (DoE, 2005).

To avoid double-counting the GHG emission reductions presented in **Table 16**, the quantitative mitigation effects of Eskom's Integrated Demand Management (IDM) project, the Municipal Energy Efficiency programme, the National Cleaner Production Centre (NCPC) Industrial Energy Efficiency programme, SASOL's Energy Efficiency programme and emission reductions achieved through CDM registered projects (for energy efficiency, renewable energy and fuel switch) have been excluded from the total estimated, as these are reported by the DoE in the Energy Efficiency Target Monitoring System. The estimated emission reductions for each initiative are presented in **Table 15** while the cumulative impacts and combined effects are presented in **Table 16** and illustrated in **Figure 20** respectively.

Industrial fuel and feed switch programmes (excluding energy efficiency programmes) undertaken individually or through the Clean Development Mechanism (CDM) and the Green Fund contributed about 15% to the overall mitigation achieved by 2014.

3.1.3 Effects on other Sustainable Development co-benefits

The effects that the analysed mitigation actions have on job-creation and other sustainable development co-benefit indicators proved to be very difficult to assess as the associated information from the various databases or the programme implementers were mostly unavailable. **Table 17** (below) presents a summary of the estimated impacts of these mitigation projects and programmes on job-creation and other sustainable development indicators, where the information was available.

By 2014, more than 40,500 jobs had been created through these major mitigation actions, with the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme and the Extended Public Works Programmes (EPWPs) being the largest providers of jobs. The indicators for the other key socio-economic co-benefits that were assessed for these projects included:

Electricity saved, where a cumulative total of more than 64,400 GWh of electricity was saved by 2014; and
Local investment, where more than R212.8 billion rand was invested into the South African economy as a direct result of implementing these programmes.

In terms of environmental co-benefits, it is estimated that more than 770,000 tons of sulphur dioxide (SO2), 400,000 tons of nitrogen oxides (NOx), 30,000 tons of Particulate Matter (PM) and 14 million tons of ash were prevented from entering the atmosphere, as a direct result of implementing these programmes. Additionally, more than 128,000 litres of water and 49 million tonnes of coal were saved.

Table 16: Summary of mitigation effects of key mitigation actions in South Africa since 2000, cumulative effects for 2010, 2012 and 2014.

Theme	Response Measure	Coordinator / Implementer	Cumulative GHG Emission Reductions (MtCO2e)		
			up to 2010	up to 2012	up to 2014
Energy Efficiency	National Energy Efficiency Strategy* (excluding IDM, municipal EE, IEE projects and SASOL EE projects)	Department of Energy (DoE)	241.3	337.9	428.1
	Integrated Demand-side Management (IDM)	Eskom	18.9	35.3	56.8
	Municipal Energy Efficiency Programme	DoE	0.0	0.1	0.3
	Industrial Energy Efficiency Improvement (IEE) Project	NCPC	0.1	0.4	1.3
	SASOL energy efficiency projects	SASOL	1.4	3.3	5.9
Electricity generation	Renewable Energy Independent Power Producer Procurement (REIPPP) Programme	DoE			3.1
	Eskom Open Cycle Gas Turbines (OCGT)	Eskom	0.3	0.4	0.9
	SASOL gas turbines	SASOL	0.9	3.2	6.2
Industrial Feed & Fuel Switch	SASOL coal-to-gas switch	SASOL	51.5	66.2	80.9
	Compressed Natural Gas (CNG) industry fuel switch	CNG Holdings	0	0	0.8-2
Cross-cutting	Clean Development Mechanism** excluding energy efficiency projects (Data source: UNEP DTU partnership)	DoE	1.5	4.7	8.2
	Green Fund	DBSA / DEA			0.2-1
Green Transport					
	DEA Green vehicles	DEA		0.4-6	0.4-5
	Transnet Road-to-Rail Programme	Transnet		0.4	1.7
	Biofuels (Data source: Statistics South Africa, 2015)	Biofuel producers	0.3-3	0.7-3	0.1-2
	CNG vehicle fuel switch (Data source: Industrial Development Corporation- IDC)	CNG holdings	0	0	0.8-2
Expanded Public Works Programmes (EPWPs)	Working for Ecosystems, Land and Energy	DEA & SANEDI	Data unavailable	Data unavailable	0.04
Total			**315.7**	**451.7**	**593.4**

* EETMS data was only available until 2011. National energy efficiency was assumed to have remained constant from then onwards, potentially underestimating the real impact.

** CDM data represents CERs issued and not necessarily real emission reductions achieved over these timeframes (i.e. CERs for emission reductions achieved in 2014 may only be issued in 2017 due to the time frames required to verify and issue carbon credits).

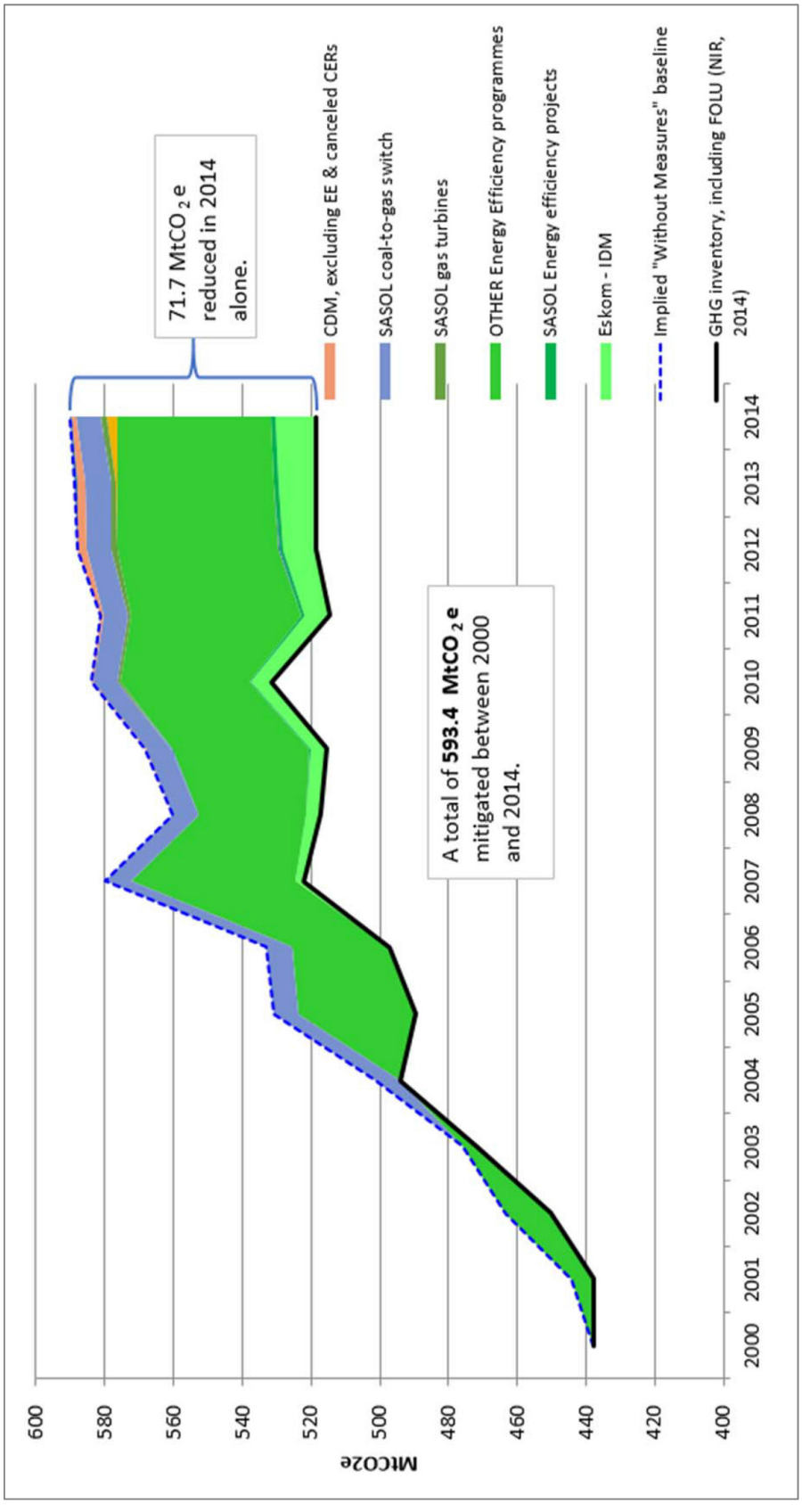


Figure 20: Annual emission reductions from analysed mitigation actions (Source: DEA, unpublished).and 2014.

Table 17: Sustainable development benefits of key mitigation projects, up to 2014.

	Socio-economic			Environmental					
	Number of Jobs	Electricity Saved (GWh)	Local Investment (R million)	Avoided SO2 (t)	Avoided NOx (t)	Avoided Particulate Matter (t)	Avoided Ash (kt)	Water Saved (Ml)	Coal Saved (kt)
Eskom IDM	N/E	58,945	6,664*	527,340	275,263	20,876	9,701	87,621	33,171
DoE Municipal Energy Efficiency programme	N/E	500	1 351	4,212	2,198	167	77	700	265
NCPC IEE Improvement Project	N/E	1,342	N/E	11,304	5,901	448	208	1,878	711
SASOL Energy Efficiency projects	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E	N/E
REIPPP programme	19,050	N/A	192,600	27,550	14,381	1,091	507	4,578	1,733
Eskom OCGT	N/E	N/A	N/E	63,888	31,977	1,876	1,213	10,958	4,149
SASOL OCGT	N/E	N/A	N/E	135,409	69,878	5,361	2,491	22,499	8,517
SASOL Coal-to-Gas Switch	N/E	N/A	12,000	N/E	N/E	N/E	N/E	N/E	N/E
CNG Vehicle & Industry Fuel Switch	30	N/A	N/E	N/E	N/E	N/E	N/E	N/E	N/E
All CDM, excl. Energy Efficiency projects	N/E	N/A	N/E	N/E	N/E	N/E	N/E	N/E	N/E
Green Fund	2,808	0.11	260	N/E	N/E	N/E	N/E	N/E	N/E
DEA Green Vehicles	0	N/A		0	0	0	0	0	0
Transnet Road-to-Rail Programme	N/E	N/A	N/E	N/E	N/E	N/E	N/E	N/E	N/E
Biofuels	N/E	N/A	N/E	N/E	N/E	N/E	N/E	N/E	N/E
EPWPs (Working for Ecosystems, Land and Energy)	20,070**	N/A	N/A	N/A	N/A	N/A	N/A	N/E	N/A
TOTAL	> 40,528	> 60,787	> 212,874	> 769,702	> 399,597	> 29,818	> 14,197	> 128,234	> 48,546

N/E = not estimated; N/A = not applicable (Source: Data provided by project owners).

* Investment value is for the 2009–2014 period only. There was no information for earlier years.

** The number of jobs created in the 2011–2014 period only for the three EPWP programmes. Information for earlier years was not available.

3.1.4 Methods and assumptions

The methodologies and assumptions applied to determine the emission reductions and environmental co-benefits for key governmental policies and measures were adopted from the World Resource Institute's Policy and Action Standard (An Accounting and Reporting Standard for Estimating the Greenhouse Gas Effects of Policies and Actions (WRI, 2014) CDM methodologies (UNFCCC, 2016) were applied to assess the impacts of mitigation actions from registered projects and programmes. The CDM standardized baseline grid emission factor for the Southern African Power Pool (0.9644 tCO2/MWh and 0.9488 tCO2/MWh for commitment period 1 and 2 respectively) were used to determine emissions from electricity, and unless otherwise stated, the 2006 IPCC default emission factors were applied for other parameters.

A study is currently underway to determine the effects and impacts of national policies and measures (such as energy efficiency and waste utilization) have on reducing greenhouse gas emissions over time. The results of the study are expected in 2018 and will be reported in BUR-3.

The general approach used to assess the effects of mitigation actions reported in this chapter involves determining the difference in the respective indicators (e.g. GHG emissions) under a "Baseline scenario" (in the absence of the mitigation action) and under an "Ex-post scenario" (when the mitigation measure is implemented), and is illustrated graphically in **Figure 21** (below).

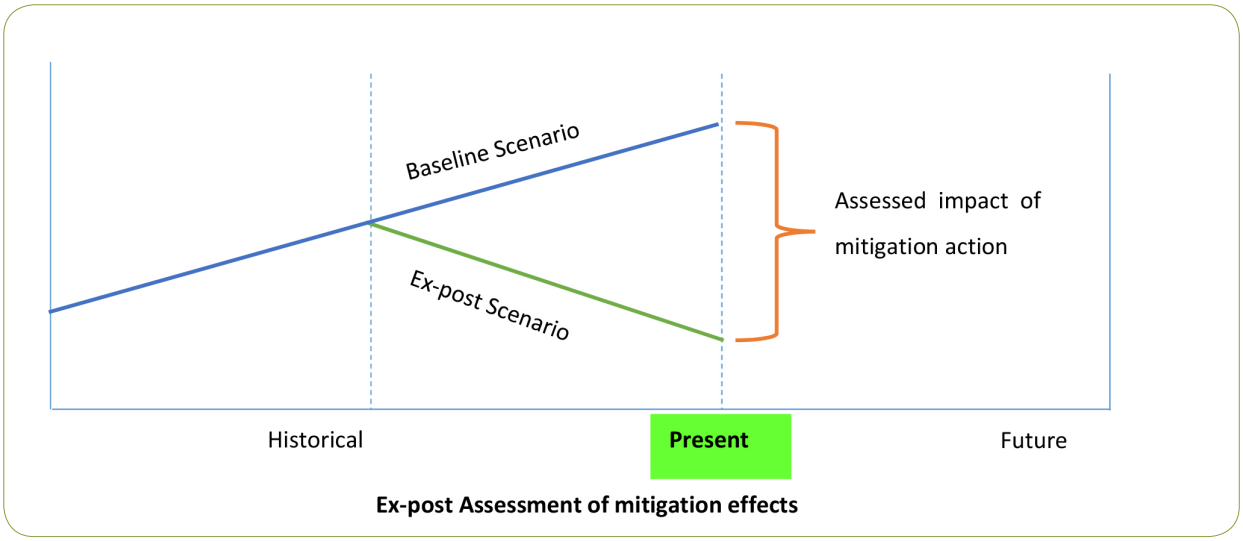


Figure 21: Ex-post assessment method for determining mitigation effects

The specific methods used, assumptions made and emission factors applied, to determine the GHG mitigation effects and the socio-environmental benefits of the projects, programmes and interventions described above, are discussed in more detail in **Table 18** (below).

A. GHG Mitigation effects:

For the assessment of the GHG emission reductions the following general formula was used:

GHG emissions reduced= baseline scenario emissions-measure scenario emissions

Table 18: Methodology table for assessing mitigation effects

Theme	Mitigation action(s)	Baseline description	GHG reduction calculation methodologies	Factors, parameters and assumptions
Energy efficiency	National Energy Efficiency Strategy	No energy savings in the economy on all energy sources as per National Energy Balance.	GHG mitigated = total energy saved x fraction of the energy type used x EF per fuel type. (GHG reductions from the IDM, Municipal EE, Industrial EE, SASOL EE and registered CDM EE projects were excluded from the result to avoid double-counting).	Fraction of energy type in the economy as per National Energy Balance data maintained by DoE. IPCC default emission factors for Coking coal, Bituminous coal, Coke oven coke, Gas works gas, Coke oven gases, Blast furnace gas, Natural gas, LPG, Motor gasoline, other kerosene, Gas diesel and Residual fuel. CDM standardized baseline grid emission factor for the Southern African power pool.
	Integrated Demand-side Management (IDM)	Had these interventions not been implemented, additional electricity from the grid, equivalent to their savings, would have been used.	GHG mitigated = Amount of saved electricity x grid emission factor	
	Municipal Energy Efficiency Programme			
	Industrial Energy Efficiency Improvement (IEEI) Project			
	SASOL energy efficiency projects			
Electricity generation	Renewable Energy Independent Power Producer Procurement (REIPPP) Programme	Had these interventions not been implemented, additional electricity from the grid, equivalent to their net generated electricity, would have been used.	GHG mitigated = renewable energy yield (MWh) x electricity grid emission factor GHG mitigated = GHG emissions from OCGT plantsA (Mt) – avoided emissions from coal plantsB (Mt). Where: A = Liquid fuels consumption (ML) x EF for fuel (Mt/ML), determined from IPCC EF in (kg/TJ) converted and Mt/TJ x Heating Value (TJ/ML); B = Electricity generated (GWh) * EF for electricity (0.964 Gg/GWh).	CDM standardized baseline grid emission factor for the Southern African power pool IPCC default emission factor for diesel. No GHG emissions from Wind and Solar.
	Eskom Open Cycle Gas Turbines (OCGT)			
	SASOL gas turbines			

Theme	Mitigation action(s)	Baseline description	GHG reduction calculation methodologies	Factors, parameters and assumptions
Industrial Feed & Fuel Switch	SASOL coal-to-gas switch	Only coal used in all SASOL plants	GHG mitigated = Avoided CO2eA (Mt) – Actual CO2eB (Mt); i.e. the difference between coal and natural gas GHG emissions (using the mass balance approach).	CDM standardized baseline grid emission factor for the Southern African power pool Country specific GHG emission for natural gas and paraffin; IPCC default emission factor for other fossil fuels. Assumed an efficiency ratio of 0.64 for HFO: CNG.
	Compressed Natural Gas (CNG) industry fuel switch	Grid electricity used for industrial energy purposes	GHG mitigated = Avoided CO2eA (Mt)– Actual CO2eB (Mt); i.e. the difference between electricity (or other fossil fuel type) and CNG GHG emissions for equivalent energy output.	
Cross-cutting	CDM	As per CDM rules	As per CDM rules and methods (EE excluded)	As per relevant CDM methods
	Green Fund	Absence of the projects	As per Green Fund rules & methods	As per Green Fund M&E methods.
Green transport	DEA Green vehicles	Use of standard internal combustion engine (ICE) petrol vehicles for transport.	GHG mitigated = Avoided CO2eA (Mt) – Actual CO2eB (Mt); i.e. the difference between petrol ICE GHG emissions and new fuel-technology combination GHG emissions for equivalent distance travelled	CDM standardized baseline grid emission factor for the Southern African power pool IPCC default emission factors for biofuels and CNG. Assumed fuel consumption rate for company fleet vehicles as 7.5 (Lit/km) for petrol vehicles.
	Transnet Road-to-Rail			
	Biofuels			
	CNG vehicle fuel switch			

B. Decoupling economic growth from environmental degradation

The following four parameters were quantified for programmes that reduce or avoid the use of electricity, as presented in the **Table 19** below:

1. Sulphur Oxides (SOx);
2. Nitrogen Oxides (NOx);
3. Particulate Matter (PM); and
4. Ash.

Table 19: Environmental impacts due to electricity production (Source: Eskom, 2015)

Year	GWh electricity sold	SO2		NOx		Particulate matter		Ash	
		kt	g/kWh	kt	g/kWh	kt	g/kWh	Mt	g/kWh
2009/10	218,591	1,856	8.5	959	4.4	88.3	0.4	36.0	164.7
2010/11	224,446	1,810	8.1	977	4.5	75.8	0.3	36.2	161.4
2011/12	224,785	1,849	8.2	977	4.5	72.4	0.3	36.2	161.1
2012/13	216,561	1,843	8.5	965	4.5	80.7	0.4	35.3	163.0
2013/14	217,903	1,975	9.1	954	4.4	78.9	0.7	35.0	160.5
2014/15	216,274	1,834	8.5	937	4.3	82.3	0.4	34.4	159.1
Totals (average)			8.5		4.5		0.4		161.6

C. Saved resources – Decoupling economic growth from resource utilization

The amount of water and coal saved due to savings in electricity usage, were determined based on coal and water used by Eskom, and are shown in **Table 20** below:

Table 20: Natural resource utilization saved due to electricity savings (Source: Eskom, 2015).

Year	Electricity Demand saving (MW)	Coal saved	Water saved
		t/MW	kL/MW
2009/10	-	0.6	1.4
2010/11	354.1	0.6	1.4
2011/12	365.0	0.6	1.3
2012/13	595.0	0.6	1.4
2013/14	409.6	0.6	1.4
2014/15	171.5	0.6	1.5

C. Economic benefit: Cost-saving

DEA launched a pilot project in 2011 to phase out fossil fuel vehicles by introducing three electric vehicles into their fleet. By 2015, eight green cars, one fast charge station and two slow charge stations made up the fleet. The costs saved on fuel through introducing electric vehicles (green cars) into their fleet, was calculated by applying the electricity tariffs and fuel costs reflected in **Table 21** (below):

Table 21: Cost savings due to electric vehicles used by DEA (Source: DEA, undated).

Year	Petrol price (R/litre)	Electricity price (R/kWh)	Cost savings (ZAR)
2012	11.6	1.0	
2013	13.8	1.1	R13,020.00
2014	12.6	1.2	R29,500.00

3.2 UPDATE ON MITIGATION ACTIONS WITHOUT QUANTIFIED EFFECTS

Implementation progress for mitigation actions that were reported in BUR-1 and for which mitigation impact and sustainability co-benefits have not been quantified for the Energy, IPPU, AFOLU and Waste sectors are presented in **Table 22, Table 23, Table 24** and **Table 25** respectively. While progress made under the financial measures for sector mitigation actions, reported in BUR-1, are presented in **Table 26(**below).

3.2.1 Energy Sector

Table 22: Update on Energy sector mitigation actions, without quantified effects, reported in BUR-1

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Diversification of energy resources (Electricity generation and liquid fuels)	Integrated Resource Plan (IRP) 2010-2030 (DoE, 2011), (DoE, 2016b)	The IRP makes provision for increased contribution from renewable and nuclear energy, for electricity generation and liquid fuels production. The draft IRP (2016) proposes diversifying the energy mix to include: 18 GW of PV, 37 GW of wind, 20 GW of nuclear, 34 GW of gas, 2.5 GW of import hydro, 15 GW of coal by the end of the study period (2050), to meet the demand forecast.	Regulatory / Promulgated March 2011; IRP Electricity Update Report published in 2013; Draft updated IRP published for public stakeholder engagement in November 2016.	Department of Energy	2010- 2030	CO2, CH4, N2O	Energy security (supply, cost and promoting access to energy); Investment in renewable energy technology; Diversification of energy mix; Minimize water usage, air emissions and other environmental impacts; Job creation.
Diversification of fuel sources	Integrated Energy Plan (IEP) (DME, 2003a); (DoE, 2016a)	The purpose and objectives of the IEP are established in the National Energy Act, 2008 (Act No. 34 of 2008). Integrated energy planning is undertaken to determine the best way to meet current and future energy service needs in the most efficient and socially beneficial manner. One of the key objectives of the Department of Energy's policy is to diversify primary energy sources and reduce the country's dependency on coal.	Regulatory / Existing measure	Department of Energy	Current	CO2, CH4, N2O	Socio-economic and environmentally sustainable growth.

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Electricity generation – renewable	National Solar Water Heating Programme (DoE, 2014a)	This programme involves the installation of solar water heaters in residential dwellings. As per the National Development Plan, 1.25 million solar water heating units are to be installed by 2019. A total of 395,088 Solar water heating systems were installed during the period of 2008-2014 (DoE, 2014a). South Africa has also registered a solar water heating Programme of Activities under the Clean Development Mechanism.	Social / Existing measure	Department of Energy	Current	CO2	Socio-economic and environmentally sustainable growth.
Electricity generation – renewable	Solar Park and Concentrated Solar Power Plant (CSP) (Eskom, 2014)	The Solar Park and Concentrated Solar Power Plant will each add approximately 100MW of renewable electricity to the grid. South Africa has registered a CSP Programme of Activities under the Clean Development Mechanism.	Economic / Existing measure	Department of Energy and Eskom	Current	CO2, CH4, N2O	Socio-economic and environmentally sustainable growth.
Electricity generation – renewable	Electricity subsidy	Subsidy to promote the installation of solar water heaters.	Economic / Existing measure	National Treasury, Department of Energy, ESKOM	Current	CO2	Reduce greenhouse gas emissions; Increase energy availability in the Grid; Job creation.

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Electricity generation – renewable	South African Wind Energy Programme (SAWEP)	The objective of SAWEP is to install and operate 5.2 MW of electricity generated from the Darling Wind Farm National Demonstration Programme and the further development of an additional 45 MW of wind power from Independent Power Producers. South Africa has registered several Wind Programme of Activities under the Clean Development Mechanism. Phase I implemented over two years from February 2008 to December 2010, contributed to the progress and development of South Africa's Wind Industry and allocation of wind power under Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. Phase II focuses on supporting refinement of the wind atlas; testing wind turbines and components, developing certification capacity, on-going awareness raising and engagement between Government and industry participants and putting a Wind Industrial Strategy in place.	Economic / Existing measure	Department of Energy	Five years: 2008-2012	CO2	Built capacity building and strengthened institutions Commercial wind energy development promoted Long-term policy and implementation framework for wind energy developed Green power funding initialised
Electricity generation	The South African Coal Roadmap	The South African Coal Roadmap was developed to explore the short, medium and long-term activities and interventions needed to support the coal industry in South Africa.	Regulatory / Planned	SANEDI	Current	CO2	Socio-economic and environmentally sustainable growth

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Energy Efficiency	Private Sector Energy Efficiency (PSEE) Project	The National Business Institute (NBI) implemented the PSEE project, which aimed to improve energy efficiency in commercial and industrial companies in South Africa, through the provision of various services to assist companies to identify and implement energy saving measures. The NBI (2016) reported that over the 2-year programme potential savings identified at 1,103 sites included: • 6,921 saving opportunities; • 2,087 GWh potential annual energy savings; • 21,896 GWh potential lifetime energy savings; • 669.1 MW estimated grid capacity saving; • 16.9 MtCO2e potential lifetime carbon saving; and • 2.3-year average payback period.	Economic / Existing measure	Department of Energy, National Business Initiative, UK Department of International Development (DFID) and Private Sector	December 2013 to November 2015.	CO2	•Energy savings and reductions in energy intensity •GHG emissions reduced •Improved economic competitiveness through resource and process efficiencies •Investment leveraged from the private and public sectors through capital investment in energy efficiency projects •Social benefits such as job creation and skills development relating to energy efficiency •Increased awareness of energy efficiency and resource conservation

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Energy Efficiency	Energy Efficiency Leadership Network (EELN)	The main objective of the EELN is to promote energy efficiency in the South African business sector, through a platform for knowledge sharing and capacity development. The EELN is also intended to support the business commitment to the 2006 Green Accord and in supporting government's target of a 12% reduction in energy consumption by 2015. View the results achieved by the PSEE project (above).	Economic / Existing measure	National Business Initiative, Department of Energy, Business Unity South Africa and approximately 60 businesses, government departments/agencies and business associations	Current, launched in December 2011	CO2	•Energy efficiency •Energy security •GHG emission reduction •Social and environment benefits
Energy Efficiency	Energy Efficiency Standards and Appliance Labelling Programme: SANS 941 for Energy Efficiency of Electrical and Electronic Equipment.	Mandatory labelling of household appliance is in place (Dti, 2014), and minimum energy performance standards (MEPS) are been introduced or are proposed for most of the major categories of appliance.	Policy & Standards / Existing and proposed measures	Department of Energy, Department of Trade and Industry, SABS and NRCS.	Current, from 2005/6	CO2	•Environmental indicators that are reported on (per MWh grid electricity saved) include: water saving, coal ash avoided, and SO2 emissions avoided •Job creation
Transport	Vehicle emissions fuel economy and CO2 emissions Labelling scheme in terms of the Standards Act 1993.	This programme covers improved vehicle efficiency, and promoting fuel efficiency awareness in buyers of new passenger vehicles. The Measurement and Verification of Energy Savings Standard: SATS 50010 SANS 20101: for the measurement of CO2 and Fuel Consumption of Categories M1 and N1 Vehicles is in place.	Economic & Standards / Existing measure	South African Automotive Industry, in conjunction with the Department of Minerals. Enforced by the National Regulator for Compulsory Specifications	2008	CO2	

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Transport	Passenger Rail Agency of South Africa (PRASA): Passenger Rail Modal shift from private vehicles to rail, including the Gautrain (DoT, 2015); (DoT, 2016).	Upgrading passenger rail infrastructure and services for an Integrated Public Transport System that reduces vehicle emissions. The PRASA National Rail Plan includes three pilot Modernisation Corridors demonstrating the impact of an integrated approach to investment in rail corridors (DoT, 2015). Gautrain commuters exceed 1.3 million passengers per month and the programme has succeeded in reducing private motor vehicle usage on the roads. Surveys conducted by Gautrain determined that 75% of the 61,500 passengers, who use the Gautrain on a daily basis, previously travelled to-and-from home to work, alone in private cars.	Economic / Existing measure	Gauteng Province Department of Transport; Passenger Rail Agency of South Africa (PRASA).	Current	CO2	

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Transport	Roadmap to Cleaner Fuel - The Clean Fuels 2 specification (SAPIA, 2016)	Draft Regulations for Clean Fuels II Specification were gazetted in June 2012, indicating regulations would come into force on 1 July 2017. The aim is to decrease the content of aromatics in petrol (from 50% to 35%) and benzene (from 5% to 1%), to align with emission standards. The sulphur content of petrol will also be reduced from 500ppm to 10ppm. The Department of Energy is in the process of amending the regulations through a stakeholder engagement process.	Regulatory / Planned	Department of Energy; Department of Transport; Industry associations	2017 onwards	CO2	
Transport	Integrated Public Transport Network (IPTN) (DoT, 2016)	To ensure sustainable, equitable and uncongested mobility and accessibility through IPTNs (DoT, 2007). The IPTN aims to integrate urban public transport modes including: Bus Rapid Transport, Metro Buses and Minibus Taxis. The programme includes dedicated lanes for public transport, inner-city distribution system, integrated ticketing, pedestrian and bicycle facilities.	Economic / Existing measure	Department of Transport and City Metropolitans	Current, since 2008	CO2	•Reduces highway congestion •Saves commuter time •Creates service, assembly and infrastructure jobs

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Transport	Bus Rapid Transport (BRT) System; a component of Public Transport Strategy (DoT, 2015); (DoT, 2016)	The aim of the BRT is to quickly and safely transport people to all parts of the city, and to link different parts of the city in a network. The goal for 13 metropolitan cities targeted to benefit from the BRT Systems is to achieve a mode shift of 20% of car work trips to public transport networks by 2020 (DoT, 2015).	Economic / Existing measure	Department of Transport and Local Governments	Current since 2006	CO2	•Reduced single car users •Reduced traffic congestion •Reliable and efficient public transport •Job creation
Transport	Intelligent Transport System (ITS) (DoT, 2015); (DoT, 2016)	The ITS ensures efficient urban transport systems and covers urban traffic control, advanced traffic management, parking management and advanced public transport management.	Economic / Existing measure	Department of Transport and Local Governments	Current	CO2	•Job creation •Reduction in traffic accidents •Reduction in fuel consumption •Reduction in travel time
Carbon capture and storage	The South African Centre for Carbon Capture and Storage (SANEDI, 2016); (DEA, 2014g)	The South African Centre for Carbon Capture and Storage is responsible for implementing a roadmap to evaluate the potential for carbon capture and storage, as well as a testing and demonstration plant to store process emissions from an existing high carbon emission facility. The first and second phases of the roadmap have been completed; the project is currently in preparation for the Pilot CO2 Storage Project (PCSP). Commercial operation is expected in 2025.	Economic / Development	Department of Energy in partnership with SANEDI	Commercial operation is expected in 2025	CO2	•Reduce air pollution •Transfer and development of skills and expertise •Job creation

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Coal bed methane reduction	Coal bed methane reduction (CBM)	CBM exploration is still in the early stages of development in Southern Africa. South Africa is planning to capture of 25% of methane emissions from coal mines, starting in 2020, and reaching the goal by 2030.	Economic / Planning	Department of Energy	2020- 2030	CO2, CH4	•Reduce air pollution •Transfer and development of skills and expertise • Job creation
Energy Efficiency in the Petroleum Refining, oil and natural gas sectors	South Africa's Greenhouse Gas Mitigation Potential Analysis (DEA, 2014e); (DEA, 2014f)	Mitigation measures applied by the Petroleum Refining sector and other energy industry sectors include: • Improved steam generating boiler efficiency; • Improved process heater efficiency; • Waste gas/heat recovery and utilization; • Minimise flaring and utilize flare gas as fuel; • Improved process controls. An estimated 8.5 ktCO2e per year reduction in emissions from the oil refining, coal mining and other energy industry sectors for the period 2000-2010, of which: 4.9 ktCO2e per year are process related; 1.9 ktCO2e per year are fuel related; and 1.7 ktCO2e per year are electricity related. The technical mitigation potential for the South African petroleum refining sector in 2020 is estimated at over 558 ktCO2e/year (DEA, 2014f).	Policy & Measure / Existing measures	Department of Environmental Affairs, Private sector (Petrol Refineries)	Current	CO2, CH4, N2O	•Improved on-site energy generation •Improved energy efficiency •Energy security

Theme	Name of Policy/ Instrument /Strategy/Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Methane capture in the coal mining and handling sector	South Africa's Greenhouse Gas Mitigation Potential Analysis (DEA, 2014e); (DEA, 2014g)	Mitigation measures for the coal mining and handling sector include: • Methane destruction by flaring; • Methane capture and use for power and heat production; • Improved energy efficiency in lighting, electric motors, mine haul, transport operations; and • On-site clean power generation.	Policy & Measures / Existing measures at one mine (and potential for further roll-out)	Department of Environmental Affairs, Private sector (mining industry).	Current	CH4	•Reducing GHG emissions •Replacing electricity previously drawn from the grid •Providing motive power for mine vehicles •replacing heat generated by coal-fired boilers and/or compressing gas to be piped off site for general use providing a source of natural gas.

3.2.2 Industrial Process and Product Use Sector

Table 23: Update on IPPU sector mitigation actions, without quantified effects, reported in BUR-1

Theme	Name of Policy/ Instrument/ Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument /Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Capture of PFC in aluminium plants	Long Term Mitigation Scenarios (LTMS)	This initiative covers that capture of PFCs at existing aluminium plants. The aim to capture 100% of PFCs emitted from these plants by 2020.	Economic / Development	Private sector	Current, 2011- 2020	PFCs	Reduce air pollution, transfer and development of skills and expertise along with job creation
Various GHG mitigation initiatives in the IPPU sector	South Africa's Greenhouse Gas Mitigation Potential Analysis (DEA, 2014e) (DEA, 2014g)	Mitigation actions implemented by the IPPU sector include: Improved process: Revamp plants (increase capacity and energy efficiency); Energy-efficient boiler systems, kilns and utility systems (e.g. lighting, refrigeration, compressed air); Increase process improvements and best available production techniques; Waste heat and/or gas energy recovery and utilization; Improved heat exchanger efficiencies; Use alternative fuels including biomass/residual wood waste; Replace coal-fired partial oxidation process with natural gas-fired steam reforming product; and Industrial Feed & Fuel switch, e.g. switching to natural gas (CNG) as an alternative energy source.					

3.2.3 AFOLU Sector

Table 24: Update on AFOLU sector mitigation actions, without quantified effects, reported in BUR-1

Theme	Name of Policy/ Instrument/ Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Extended Public Works Programme (EPWP)	Working on Fire Programme	EPWP programmes are implemented at national and at local government levels. The purpose of the EPWP is to develop and implement labour intensive initiatives which support economic growth and improve the environment. Between 2011 and 2014 government allocated around R 13.6 billion to these programmes (National Treasury, 2015). The Working on Fire Programme focusses on enhanced human safety, through setting-up high-quality fire and land management customs to prevent harm to goods and life.	Economic / Existing measure	Department of Environmental Affairs, and Forest Fire Association (FFA).	Current, since 2007	CO2, CH4, N2O	•Improved resiliency of the ecosystem •Protection of life, goods and indigenous biodiversity •Wetland rehabilitation, protection and sustainable use • Job creation and skills transfer
Extended Public Works Programme (EPWP)	Working for Water Programme	The Working for Water focusses on clearing Invasive Alien plants (IAPs) which pose a direct threat to South Africa's biological diversity, and also to water security, ecological functioning of natural systems and the productive use of land. IAPs also intensify the impact of fires and floods and increase soil erosion. The programme aims to clear 877,030 hectares of invasive alien plants per year.	Economic / Existing measure	Department of Environmental Affairs	Current: 2005- 2030		• Protection of native biodiversity • Job creation • Skills transfer

Theme	Name of Policy/ Instrument/ Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Extended Public Works Programme (EPWP)	Working for Wetlands	Working for Wetlands uses wetland rehabilitation as a vehicle for both poverty alleviation and the wise use of wetlands. While the programme's primary focus is wetland rehabilitation, protection, rehabilitation and sustainable use of those wetlands is simultaneously entrenched within the programme's core aims and objectives.		Managed by South African National Biodiversity Institute (SANBI) on behalf of the Departments of Environmental Affairs (DEA), Water Affairs (DWA), and Agriculture, Forestry and Fisheries (DAFF).	Current, since 2006		
Extended Public Works Programme (EPWP)	Working on Land	The objective of this programme is to manage natural resources in order to alleviate bush infringement/thickening, as well as loss of top soil. The first stage of the project is aimed at controlling bush encroachment – thinning teams have been put in place to control encroachment on about 1,526 ha of land.	Economic / Existing measure	DEA partnered with Land Care programme as well as other groups/ institutions (municipalities, famers, universities, schools, etc.)	April 2011 to March 2014	CO2	•Create new job opportunities; •Socio-economic benefits for local residents which ultimately contributes to the Expanded Public Works Programme (EPWP).
Forestry	Long Term Mitigation Scenarios (LTMS): Afforestation Projects (DEA, 2014j); (DEA, 2015b)	The rate of commercial afforestation is planned to increase from 2008 to 2030. This means that an additional 760,000 ha of commercial forests are to be planted by 2030. The National Terrestrial Carbon Sinks Assessment (NTCSA) was undertaken to assess the national carbon sinks in relation to afforestation, forest restoration, wetlands, agricultural practices and urban greening (DEA, 2015b)	Economic / Existing measure	Department of Environmental Affairs	Current: 2008- 2030	CO2	•Maintained ecosystems; •Water conservation; •Preservation of biodiversity; •Job creation.
Agriculture	Long Term Mitigation Scenarios (LTMS): Enteric fermentation (DEA, 2014j)	This programme plans to reduce enteric fermentation from cattle, by transferring free-range cattle to feedlots and feeding them high-protein, highly-digestible food.	None / Planned	Department of Environmental Affairs	2003- 2050	CO2	•Maintained ecosystems; •Water conservation; •Preservation of biodiversity; •Job creation.
Agriculture	Long Term Mitigation Scenarios (LTMS): Reduced tillage (DEA, 2014j)	This programme aims to reduce tillage on croplands in order to reduce soil erosion.	None / Planned	Department of Environmental Affairs	2003- 2050	CO2	•Saves labour and energy costs; •Benefits soil conservation.

3.2.4 Waste Sector

Table 25: Update on Waste sector mitigation actions, without quantified effects, reported in BUR-1

Theme	Name of Policy/ Instrument/ Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Organic Waste	National Organic Waste Composting Strategy (NOWCS) (DEA, 2013a)	This Strategy has been developed to promote composting as a method to beneficiate organic waste, and to divert organics from landfill disposal. Department of Environmental Affairs published drat Norms and Standards for Organic Waste Compositing in 2014. Organic Waste Composting pilot projects are underway in and Mpumalanga Gauteng Province	Economic / Existing measure	Department of Environmental Affairs	Current	CH4	•Reduce waste disposal costs
Waste Management	Municipal Solid Waste Tariff Strategy (DEA, 2012b)	The Municipal Solid Waste Tariff Strategy was developed in 2011. The Solid Waste Tariff Setting Guidelines for Local Authorities was published in May 2012; in line with the intentions of the National Waste Management Strategy. The Solid Waste Tariff Model was published in 2015	Regulatory, Economic, / Existing measure	Department of Environmental Affairs	Current	CH4	•Conserve space in existing landfills
Waste Recycling	Recycling and Economic Development Initiative of South Africa (REDISA) (DEA, 2012c)	The purpose of this initiative is to increase recycling, reuse of materials, and energy recovery. REDISA diverted over 79,000 tCO2 from the environment, thereby reducing the carbon footprint of the industry (http://www.redisa.org.za/)	Economic / Existing measure	Department of Environmental Affairs	Current	CO2	•Conserve space in existing landfills •Reduce pollution and energy consumption associated with the manufacture of new materials •Innovation and challenges (for example, the training and skills required for deconstruction) can help to attract and retain employees who are keen to develop new skills.

3.2.5 Financial Measures for Sector Mitigation

Table 26: Update on Financial Measures for mitigation actions, without quantified effects, reported in BUR-1

Theme	Name of Policy/ Instrument /Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Carbon Tax	Carbon Tax Bill Carbon Tax Policy	Carbon tax is to be implemented in order to allow business to internalise the negative effects of GHG emissions, by adjusting the price of such services and environmental goods accordingly. Carbon taxes will encourage behavioural transformation amongst consumers and producers, in support of greener, cleaner, more efficient and lower-carbon emitting technologies.	Regulatory / Draft – under development	National Treasury	Mid 2017 onwards	CO2, CH4, N2O, HFCs, SFs, PFCs.	•Facilitate the transition to a green economy •Environmentally sustainable growth •Job creation
Tax incentive for Energy Efficiency	Income Tax Act 58 of 1962; relating to the Industrial Production Policy incentive scheme (Section 12L) and the National Energy Act 34 of 2008, Section 19 read with the 'Regulation on the allowance for energy efficiency savings' (No. R.729).	Financial support measures for mitigation actions in energy sector. Tax rebates for the implementation of energy efficiency measures; including electricity, gas, diesel, waste heat etc., but excluding energy generated from renewable sources or co-generation. Renewable sources excluded are biomass, geothermal, hydro, ocean currents, solar, tidal waves or wind. The energy efficiency savings can be claimed for a consecutive period of 12 months. The incentive increased from 45 to 95 cents per kilowatt hour saved.	Economic / Existing measure	National Treasury, Department of Energy, SANAS accredits M&V bodies, who verify energy savings, for approval by SANEDI, prior to submission to SARS	Current (01 October 2013 to 31 December 2019).	CO2	•Reduce greenhouse gas emissions •Increase energy efficiency •Job creation
Environmental Tax on Energy Generation	Environmental levy for electricity generated in South Africa from non-renewable resources (fossil fuels) and environmentally hazardous (nuclear) sources. SARS Excise external standard in place. Energy charge on utility bills includes an environmental levy of 3.5 c/kWh, recovered from the consumer and paid to SARS.	Environmental levy for electricity generated in South Africa from non-renewable resources (fossil fuels) and environmentally hazardous (nuclear) sources. SARS Excise external standard in place. Energy charge on utility bills includes an environmental levy of 3.5 c/kWh, recovered from the consumer and paid to SARS.	Economic / Existing measure	National Treasury, Department of Energy, SARS, Generators of electricity from fossil fuels	Current	CO2	•Reduce greenhouse gas emissions; •Increase energy availability in the grid; •Job creation.

Theme	Name of Policy/ Instrument /Strategy/ Plan	Primary Objective(s) and Progress	Type of Instrument / Status	Administering government agency/ Actors	Time Horizon	GHG	Co-benefits
Environmental tax on Energy Efficiency	Environmental levy for Electric Filament Lamps (non-energy-saving light bulbs) manufactured in South Africa. The levy of 600 c/ lamp is self-assessed by licensed manufacturers per monthly Excise return and paid to SARS, in terms of the Schedules to the Customs and Excise Act, 1964 (Tariff Book) Part 3B.	Economic / Existing measure	National Treasury, Department of Energy, SARS, manufacturer, electricity users	Current	Current	CO2	•Reduce greenhouse gas emissions; •Increase energy efficiency; •Job creation.
Carbon Tax on Transport	Environmental Levy on Carbon Dioxide Emissions on New Motor Vehicles Manufactured in South Africa	A tax payable on new motor vehicles with CO2 emissions above specified thresholds, manufactured in or imported into South Africa. The main objective of this tax is to influence the composition of South Africa's vehicle fleet to become more energy efficient and environmentally friendly. The tax is included in purchase price of vehicle and passed through to SARS quarterly by the Merchant, in terms of the Schedules to the Customs and Excise Act, 1964 (Tariff Book) Part 3D.	Economic / Existing measure	National Treasury, SARS, Merchants; Consumers	Current	CO2	•Reduce greenhouse gas emissions; •Job creation.

3.3 ADDITIONAL MITIGATION ACTIONS NOT REPORTED PREVIOUSLY IN BUR-1

Mitigation actions that have been implemented in South Africa up until 2014, but which were not reported in BUR-1, are presented in this section. Additional information on the mitigation actions in the Energy, IPPU, AFOLU and Waste sectors are presented in **Table 27, Table 28, Table 29**and **Table 30,** respectively. Progress made with the implementation of these projects and achieved mitigation effect until 2016 will be provided in BUR-3.

3.3.1 Energy

Table 27: Additional mitigation actions in the Energy Sector, not reported previously in BUR-1

Name of Policy/ Instrument/ Strategy/ Action	Description of the mitigation action and Objectives	Type of instrument / Status of	Administering government agency/Actors	GHG	Estimated emission reductions (MtCO2e)	Co-benefits
Private sector related initiatives: Low carbon installation	Private companies, listed on the Johannesburg Stock Exchange (JSE), voluntarily reporting to the Carbon Disclosure Project (CDP) have adopted initiatives to implement various projects to reduce their emissions.	Economic / Implemented	Private sector and NBI	CO2	The estimated emission reduction is 317,919MtCO2e.	•Reducing GHG emissions •Socio-economic and environmentally sustainable growth
Green Fund: Bio-Waste Treatment and Combined Heat and Power Facility	The project aims to establish a bio digester that uses cow dung, blood and other organic waste as feedstock to capture methane and produce organic fertilizer. The methane is to be used as fuel in a Combined Heat and Power unit to generate electricity.	Economic / Project development phase	The DEA has appointed the Development Bank of Southern Africa (DBSA) as the implementing agent of the Green Fund.	CH4	Not available	•Reducing GHG emissions •environmental sustainability
Private Sector related initiative: Transport	Private companies, listed on the Johannesburg Stock Exchange (JSE), voluntarily reporting to the Carbon Disclosure Project (CDP) have adopted initiatives to implement various projects to reduce their emissions.	Economic / Implemented	Private sector and NBI	CO2	The estimated emission reduction is 36,669 MtCO2e.	•Reducing GHG emissions
National Hydrogen and Fuel Cell Technologies Research, Development and Innovation Strategy (HySA Strategy)	The HySA Strategy is in the second phase of implementation. The key goal of the HySA Programme Phase II is the deployment of 25 National Hydrogen and Fuel Cell Technologies (HFCT) by 2020 using HySA technology. Hydrogen power (generated in fuel cells) is used successfully to provide stand-by power in some schools in the Eastern Cape Province.	Research & Development / Implementation of Phase II	Department of Science and Technology, Hydrogen South Africa Centres of Competence, Department of Basic Education,	CO2	Not Available	•Energy security; •Diversification of energy mix; and •Socio-economic and environmentally sustainable growth •Improving education in this technology, and in these areas.
Green Fund: Organic Waste Treatment to Energy Project	The project involves investigating the feasibility of a dry anaerobic digestion (AD) facility to manually separate and recover food-waste and recyclables from existing mixed solid waste streams throughout the regions of Durban and the northern areas of Ballito. Methane biogas produced by the plant will be utilised for energy and heat generation.	Economic, project development phase	The DEA has appointed the Development Bank of Southern Africa (DBSA) as the implementing agent of the Green Fund.	CH4	Not available	Conserve space in existing landfills, compost from digestion and reduction in GHG emissions.

Name of Policy/ Instrument/ Strategy/ Action	Description of the mitigation action and Objectives	Type of instrument / Status of	Administering government agency/Actors	GHG	Estimated emission reductions (MtCO2e)	Co-benefits
South African Cities Network Green Transport Programme, 2014	The South African Cities Network Green Transport Programme forms part of the Transport Flagship Programme articulated in the National Climate Change Response White Paper. The purpose of the programme is to conduct research and pilots in green transport, review international best practice and local experience, evaluate the lifecycle costs and emission profiles of various green transport technologies, and develop a business plan to accelerate the adoption of green transport in member cities.	Economic, Planning phase	Department of Transport (DoT), and South African National Energy Development Initiative (SANEDI).	CO2	Not available	•Job creation; •Develop capacity building and strengthen institutions; •Reduction in fuel consumption; • Promote the development of green public transport; •Develop long term policy and implementation framework for clean transport; and •Initiate funding for clean transport measures.
Energy and Environment Partnership (EEP) Programme of Southern and East Africa, 2010	The EEP Programme is funded by the Ministry of Foreign Affairs of Finland (lead donor), UK Department for International Development (DFID) and the Austrian Development Agency (ADA). Promotes renewable energy, energy efficiency and clean technology investments.	Economic, Existing measure	Department of Energy (DoE)	CO2	Not available	•Reduce energy consumption; and •Reduce air pollution; •Reduce electricity bills; •Transfer and development of skills and expertise; •Job creation.
Diversification of electricity generation sources: Bio2watt Project	The Bio2watt project utilizes cattle and poultry manure in an animal management waste system in order to generate 3MW electricity. The project is in the process of being registered as a CDM project.	Economic, Existing measure	Private sector	CO2, CH4	The annual estimated emission reduction from the project is 0.4MtCO2e.	•Reduce GHG emissions •Reduce water pollution •Reduce waste production •Job creation. •Cleaner environment

3.3.2 Industrial Processes and Product Use Mitigation Actions

Table 28: Additional mitigation actions in the IPPU Sector, not reported previously in BUR-1

Name of Policy/Instrument/Strategy/ Action	Description of the mitigation action and Objectives	GHG	Type of instrument and status of instrument	Administering government agency/	Impact of the mitigation action	Type of instrument and status of instrument
Private sector related initiative: Fugitive and process emission reductions	Different companies voluntarily report to the Carbon Disclosure Project adopting initiatives to implement several projects to reduce their emissions.	CO2	Economic, Existing measure	Private Sector and NBI	The estimated emission reduction is 72 703 Mt-CO2e.	•Reduce air pollution; and •Transfer and development of skills and expertise along with job creation.
The Department of Trade and Industry's Incentive Schemes, 2005	Drive growth, direct foreign investment and promote competitiveness in the manufacturing sector, in line with the Industrial Policy Action Plan and the National Industrial Policy Framework. The incentive schemes that cover green technologies include the: •Capital Projects Feasibility Programme; •Critical Infrastructure Programme; and •Manufacturing Competitiveness Enhancement Programme.	CO2, CH4, N2O	Economic, Existing measure	Department of Trade and Industry's (DTI)	Not available	•Increase competitiveness of South African manufacturing companies; •Create new job opportunities; •Socio-economic and sustainable growth
Green Economy Initiative	Implement green economy programmes in conjunction with the private sector, civil society and all levels of government.	CO_2	Economic/ Implemented	Department of Environmental Affairs	Not available	•Reducing carbon emissions; •Job creation and skills transfer

3.3.3 Agriculture Forestry and Other Land Use Mitigation Actions

Table 29: Additional mitigation actions in the AFOLU sector, not previously reported in BUR-1

Name of Policy/ Instrument/Strategy/ Action	Description of the mitigation action and Objectives	GHG	Type of instrument and status of instrument	Administering government agency/ Actors	Impact of the mitigation action	Co-benefits
White Paper on Sustainable Forest Development in South Africa, 1997	Details regimes for sustainable forest management with the aim of promoting a thriving forest sector. South Africa is signatory to the convention on Biological Diversity and the Framework Convention on Climate Change and faces the task of turning them into national policy.	CO2, CH4, N2O.	Economic-Current	Department of Agriculture, Forests and Fisheries.	Not available	•Resource management; •Biodiversity benefits; and •Socio-economic and environmentally sustainable growth.
Kuzuko Lodge Private Game Reserve thicket restoration project.	The project will restore degraded thickets in the project area in Eastern Cape, SA, by planting cuttings of the indigenous thicket tree Portulacaria afra Jacq. (P.afra or spekboom) in the project area. Through the use of P.afra, the project aims to captures considerable amounts of carbon in biomass and soils, as has been demonstrated at several sites across the thicket biome.	CO2	Economic-Current	Private Sector	The proposed project will sequester approximately 2.4 million tonnes of carbon dioxide equivalent (CO2e) over a period of 54 years at an average rate of over 44,000 tonnes of CO2e yr-1. This assumes an average survival rate of 70 % for all P.afra cuttings planted in the Kuzuko project area.	•Increases biodiversity. •Reducing soil erosion and improving the stabilization of slopes. •Improving the functioning of the project area as a water catchment to supply high quality water to downstream dams. •Creating skilled and unskilled employment opportunities. •Contributing to local capacity building, environmental education, awareness and knowledge transfer.
The National Forests Act, No. 84, 1998	Promotes the sustainable management and use of natural forests and woodlands as well as forest plantations in South Africa.	CO2, CH4, N2O.	Regulatory	Department of Agriculture, Forests and Fisheries	Not available	•Improves biodiversity; •Natural resource management and other adaptation benefits; •Socio-economic and environmentally sustainable growth.

3.3.4 Waste Mitigation Actions

Table 30: Additional mitigation actions in the Waste sector, not reported previously in BUR-1

Name of Policy/Instrument/ Strategy/ Action	Description of the mitigation action and Objectives	Type of instrument and status of instrument	Administering government agency/	GHG	Co-Benefits
National Waste Management Strategy (DEA, 2011b)	Provide the overall approach of the National Waste Management Strategy, including the eight priority goals and accompanying objectives for its achievement. It also sets out the indicators to measure the achievements against targets which are to be met within a five-year time-frame. One of the key outputs is the reduction of GHG emissions to mitigate climate change and improve air quality.	Economic - Existing Measure	DEA Estimated emissions not quantified.	CO2, CH4, N2O.	•Reduce air pollution; • Encourages recycling and reuse; and •Conserve space in existing landfills •Proper waste management practices,
Green Fund Programme: Waste Beneficiation Centre	The project entails the construction of a waste management and beneficiation centre with incubator and training facilities. This will promote the creation of entrepreneurial skills for community based recycling of selected waste streams.	Economic,	The DEA has appointed the Development Bank of Southern Africa (DBSA) as the implementing agent of the Green Fund.	CH4	•job creation, •skills development, •recycling and re-use of resources.
Waste Management Flagship Programme 2015	Determine the Waste-Related GHG Emissions Mitigation Action Plan, including investigating waste-to-energy opportunities available within the solid-, semi-solid and liquid-waste management sectors, especially the generation, capture, conversion and or use of methane emissions.	Economic	DEA	CH4	•Efficient use of landfills, Contribution of the waste sector to the green economy

3.4 KEY ELEMENTS OF SOUTH AFRICA'S APPROACH TO MITIGATION

South Africa's overall approach to mitigation is informed by two contexts: first, its contribution as a responsible global citizen to the international effort to reduce global GHG emissions; and second, its successful management of the development and poverty eradication challenges it faces (DEA, 2011a). As South Africa is committed to keeping global warming to less than 2°C above pre-industrial levels, and has pledged to "deviate from business as usual", through the "peak, plateau and decline" in GHG emission of 34% by 2020 and 42% by 2025, below business-as-usual emission levels. South Africa's emissions by 2025 and 2030 are forecast to range between 398 Mt CO2e and 614 Mt CO2e (DEA, 2015c). Policy instruments to aid in achieving this are under development and include a carbon tax, desired emission reduction outcomes (DEROs) for sectors, company-level carbon budgets, as well as regulatory standards and controls for specifically identified GHG pollutants and emitters. This mix of policies and measures will be implemented at a national level over five-year periods. Specifically, the 2016 and 2020 phase will focus on developing and demonstrating the mix of policies and measures in order to meet South Africa's Cancun pledge. The 2021-2025 and 2026-2030 phases will focus on achieving the pledges made in the INDC. This level of effort will enable South Africa's greenhouse gas emissions to peak between 2020 and 2025, plateau for approximately a decade and decline in absolute terms thereafter.

South Africa's BUR-1 discussed four key mitigation initiatives led by Government in an effort to transition to a low-carbon economy, namely the Climate Change Flagship Programmes, the Mitigation Potential Analysis, Desired Emission Reduction Outcomes, and a Carbon Tax. The progresses made with these mix-of-measures are presented below.

3.4.1 Climate Change Flagship Programmes

The initial sets of Climate Change Near-term Priority Flagship Programmes were first described in the National Climate Change Response Policy (DEA, 2011a) and summaries of these were provided in BUR-1 (DEA, 2014b). There are nine main programmes in place with 43 distinct components in total, as listed in **Table 31** (below).

Each flagship is made up of sub-programmes, which are disaggregated further into separate projects, typically implemented at provincial and municipal level. The Climate Change Flagship Programmes are described in detail in South Africa's 1st Climate Change Annual Report (DEA, 2016e) and brief summary reports of progress made, since BUR-1 was published, are reported in **Chapter 7** below.

Table 31: South Africa's Climate Change Near-term Priority Flagship Programmes (DEA, 2016e)

Flagship Programme	Sub-Programmes Implemented
The Climate Change Response Public Works Flagship Programme	•Working for Water •Working for Wetlands •Working for Land •Working on Fire •Working for Energy •Working for Ecosystems •People and Parks •Greening and Open Space Management •Working on Waste •Working for the Coast •Working for Fisheries •LandCare
The Water Conservation Flagship Programme	•Development and implementation of WCWDM strategies •War on Leaks Project •The Accelerated Community Infrastructure Programme •The National Rainwater Harvesting Programme •WC/WDM target setting for metropolitan municipalities •The No Drop Assessment and Certification Programme
The Renewable Energy Flagship Programme	•Renewable Energy Independent Power Producer Procurement (REIPPP) Programme •National Solar Water Heating Programme •Eskom renewable energy projects •Off-grid household electrification •Green industries development •Green Energy Accord •Strategic environmental assessment for Renewable Energy Development Zones
The Energy Efficiency & Management Flagship Programme	•Integrated Demand Management Programme •Industrial Energy Efficiency •Residential Energy Efficiency Programme •Government Building Energy Efficiency Programme •Energy Efficiency Labelling Standards •Biofuels
The Transport Flagship Programme	•Integrated Rapid Public Transport Networks •Non-Motorised Transport Networks •Promotion of Fuel Efficiency Measures •Transport Modal Shifts •Taxi Recapitalisation Programme •Integrated Urban and Transportation Planning
The Waste Management Flagship Programme	•Landfill gas-to-energy projects •Diversion of waste from landfills •Biogas combined heat and power in wastewater treatment facilities
The Carbon Capture & Sequestration (CCS) Flagship Programme	•National CCS Roadmap Development, Implementation and Oversight •Pilot CO2 Storage Project & Pilot CO2 Capture Project
Long-term Adaptation Scenarios Flagship Research Programme	•Climate modelling and Development of adaptation scenarios for future climate conditions

3.4.2 Mitigation Potential Analysis

The Mitigation Potential Analysis (MPA) follows the Long-Term Mitigation Scenario (LTMS) to determine whether climate change goals are met in the country (DEA, 2014e). As part of the MPA process, GHG emission projections for the energy, transport, IPPU, AFOLU and waste sectors were made for 2020, 2030 and 2050 and are reported in more detail in South Africa's Third National Communication (TNC).

The MPA projections 'with existing measures' (WEM) and 'without existing measures' (WOM) are presented graphically in **Figure 22** (below), along with South Africa's Business-As-Usual (BAU) trajectory, the Peak-Plateau-Decline (PPD) projections, and the INDC commitments. The measured emissions from the National GHG Inventories from 2000 – 2012 are also presented in **Figure 22** to show that South Africa is on track to achieve its

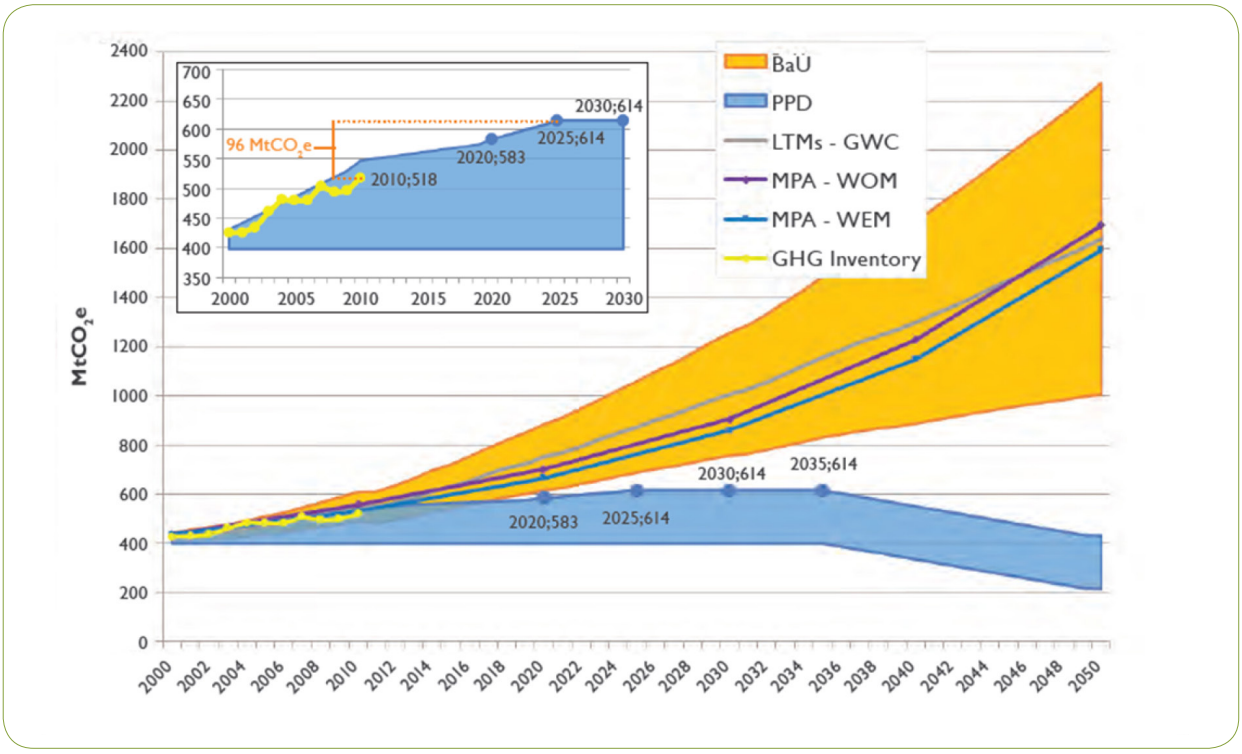


Figure 22: Tracking GHG emission reductions against the BAU, PPD and NDC projections (DEA, 2016e)

3.4.3 Desired Emission Reduction Outcomes and Carbon Budgets

The National Climate Change Response Policy (NCCRP) White Paper (DEA, 2011a) mandates that "carbon budgets" for significant emitting sectors be adopted through Desired Emission Reduction Outcomes (DERO's). DEROs are a set of emissions reduction goals for the long- (2050), medium- (2030), and short term (2016-2020), which collectively ensure that national emissions remain within the performance benchmark of the National GHG Emissions Trajectory Range specified in the NCCRP (also called the 'Peak, Plateau and Decline trajectory'). In respect of significant point source emissions, DEROs will be set for sub-sectors and ultimately company level where emissions are above the specific threshold. Phase 1 of the carbon budget system commenced on 1 January 2016 and ends on 31 December 2020 and is being implemented as a voluntary pilot to allow companies and the DEA the opportunity to prepare for a second mandatory phase, which will start in 2021. Key components of Phase 1 are:

Specification of the sectors and sources covered;

- List of participating companies, identified according to set criteria and in consultation with business;
- Carbon budget allocation to companies included in the list-Submission of Pollution Prevention Plans by companies which have allocated carbon budgets, as required in terms of regulations which are being finalised by the DEA.;
- Annual reporting of GHG emissions by companies, as contemplated in the DEA's draft reporting regulations;
- Annual reporting by companies of progress made with implementation of Pollution Prevention Plans (PPPs), as required by the draft PPPs-GHGs regulations; and
- A final comparison between a company's emissions during the Phase 1 carbon budget period, and the company's carbon budget, after the submission of the report on the company's emissions for 2020.

Carbon budgets are allocated during the first phase to support the current operations of companies, and to cover existing plans for expansion. Since the carbon budgets system will rely on the National Atmospheric Emissions Inventory System (NAEIS) currently under development, emissions coverage (in terms of activities, gases and company boundaries) of carbon budgets will be consistent with the reporting system.

While the possibility of flexible mechanisms to allow companies to transfer portions of their carbon budget between each other were proposed as an option for the carbon budgets system, these mechanisms will not be implemented in Phase 1. Since the carbon budgets will be non-binding in Phase 1, and because budgets will not be consistent with any national emissions goal, the transfer of unused portions of a company's carbon budget from Phase 1 to subsequent phases will not be allowed.

Scope 2 emissions (emissions produced elsewhere as a result of a company's electricity use) will NOT be included in company's carbon budgets. However, the possibility of crediting a company's carbon budget with emission reductions resulting elsewhere in the economy due to the company's increased electricity efficiency is being explored and may be introduced on a trial basis during Phase 1.

Any company emitting more than 0.1 Mt of GHGs annually, and who undertakes any of the following activities will be allocated a carbon budget:

- Coal mining;
- Production and/or refining of crude oil;
- Production and/or processing of natural gas;
- Production of liquid fuels from coal or gas;
- Cement production;
- Glass production;
- Ammonia production;
- Nitric acid production;
- Carbon black;
- Iron and steel production;
- Ferro-alloys production;
- Aluminium production;
- Polymers production; and
- Pulp and paper production.

In addition, any company producing electricity for public or private use by combusting fossil fuels, excluding the use of back-up generators will also be allocated a carbon budget. Furthermore, companies outside of those identified above, wishing to be allocated a carbon budget during Phase 1, may request the allocation of a carbon budget from the DEA. Participating company will be required to develop a Pollution Prevention Plan covering a 5-year period and to submit annual reports on progress made towards achievement of their budget.

It needs to be emphasised that during Phase 1, companies will not be legally required to limit their emissions to their carbon budgets. There will therefore be no legal consequences following companies exceeding their budgets during Phase 1. As indicated above, in Phase 1, companies will be required to comply with the process of allocating carbon budgets, by reporting their emissions and progress made with achieving their budgets, and to submit a final report after the conclusion of the first phase; indicating to what extent the company has complied with its carbon budget or not, and any other supplementary information required in terms of the Pollution Prevention Plan regulations. It needs to be emphasised that the nature of the compliance regime applicable during Phase 1 of the carbon budget system does not in any way exclude the companies of a more stringent compliance regime in subsequent phases.

3.4.4 Regulatory Standards for Specifically Identified GHG Pollutants and Emitters

The National Climate Change Response Policy (NCCRP) White Paper anticipated that the reporting of emissions data would be made mandatory for entities (companies and installations) which emit more than 0.1 Mt of GHG annually, or which consume electricity which results in more than 0.1 Mt of emissions from the electricity sector (DEA, 2011a). Qualifying entities would also be obliged to report energy use by energy carrier and other data as may be prescribed. To this end the draft declaration of the greenhouse gases; Carbon dioxide (CO2), Methane (CH4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF6), as 'priority air pollutants', under section 29(1), read with section 57(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) was published by the Honourable Minister of Environmental Affairs, Ms Edna Molewa on Friday, the 8th January 2016. Pollution Prevention Plans are required for a substance declared as a priority air pollutant.

The Minister also issued draft Regulations for Pollution Prevention Plans on the same day, which prescribe the requirements of Pollution Prevention Plans, in terms of section 29(3) of the Act, read with section 53(a) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). The regulations require a company conducting certain production processes and which emits more than 0.1 megatonne (Mt) of greenhouses gases per annum to prepare, submit and implement a Pollution Prevention Plan. The production processes include coal mining; production and/or refining of crude oil; production and/or processing of natural gas; production of liquid fuels from coal or gas; cement production; glass production; ammonia production; nitric acid production; carbon black production; iron and steel production; ferro-alloys production; aluminium production; polymers production; pulp and paper production; and electricity production (combustion of fossil fuels, excluding the use of back-up generators). Companies allocated carbon budgets have a mandatory requirement to compile Pollution Prevention Plans and periodic reporting of their progress towards implementation, which will help the country measure its contribution towards a global effort to reduce greenhouse gas emissions. The draft Declaration and Regulations were published in the South African Government Gazette No. 39578 as Notices No. 5 and 6 of 2016, respectively. These are also available on the Department of Environmental Affairs' website (https://www.environment.gov.za/legislation/gazetted_notices).

3.4.5 Carbon Tax

South Africa intends using a carbon tax as one of the market based instrument to lower greenhouse gas emissions. A carbon tax seeks to level the playing field between carbon intensive fossil fuel based firms and low carbon emitting sectors which utilise renewable energy and energy efficient technologies. Although a tax on emissions does not set a fixed quantitative limit on carbon emissions over the short term; a carbon tax at an appropriate level and phased in over time to the "correct level" will provide a strong price signal to both producers and consumers to change their behaviour over the medium to long term (National Treasury, 2010).

The National Climate Change Response Policy (NCCRP) (DEA, 2011a) and the National Development Plan (NPC, 2011) recognise carbon tax as an important instrument to ensure cost effective mitigation of greenhouse gases. The current design of the tax and the draft Carbon Tax Bill (National Treasury, 2015a) are the culmination of stakeholder consultations and revisions to the policy, since the publication of the Carbon Tax Discussion Paper (National Treasury, 2010). The draft Carbon Tax Policy Paper (National Treasury, 2013), taking into account public comments on the 2010 Discussion Paper, was published for stakeholder engagement in November 2013, followed by the draft Carbon Offsets Paper (National Treasury, 2014) published in April 2014. An overview of key milestones undertaken by the South African Government in the development of the carbon tax policy is presented in **Table 32** (below).

Table 32: Milestones for Carbon Tax policy development in South Africa

Date	Milestones reached
2006	Environmental Fiscal Reform Policy Paper
2007	Long Term Mitigation Scenario (LTMS)
December 2010	Carbon Tax Discussion Paper
2011	National Climate Change Response White Paper
May 2013	Carbon Tax Policy Paper
April 2014	Carbon Offset Paper
January 2015	Publication of Carbon Tax Bill for Public Consultation
2016	Revision of the Carbon Tax Bill Publication of the Draft Carbon Offset regulations and consultations
2017	Implementation of Carbon Tax (Carbon Tax Act to be promulgated).

The broad aims and key elements of the draft Carbon Tax Policy were discussed in BUR-1 (DEA, 2014) and the carbon tax design, as contained in the revised draft carbon tax bill (National Treasury, 2015a), provides for an initial relatively low marginal carbon tax rate of R120 per ton CO2e and a combination of tax-free thresholds of between 60% and 95%. This results in an effective tax rate of between R6.00 and R48.00 per ton of CO2e. The revised carbon tax design as contained in the Draft Carbon Tax Bill includes the following features:

- A basic 60% tax-free threshold during the first phase of the carbon tax, from implementation date up to 2020;
- An additional 10% cent tax-free allowance for process emissions;
- An additional tax-free allowance for trade exposed sectors of up to 10%;
- Recognition for early actions and/or efforts to reduce emissions that beat the industry average in the form of a tax-free allowance of up to 5%;
- A carbon offsets tax-free allowance of 5% to 10%;
- To recognize to role of carbon budgets, an additional 5% tax free allowance for companies participating in phase 1 (up to 2020) of the carbon budgeting system;
- The combined effect of all of the above tax-free thresholds will be capped at 95%; and
- An initial marginal carbon tax rate of R120 (approximately $13) per ton CO2e will apply.

The Carbon Tax will apply to all the sectors and activities except the AFOLU and Waste sectors, which will be exempt during the first implementation phase (up to 2020). However, combustion activities identified for emissions reporting under the National GHG Inventory will be subject to the tax. It is anticipated that the tax will come in effect from late 2017 and the emissions reporting for the carbon tax will be in line with mandatory reporting requirements for GHG emissions under the National Air Emissions Inventory System (NAEIS), discussed in more detail under **Chapter 6 Monitoring Reporting and Verification** (below).

3.4.6 Carbon Offsets

In order to increase the flexibility of the tax and complement the policy package to address climate change and protect households and businesses, the draft Carbon Offset Regulations were published under the Carbon Tax Bill. Section 12 of the Carbon Tax Bill states that "*a taxpayer may reduce the amount in respect of the carbon tax for which the taxpayer is liable in respect of a tax period by utilising carbon offsets as prescribed by the Minister*". This allows entities to reduce their carbon tax liability through the purchase of offsets of between 5% and 10%.

Carbon offsets involve specific projects or activities that reduce, avoid or sequester emissions and are developed and evaluated under specific methodologies and standards, which enable the issuance of carbon credits. The carbon offset component of the carbon tax has a dual purpose:

To serve as a flexibility mechanism that will enable industry to deliver least cost mitigation (i.e. mitigation at a lower cost to what would be achieved in their own operations) and thereby lower their tax liability; and
To incentivise mitigation in sectors or activities that are not directly covered by the tax and/or benefiting from other government incentives, especially transport, AFOLU and waste.

The carbon offset scheme will rely primarily on existing international carbon offset standards, such as the Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) and the Gold Standard (GS) and their associated institutional and market infrastructure. However, scope is also provided for the use of local standards and methodologies, where appropriate and independently verifiable (National Treasury, 2014).

It is expected that the creation of a domestic carbon offsets market, building on the capacity and experience with international carbon-offset standards, could provide further flexibility to the offset market in South Africa and enhance demand and supply of least-cost South African carbon offsets. Based on actual and estimated GHG emissions of South African companies in 2013, the national demand for carbon offsets generated by the carbon tax was expected to be in the order of 32 MtCO2e a year, culminating at 160 MtCO2e during the first 5-years of the tax (proposed as 2016-2020). A list of eligible projects that could generate carbon offset credits, is presented in **Table 33** (below).

A set of eligibility criteria for carbon offset projects has been drafted (National Treasury, 2014) to ensure effective implementation of the offset mechanism and these include:

Projects that generate carbon offset credits must occur outside the scope of activities subject to the carbon tax to ensure that no double-counting of tax benefits occurs;
Only South African based credits will be eligible for use within the carbon offset scheme; and
Carbon offset projects registered and/or implemented before the introduction of the carbon tax regime will be accepted subject to certain conditions and within a specific timeframe.

Table 33: GHG emission reduction projects eligible to generate carbon offsets

Sector	Eligible projects
Energy: Energy Efficiency (except projects claiming the energy efficiency tax incentive)	•Energy efficiency in the residential and commercial sector; •Energy efficiency in buildings; -Community-based and municipal energy efficiency and renewable energy; -Fuel-switching projects; •Electricity transmission and distribution efficiency.
Transport	•Public transport -Transport energy efficiency
Agriculture, Forestry and Other Land Use (AFOLU)	•Restoration of sub-tropical thicket, forests and woodlands: -Restoration and management of grassland; -Small scale afforestation; -Biomass energy; -Anaerobic biogas digesters; -Reduced tillage.
Waste	•Municipal waste projects.

The Designated National Authority (DNA), within the Department of Energy (DoE), which was established to support the development and implementation of CDM projects under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), will be responsible for administering the carbon offset scheme.

4. FINANCE, TECHNOLOGY AND CAPACITY-BUILDING NEEDS AND SUPPORT RECEIVED

4.1 CLIMATE FINANCE

According to National Climate Change Response Policy (NCCRP) White Paper "*Climate finance is defined as all resources that finance the cost of South Africa's transition to a lower-carbon and climate resilient economy and society. This covers both climate-specific and climate-relevant financial resources, public and private, domestic and international. This includes: financial resources that go towards reducing emissions and enhancing sinks of greenhouse gases; reducing vulnerability, maintaining and increasing the resilience of human and ecological systems to negative climate change impacts; climate-resilient and low-emission strategies, plans and policies; climate research and climate monitoring systems; as well as climate change capacity-building and technology*" (DEA, 2011a).

The NCCRP recognises the need to intensify the country's efforts to create, allocate and mobilise finance for climate change mitigation and adaptation, in addition to international support received. The different distribution channels in the financial system, such as domestic public finance, private sector finance and international climate finance sources are important development partners for the Government to be able to adapt to and mitigate climate change impacts.

Climate finance sources for South Africa can be classified into four different categories; bilateral finance, multilateral finance, domestic public finance and private sector finance. Support is classified as 'bilateral' if it comes from one donor country and as 'multilateral' more than one country/entity provide the support and it is channelled through one donor agency. Bilateral assistance for climate change comes in different forms; through individual donors, through donor agencies, directly in the form of Official Development Assistance (ODA) and through bilateral finance institutions.

4.2 SUPPORT RECEIVED

The financial support committed and non-monitised capacity building and technology support received from international sources, as well as domestic funds committed through government grants and loans are reported below.

4.2.1 International Financial Support Received

Detailed information on the breakdown of the international bilateral and multilateral financial support received for the period of 2000-2010 are presented in **Table 28** and **Table 29** respectively in South Africa's BUR-1, available on http://unfccc.int/resource/docs/natc/zafbur1.pdf. The graph in Figure 23 (below) presents the international financial support received for the period 2000 to 2010, as reported in BUR-1, and for the period 2010 to 2014, for the additional information reported in BUR-2 and presented in **Table 34** and **Table 35**(below).

Figure 23: Summary of international financial support South Africa received (2000-2014)

South Africa has received financial support of USD 156.0 million in the form of grants and USD 1,033.2 million in a form of loans over the period 2000 – 2014. The analysis of the bilateral grants and loans received/committed is presented graphically in **Figure 24** while the multilateral financial support received over the same period is presented in **Figure 25** (below). From the total support received/committed 55.8% was in the form of multilateral loans, while funding from bilateral loans made up 35.2% of the total international funding received/committed.

Table 34: Additional information on bilateral financial support committed between 2010 and 2014

Financial flows/ Support	Country	Amount in (ZAR)	Amount in USD	Type of funding Mitigation	Principal focus ODA	Co-financing (USD)	Specific purpose of funding
Grant	Australia	1 001 250	121 954	X	X		Retro-fit low income with energy efficiency measures
Grant	Australia	7 008 750	853 684		X		South African Land Sector Measurement, Reporting and Verification (MRV) Capacity building project.
Grant	Germany	1 000 663	121 883		X		To support the tracking of climate change response impacts of South Africa's national policies, strategies and plans, using the approach of the World Resources Institute's Greenhouse Gas Protocol: Policy and Action Standard and To support the implementation the overall National Climate Change Response Monitoring and Evaluation System as required by the National Climate Change Response Policy
Grant	Germany	1 004 000	122 289	X		256 808	Determining savings potential for optimising energy and resource efficiency in private sector.
Grant	Germany	1 194 760	145 524	X		339 965	Fabrication and installation of a biomass boiler at Backsberg vineyard in South Africa. The boiler generates thermal energy using grape pulp and root stock
Grant	Germany	3 440 948	419 116	X	X		The low carbon development framework project aims at providing input to the rollout of South Africa's National Climate Change Response Policy to maximize mitigation ambition with concrete sectorial targets, to deepen the understanding and reveal opportunities beyond the current economic trajectory. The project is implemented by the World Wide Fund for Nature (WWF)
Grant	Germany	1 947 760	237 242	X		551 527	Installation of a modern and highly efficient pump system at Morgenster Wine & Olive Estate in South Africa, for water and energy consumption optimisation
Grant	Germany	120 480 000	14 674 786		X		Skills development and promotion of innovations for climate and environment related employment (Skills for Green Jobs)
Grant	Germany	100 400 000	12 228 989		X		Climate programme for the support of the South African Department of Environmental Affairs
Grant	Germany	17 445 000	2 124 847	X	X	5175000	To support the Department of Energy and other implementing partners in improving strategies and programmes to enhance the uptake of renewable energies and energy efficiency measures.

Financial flows/ Support	Country	Amount in (ZAR)	Amount in USD	Type of funding Mitigation	Principal focus ODA	Co-financ-ing (USD)	Specific purpose of funding
Loan	France	440 055 000	53 599 878	X	X		The objective of AFD's Credit Facility is to facilitate and up-scale the financing of economically viable small and medium sized sustainable energy investments, in the areas of Greenfields Energy Efficiency and small scale Renewable Energy investments. Approximately 13 projects supported.
Grant	Sweden	2 657 133	323 646		X		International Training Program (ITP261) Climate Change- Mitigation and Adaptation Southern Africa (2009-2012)
Grant	Sweden	316 610	38 564	X	X		Sustainable biofuels in South Africa- Develop a plan for sustainable biofuels in South Africa (2013): The project aims to develop a business case for biofuels for fleet transport (buses/distribution trucks/waste collectors) within South Africa with a special focus on ethanol from waste in the Western Cape and surrounding areas
Grant	Sweden	1 949 333	237434	X	X		Promoting low carbon development in Cape town: The proposed project aims at developing a detailed low carbon programmatic component to support Cape Town's Energy and climate Change Action Plan.
Grant	Sweden	242 539	29542	X	X		Tricorona CDM (planning grant): This planning Grant is for Tricorona Climate Partner AB (TCP) to facilitate meetings and a feasibility study to assess specific cooperation possibilities for the South African market within the area of carbon Management plans/strategies.
Grant	Sweden	2 695 162	328278		X		Programs with partial support to climate initiatives: Demo Environment South Africa (2012-2014) Through call for applications partners in Sweden, in cooperation with partners in South Africa, are given an opportunity to carry out (ii) planning grant projects in the area of environment and climate, which have the potential to lead to long-term sustainable development not funded by development cooperation.
Grant	Sweden	68 167	8303		X		Minesto AB (Planning Grant): This planning grant has the main objective of establishing a (contractual) partnership between Swedish company Minesto AB and the South African partners Stellenbosch University and Sea Renewable Energy (Pty) Ltd within the field of ocean current technologies (OCT)
Grant	Sweden	8 583 858	1045537		X		The project support civil society organisations in the environment movement in South with regard to five sub-programs: Agriculture and Food Security, Climate, Marine Ecosystems, Chemicals and Forests.

Financial flows/ Support	Country	Amount in (ZAR)	Amount in USD	Type of funding Mitigation	Principal focus ODA	Co-financing (USD)	Specific purpose of funding
Grant	Sweden	9 269 582	1129060		X		The focus of the program was to take on urgent and prioritized infrastructure projects, from perception to implementation by providing hands on knowledge and tools for manager and specialists at regional organizations, public energy companies and national and local authorities for realization of projects in Southern Africa. The training in South Africa was mainly focusing on energy efficiency and bio energy
Grant	Switzerland	34 528 000	4 205 603		X		Switzerland is supporting the South-South technology transfer of the Vertical Shaft Brick Kiln. This energy-efficient technology considerably reduces coal consumption and cuts CO2 emissions by half. The first pilot plant was inaugurated in September 2011 in Jeffrey's Bay, Eastern Cape.
Grant	Switzerland	6 433 240	783 586		X		To support the establishment of sustainable skills development and capacity building systems in crucial areas for fostering energy efficiency measures in the building sector.
Grant	Switzerland	20 510 305	2 498 210		X		The overall goal of this project is that South African houses and buildings are built in compliance with best practices of the national standards for energy efficiency and use solar water heaters. To achieve this goal, Switzerland contribution will be to support the establishment of sustainable skills development and capacity building systems in crucial areas for fostering energy efficiency measures in the building sector.
Grant	Switzerland	27 000 000	3 288 672	X	X	2 436 053	The fund was used for Energy Management Systems (EnMs) Implementation. EnMS provide a framework for understanding significant energy uses; action plans to continually improve energy performance and documentation to sustain and demonstrate energy performance improvements over time.
Grant	Norway	33 286 191	4 054 347	X	X		The overall goal for the energy-programme is to contribute to sustainable access to all forms for energy and related opportunities, by various consumer groups.
Grant	Norway	5 641 956	687 205		X		Small scale operational support to faith based initiatives on environment and Climate Change. Focus on learning and exchange within the Faith Constituencies.

Financial flows/ Support	Country	Amount in (ZAR)	Amount in USD	Type of funding Mitigation	Principal focus ODA	Co-financing (USD)	Specific purpose of funding
Grant	Norway	20 614 336	2 510 881		X		South Africa-Norway Research Cooperation on Climate, the Environment and Clean Energy (SANCOOP) aims to contribute to expanded research opportunities and improve research cooperation based on equal partnership between South African and Norwegian researchers within the selected thematic areas, and the implementing agency is South Africa National Research Foundation.
Grant	Norway	5 309 266	646 683		X		The focus is on achieving climate resilient, low carbon development based on a 100% renewable energy and access to clean and safe energy for all. The Initiative work on the national level and with the corporate sector, and on international advocacy, including work with public finance.
Grant	Norway	931 000	113 389		X		Continuation of "continental dialogue on women and climate change, towards Durban". Advance gender perspective in climate negotiations and climate change agenda with partners in governments (DIRCO) and civil society.
Grant	United Kingdom	86 344 000	10 516 931	X	X		The National Business Initiative (NBI) has been awarded funding by the UK Government through its Department for International Development (DFID) to implement a countrywide programme of support to the private sector for Energy Efficiency improvement. The Private Sector Energy Efficiency Project (PSEE) aims to improve energy efficiency in commercial and industrial companies in South Africa through the provision of various services to assist companies in identifying and implementing energy saving measures
Grant	United Kingdom	12 000 000	1 461 632				Training courses in energy management systems (EnMS) and energy systems optimisation (ESO) were developed in partnership with UNIDO as part of the IEE Project. It consists of Energy Systems Optimisation and Energy Management Systems training and is offered at an Advanced and Expert level.

Table 35: Additional information on multilateral financial support committed between 2010 and 2014

Financial flows/ Support	Donor	Amount (USD)	Amount (ZAR)	Type of funding						Principal focus		Co-financing (USD)	Specific purpose of funding
				Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General	ODA	Non-ODA		
Grant	Adaptation Fund	2 442 682	200 054 419		X						X		The objective is to incorporate climate adaptation response strategies into local practices so that assets, livelihoods and ecosystem services are protected from climate-induced risks associated with expected droughts, seasonal shifts and storm-related disaster events. The project is taking place in Namakwa and Mopani district municipalities.
Grant	Adaptation Fund	7 494 055	61 526 191		X						X		Building Resilience in the Greater uMngeni Catchment. This project aims to reduce climate vulnerability and increase the resilience and adaptive capacity in rural and peri-urban settlements and small-scale farmers in productive landscapes in the uMgungundlovu District Municipality (UMDM), KwaZulu- Natal Province, South Africa, that are threatened by climate variability and change, through an integrated adaptation approach.
Grant	Global Environment Facility	304 506	2 500 000	X							X		To assist South Africa to conduct a survey on the consumption, production and application of Hydro Flouro-Carbons (HFCS) in South Africa.
Grant	Global Environment Facility	60 901	500 000	X							X		To conduct the transport modelling study.
Grant	Global Environment Facility	365 408	3 000 000	X							X		To assist South Africa to develop a country-specific CO2 emissions factor for the estimation of Greenhouse Gas (GHG) emissions for ferroalloy production in the metal industry.
Grant	Global Environment Facility	125 000	1 026 250						X		X		To update the Technology Needs Assessment of South Africa.

Financial flows/ Support	Donor	Amount (USD)	Amount (ZAR)	Type of funding						Principal focus		Co-financing (USD)	Specific purpose of funding
				Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General	ODA	Non-ODA		
Grant	Global Environment Facility	28 715	235 752						X		X		Development of Principles and Procedures governing the compilation of National Communication reports.
Grant	Global Environment Facility	115 000	944 150			X					X		Supporting the implementation of education; training and public awareness activities on climate change.
Grant	Global Environment Facility	4 222 110	34 663 523	X							X	25,450,000	Promoting Organic Waste-to-Energy and other Low-carbon Technologies in Small and Medium-scale Enterprises (SMMEs): Accelerating Biogas Market Development
Grant	Global Environment Facility	1 300 000	10 673 000									6,050,000	Energy Efficient Low-carbon Transport
Grant	Global Environment Facility	15 000 000	123 150 000	X							X	190,450,000	The Development Bank of Southern Africa is establishing an equity fund to remove financial barriers in the small scale Renewable Energy projects. The Fund is for the Small Projects Independent Power Producer Procurement Programme.
Grant	Global Environment Facility	1 800 000	14 778 000						X		X	180,000	Preparation of Intended Nationally Determined Contribution (INDC) to the 2015 Agreement under the United Nations Framework Convention on Climate Change (UNFCCC)
Loan	Clean Technology Fund	57 500 000	472 075 000	X							X		Expansion of the Approved South Africa Sustainable Energy Acceleration Program (SEAP)
Loan	Clean Technology Fund	250 000 000	2 052 500	X							X		Eskom Renewables Support, the project objective is to facilitate accelerated development of large scale renewable energy capacity in support of the long-term carbon mitigation strategy of South Africa.

Financial flows/ Support	Donor	Amount (USD)	Amount (ZAR)	Type of funding						Principal focus		Co-financing (USD)	Specific purpose of funding
				Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General	ODA	Non-ODA		
Loan	Clean Technology Fund	15 000 000	123 150 000	X							X		Energy Efficiency Program seeks to encourage transformation of the energy efficiency sector by establishing a source of funding. The goal of the program is to address energy efficiency improvements for the commercial, industrial, and municipal sectors with a particular focus on smaller-scale energy efficiency projects for the SME sector and, use of ESCos (Energy Service Companies) as effective energy efficiency project aggregators. The program is a joint initiative of the International Finance Cooperation and African Development Bank (AFDB).
Loan	Clean Technology Fund	85 000 000	697 850 000	X							X		Sustainable Energy Acceleration Program aims to support and enable the first megawatt scale private-sector wind and solar projects and significant expansion of private sector cogeneration in South Africa. The program is a joint initiative of the International Finance Cooperation, African Development Bank and Private sector.
Grant	UNIDO	1 827 040	15 000 000	X							X		The IEE Project equips companies to systematically target selected systems within their processing facilities and interrogate their performance and effectiveness.

Financial flows/ Support	Donor	Amount (USD)	Amount (ZAR)	Type of funding						Principal focus		Co-financing (USD)	Specific purpose of funding
				Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General	ODA	Non-ODA		
Grant	Energy Environment Partnership Fund	4 928 660	40 464 299	X							X		Energy and Environment Partnership programme is funded by the ministry of Foreign Affairs of Finland (Lead donor), UK Department for International Development (DFID) and Austrian Development Agency. The overall objective of the EEP is to reduce poverty by promoting inclusive and job-creating green economy and by improving energy security in the Southern and East Africa regions while mitigating global climate change. The fund focuses on renewable energy and energy efficiency projects that are at an early stage of implementation, including demonstrations and small pilot projects. In South Africa, the management and implementation of the programme is coordinated by the KPMG.
Loan	European Investment Bank	170 523 751	1 400 000 000	X							X		The Development Bank of Southern Africa entered in agreement with European Investment Bank (EIB) to support the development of the !Ka Xu 100 MW concentrated solar power in Northern Cape Province.
Loan	European Investment Bank	133 982 947	1 100 000 000	X							X		To support Eskom's 100 MW concentrated solar power plant in Northern Cape Province.
Loan	European Investment Bank	61 144 945	502 000 000	X							X		To support 50 MW concentrated solar project in Northern Cape.
Loan	European Investment Bank	61 144 945	502 000 000	X							X		To establish a renewable energy facility to support renewable energy projects and energy efficiency activities.
Loan	World Bank	250 000 000		X							X		South Africa - Eskom Renewables Support Project
Loan	World Bank	3 750 000		X							X		Eskom Investment Support Project

The bilateral loans and grants received/committed per donor country is presented graphically in **Figure 24** (below), indicating 67.9% of the bilateral funds were received in the form of loans from Germany, 19% as loans from France, while the remaining 13.1% was grant funding received from various donor parties, as depicted in **Figure 24**

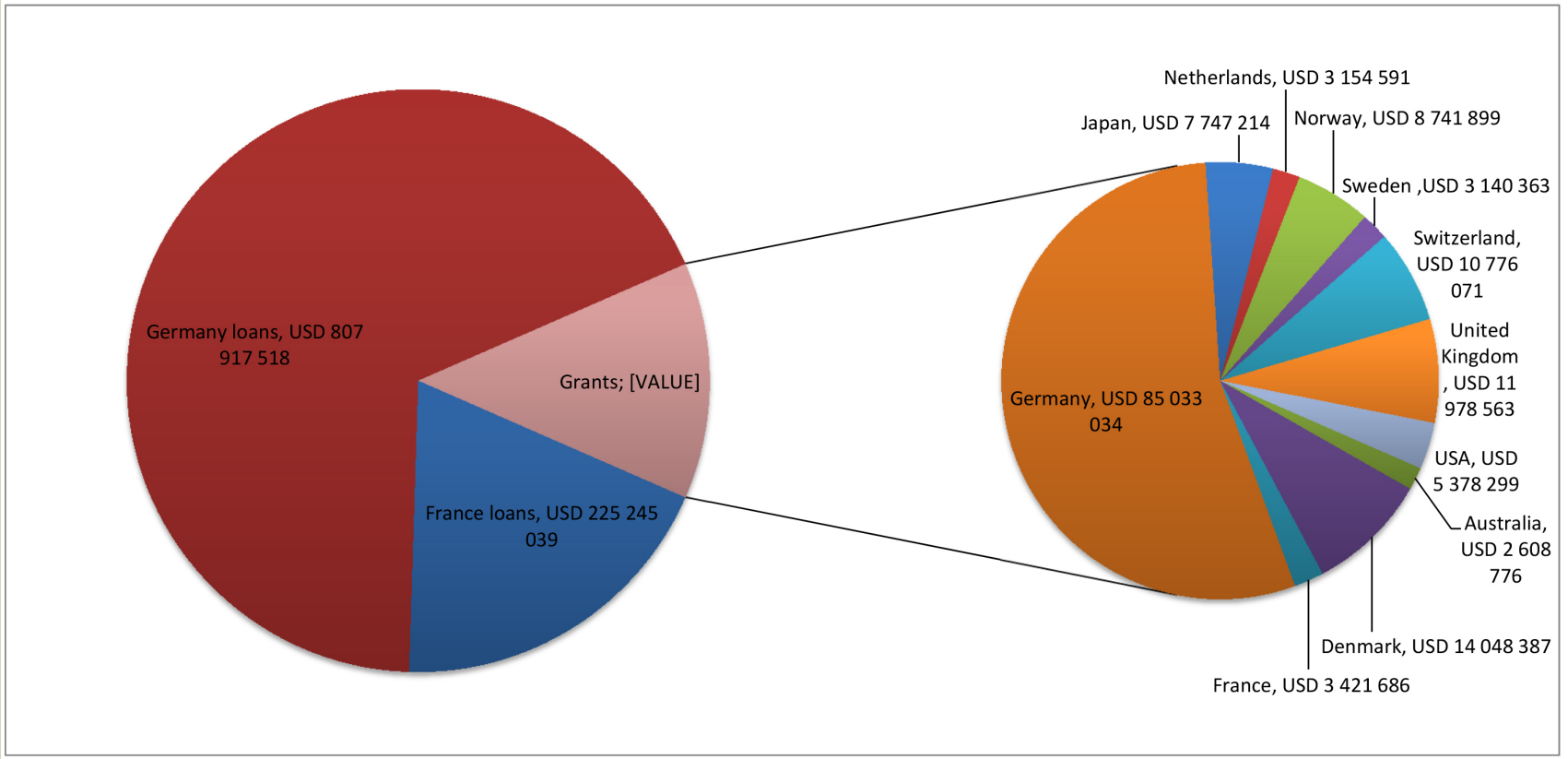


Figure 24: Analysis of bilateral support committed/received (2000-2014)

An analysis of multilateral support South Africa received for the period of 2000-2014 is shown in **Figure 25** (below). The contribution received/committed as loans (pie chart on the left), make up 92.9% of the multilateral funds received. Nearly half of the multilateral loans were received through the Clean Technology Fund at USD 907.5 million (49.7%), with USD 426.8 million (23.4%) channelled through the European Investment Bank, USD 261.1 million (14.3%) channel through the World Bank and USD 231.2 million (12.7%). The contributions received/committed as grant funding is depicted in the pie chart on the right. Most of grants (82.1%, USD 1239.9 million) were received through the Global Environment Facility

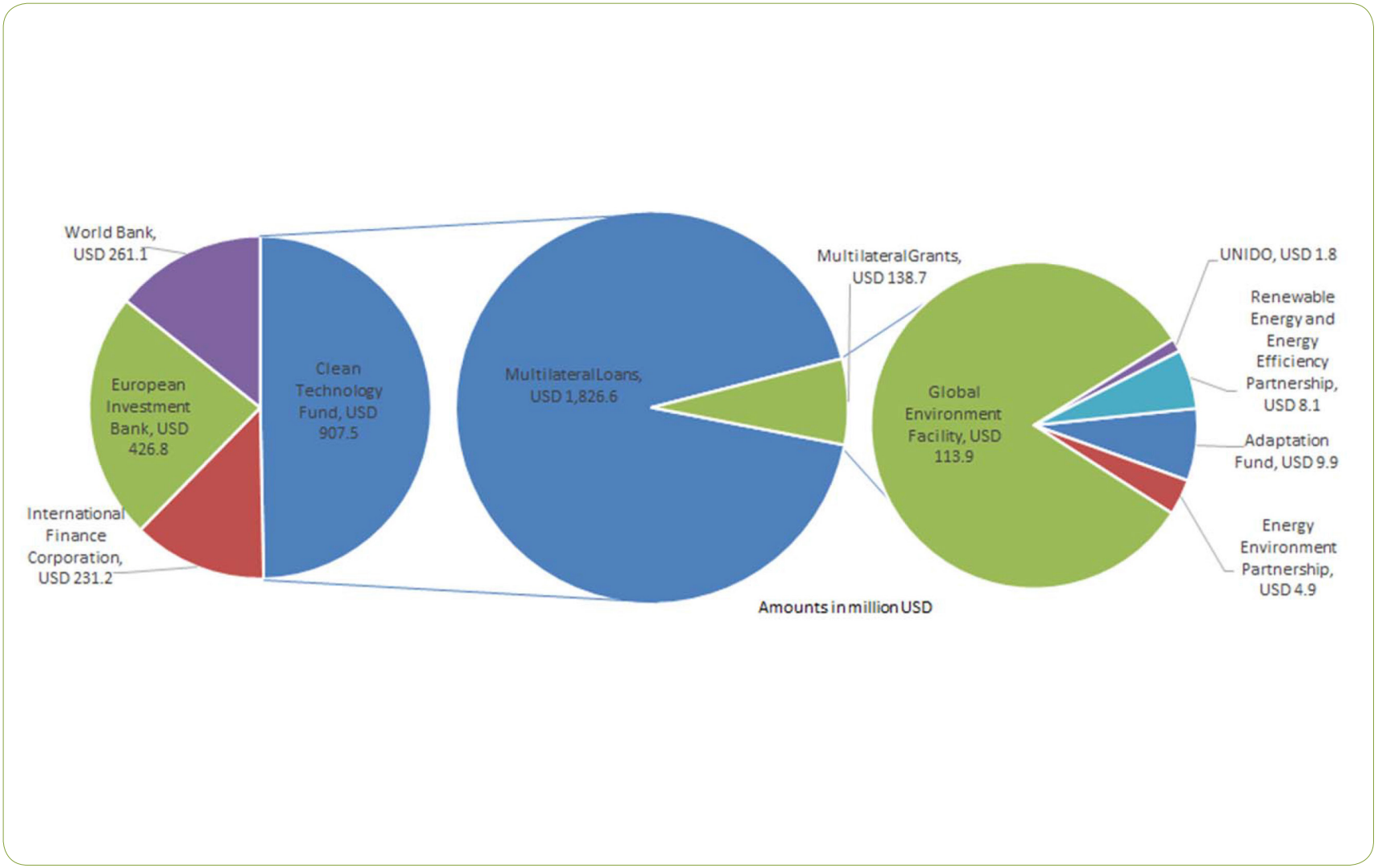


Figure 25: Analysis of multilateral support committed/received (2000-2014)

4.2.2 Domestic Financial Flow for Climate Change Response Actions

The government of South Africa has an important role to play in creating conditions for inclusive economic growth and development and to establish the appropriate economic framework to encourage the shift towards environmentally cleaner technologies and low carbon activities. South Africa has made commitments to climate related investments in the country and as a result several funds have been created specifically for climate change initiatives. These include the Green Fund, managed by the Development Bank of Southern Africa (DBSA) and the Department of Environmental Affairs (DEA), the Green Industries Fund, managed by the Industrial Development Corporation (IDC) and the Energy Efficiency and Demand-side Management programme managed by the Department of Energy (DoE). Although Table 30 in BUR-1 states the domestic finance flow is reported for the period 2000 to 2010 in both US Dollar (USD) and South African Rand (ZAR), by applying the average exchange rate for 2010. Some values reported included data up until 2012, to which the 2010 exchange rates were erroneously applied. The information has been corrected in **Table 36** below by applying the annual exchange rates, released by the Presidency as part of the annual Development Indicator reports, namely R6.82, R8.21, R10.50 and R11.58 for the years 2010 to 2014 respectively (where project data could be segregated). A summary of all domestic finance committed to climate change response actions between 2000 and 2014 is presented graphically in **Figure 26.**

Table 36: Domestic financial flows between 2008 and 2014

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	Department of Trade Industry (MCEP administered by Industrial Development Corporation)	Manufacturing Competitiveness Enhancement Programme (MCEP)	1 297 734 532	12 005 250 000	X						The MCEP provides financial incentives to encourage manufacturers to upgrade their production facilities by making use of green technology and resource efficiency improvement.	Green technology upgrades lead to cleaner production and energy efficiency. From June 2012 to January 2015, 2,033 applications were received and of these 814 were approved for funding.
Grant	Department of Trade Industry, South Africa's National Cleaner Production Centre (NCPC-SA) hosted by the Council for Scientific and Industrial Research (CSIR), United Nations Industrial Development Organisation (UNIDO) is the implementing agent.	Industrial Energy Efficiency (IEE) Project	4 371 585	32 000 000	X		X	X	X		To promote the implementation of resource efficiency and cleaner production (RECP) methodologies and assist industry to lower costs through reduced energy, water and materials usage, and waste management.	Over the 4-year period (2010-2014) IEE Projects have been implementation in 54 industry plants, resulted in energy savings of 571 GWh = R344 million and GHG mitigation of 568,000 tCO2e.

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
		The NCPC-SA's Internship Programme trained 22 engineering graduates, and assessments by interns and their mentors identified R33.5 million in savings in 16 plants in 2013/14. Adoption by the plants resulted in actual resource savings to the value of R27.2 million, and Interns facilitated implementation of interventions that realised savings worth R3 million.										

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grants and Loans	Department of Environmental Affairs (Managed and implemented by Development Bank of Southern Africa (DBSA)	Green Fund Investment Projects	45 726 861	529 517 046	X	X	X	X	X		Green Fund provides support through the Green Cities and Towns, Low Carbon Economy and Environmental and Natural Resources Management windows to enable the implementation of innovative green projects capable of demonstrating social, economic and environmental impact.	Innovative projects leading to additional green economic activity. Key economic impacts include private sector participation and leveraging. Economic impacts include job creation and green skills training. Environmental impact spans a number of domains, which include renewable energy, protected habitats and waste that is recycled. The initial request for proposals were opened in September 2012 and 14 projects were approved in 2013, and the Green Fund project investment portfolio totalled 23 projects by February 2015 (DBSA, 2016).
Grant	Department of Environmental Affairs (Managed and implemented by Development Bank of Southern Africa (DBSA)	Green Fund Research Projects	3 132 134	36 270 177			X	X			Applied research and policy development to advance South Africa's green economy expansion. Providing an opportunity to the research community to build a knowledge-, economy- and evidence base for expanding South Africa's proposed green economy transition.	The 16 research projects funded in the 2013/14 financial year are developing new knowledge areas and contributing towards building capacity in applied research by providing insights into the innovative policies, products and processes to support SA's transition to a green economy. Researchers conducted include the development of green technologies, in energy, agriculture and recycling, as well as innovative planning and finance models.

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	Department of Environmental Affairs (Managed and implemented by Development Bank of Southern Africa (DBSA)	Green Fund Capacity Building Projects and Programme	5 697 246	65 974 110			X				Capacity development initiatives – cross-cutting and catalytic in nature. Programmatic and national level projects in the climate change, renewable energy, green jobs, green enterprises, green skills and green economy knowledge development.	Lessons learned from the capacity building interventions will form an integral part of the evidence base of the Green Fund and also shape future investments. In addition, the capacity development funding programme is likely to deliver the types of systemic changes required to achieve strengthened capacities and abilities to transition to a greener development path. 8 initiatives received funding.
Loan	Industrial Development Corporation	Green Energy Efficiency Fund	54 921 687	562 000 000	X	X	X	X			Funding for small-scale renewable energy and energy efficiency projects.	Since the launch of the GEEF in October 2011 and March 2014, 19 projects have been approved, with a projected annual energy saving of 388.6 MWh, and an associated reduction in Greenhouse Gas emissions of 385.1 tons CO2-equivalent per annum. (IDC, 2014). In the 2014-15 financial year 12 projects totalling R366 million were approved, which will achieve 523 000 MWh in energy savings annually, and an associated reduction in greenhouse gas emissions of 480 000 tonnes CO2–equivalent per year (IDC, 2015).

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	National Treasury (Managed by Department of Energy)	Energy Efficiency and Demand-side Management funding program	216 674 657	1 781 762 000	X		X	X	X		Build capacity and establish EE funding streams to support the implementation of the EE demand side management programme at the municipal level in South Africa	500 Gigawatt (GW) of electricity saved from municipal EEDSM measures; primarily by retrofitting lighting in buildings, LED street-lighting, the installation of smart meters, water and sewage pumps.
Grant	National Treasury (managed by Department of Environmental Affairs)	National Expanded Public Works Programmes: Environment and Culture programmes	1 318 879 415	10 828 000 000			X			X	Creates employment in the environment, culture, social and non-state sectors; through implementing green economy projects.	Programmes implemented include: •Working for Forests •Working for Water •Working for Land •Working for Wetlands •Working on Fire •Working for Waste •Working for Coasts? •Working for Ecosystems
Grant	National Treasury (Managed by Provincial Departments of Agriculture, Land Use and Planning)	Municipal Expanded Public Works Programmes: Land Care programme grant	347 258 796	2 775 402 000			X			X	Provincial Grant allocation to Municipalities for poverty relief, infrastructure development, to improve productivity and build resilience in local communities.	Sustainable natural resource use and value-add processing to local agriculture (Lets Respond Toolkit, 2012)

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	ESKOM	Integrated Demand Management (IDM) fund	812 109 200	6 644 000 000			X		X	X	Electricity savings, enhancing sustainability Approved projects, structured to sustain verified electricity savings during weekday evening peak periods.	Programmes implemented to manage demand and improve energy efficiency include: i) Demand Response Programme – a combined certified (instantaneous, supplemental and standby generation) capacity of 1,356MW dispatchable load; ii) Energy Efficiency in the residential sector - a total of 390,643 compact fluorescent lamps (CFLs) installed against a target of 500,000; iii) Eskom internal energy efficiency (IEE) saving initiatives -focussed on lighting, heating, ventilation and air-conditioning iv) Power Alert and "5pm to 9pm" campaigns: to reduce power demand during the evening peak through awareness and behaviour change; an average impact of 339MW achieved on the worst-constrained days, in April and July 2014. (Eskom, 2015).

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	Department of Energy and ESKOM	Integrated National Electrification Programme (INEP)	4 655 886 359	37 439 569 000	X		X		X		To ensure universal access, efficient delivery and affordable electricity, by expanding infrastructure into rural areas. This includes access to grid and off-grid electrification (e.g. solar heating systems)	
Grant	Department of Energy in partnership with the South African National Energy Development Institute (SANEDI) and the South African Centre for Carbon Capture & Storage (SACCCCS).	Southern African Carbon Capture & Storage (SACCS) grant	812 109 200	6 644 000 000	X		X	X	X		CCS plays a critical role in reducing CO2 emissions from large point sources such as industrial facilities and power plants. (SACCCS 2015 Annual Report). The objective of the Pilot CO2 Storage Project is to inject +10,000 tonnes of CO2 per year into the selected geological storage site.	The South African CCS Roadmap milestones reached include: • 2004 - Assessment of the potential for CCS in South Africa; and • 2010- Development of a South African CO2 Geological Storage Atlas The Pilot CO2 Storage Project is underway and expected to be completed in 2017. The third SACCCS Conference was held in 2013.

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Grant	Department of Transport	Municipal Public Transport Infrastructure grant	2 548 749 865	20 578 000 000	X				X		To promote public transport access and mobility, sustainable public transport and provide rural pubic and scholar transport.	Bus Rapid Transport (BRT) System is operational in 4 major cities, infrastructure development taking place in four other major cities and expected to be completed in 2018. The Taxi Recapitalisation Programme, Non-motorised Transport (NMT) Programme and Shova Kalula National Bicycle programme being rolled-out.
Grant	Department of Science and Technology	Sector innovation and green economy	363 184 273	3 264 061 000	X	X	X		X		Research and development in energy security, space science and bio-economy. Aims to support 8 demonstration plants for energy research, development and innovation capabilities for sustainable development and the greening of the economy.	Various energy programmes and initiatives (renewable energy, energy efficiency, solar and transportation) underway in accordance with the Global Change Research Plan (GCRP). The HySA Systems is one of three national Competence Centres initiated by the DST's National Hydrogen and Fuel Cells Technology Flagship Project – also known as Hydrogen South Africa (HySA).

Financial flows/ Support	Institution facilitating the transfer of support	Scheme	Amount in USD	Amount (ZAR)	Type of funding						Specific purpose of funding	Outcome (Where Available)
					Mitigation	Adaptation	Capacity Building	Technical Support	Technology support	General		
Conditional Grant	National Disaster Management Centre (NDMC) in the Department of Cooperative Governance	Municipal Disaster Grant	137 530 209	1 051 261 000		X	X				Introduced in 2011 as an unallocated grant to local government. The NDMC can disburse disaster-response funds immediately without the need for the transfers to be gazetted first. Grant provisions of R1.1 billion made for 2011-2014.	Relief provided to local municipalities for extreme events (wild fires, storms, floods, droughts).
Conditional Grant	National Disaster Management Centre in the Department of Cooperative Governance	Municipal Disaster Recovery Grant	28 045 347	312 593 000		X	X				Funds to rehabilitate and reconstruct municipal infrastructure damaged by disasters.	

The South African government has invested approximately 11.7 billion USD in the form of grants and 71.8 million USD in the form of loans to support climate change related programmes from 2008 to 2014, as depicted in Figure 26 below.

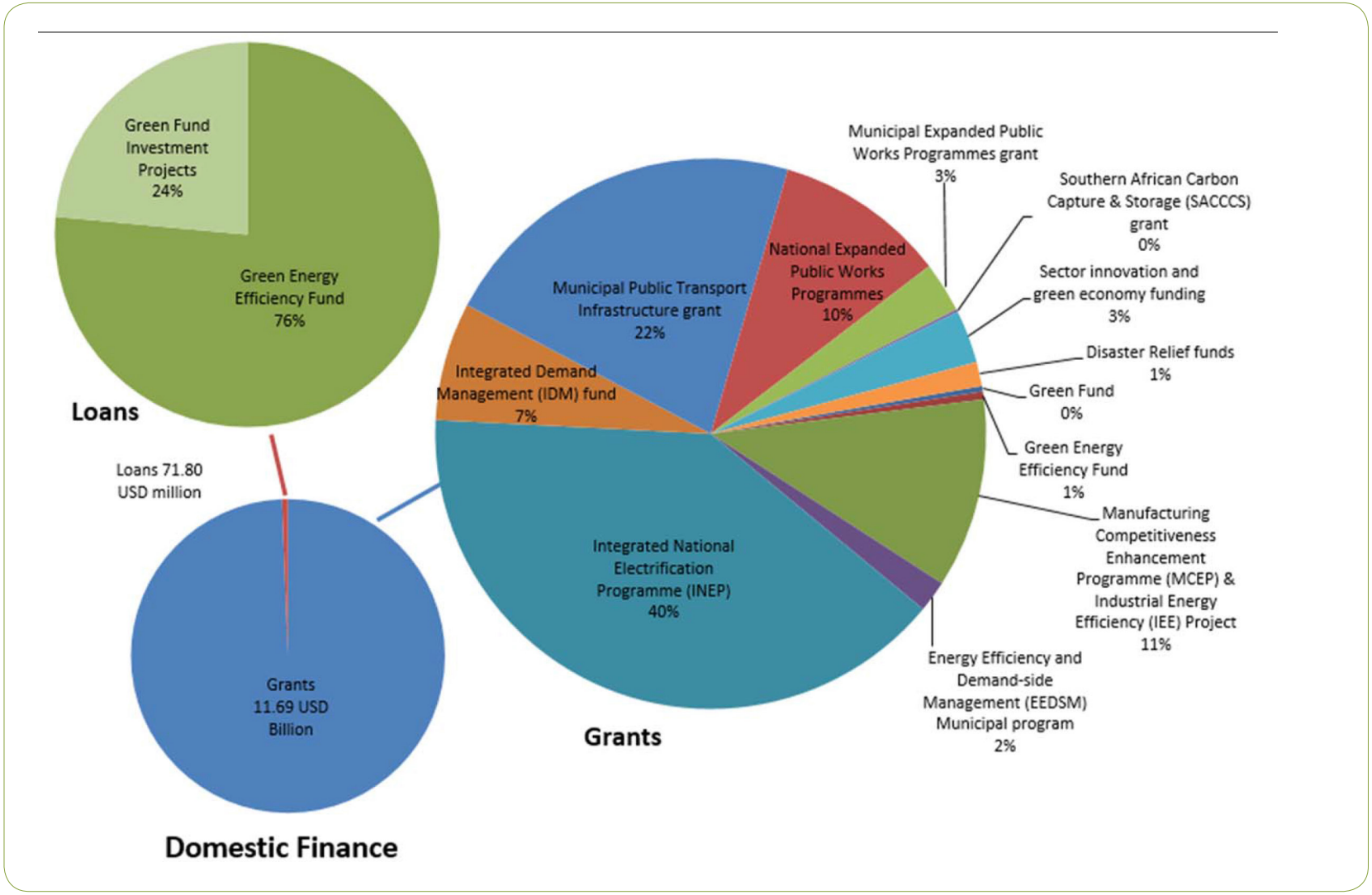


Figure 26: Summary of domestic funds that impact climate change responses (Source: compiled from (National Treasury, 2015b)

4.2.3 Non-monitised Support Received

In addition to the technical and capacity building support received over the period 2000-2010, as reported in **Table 31** of BUR-1 (DEA, 2014b), South Africa continues to receive non-monitised support from developed countries in the form of technical support and capacity building, as summarised in the **Table 37** (below).

Table 37: Non-monetised capacity building and technology support received

Type of support	Activity	Focus	Timeframe	Donor
Technical support	The Industrial Energy Efficiency Project assists companies in developing and implementing an energy management system in line with the SANS/ISO 50001 Energy Management Standard, and support companies' efforts to achieve this certification. ISO 50001 is the only standard that impacts directly on the company's bottom line, as it aims to reduce overall operating costs by driving down energy spending.	Mitigation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).
Capacity Building	Training in various systems including Steam, Pumps, Fans, Motors and Compressed Air.	Mitigation and Adaptation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).
Technical Support	Assisting companies with technical support regarding implementation of saving opportunities identified and assisting in ISO 5001 accreditation	Mitigation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).

Type of support	Activity	Focus	Timeframe	Donor
Technical support	The Industrial Energy Efficiency Project assists companies in developing and implementing an energy management system in line with the SANS/ISO 50001 Energy Management Standard, and support companies' efforts to achieve this certification. ISO 50001 is the only standard that impacts directly on the company's bottom line, as it aims to reduce overall operating costs by driving down energy spending.	Mitigation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).
Capacity Building	Training in various systems including Steam, Pumps, Fans, Motors and Compressed Air.	Mitigation and Adaptation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).
Technical Support	Assisting companies with technical support regarding implementation of saving opportunities identified and assisting in ISO 5001 accreditation	Mitigation	Project Phase 1: 2010- 2015	The Swiss Secretariat for Economic Affairs (SECO) and the UK Department for International Development (DFID). The IEE Project is implemented by the United Nations Industrial Development Organization (UNIDO) and the National Cleaner Production Centre of South Africa (NCPC-SA).

Type of support	Activity	Focus	Timeframe	Donor
Technical Support	Green Energy Efficiency Fund (GEEF): This Fund supports the implementation of energy efficiency and personal utilisation of renewable energy technologies. The Fund also supports South Africa's economic development and growth and facilitates access to international and local technical experts who will: • Perform energy evaluations and audits to recommend sustainable energy solutions; • Conduct economic evaluations of solutions; and • Support the selection of suitable equipment and enhanced performance technologies.	Mitigation	2010-2013	Industrial Development Corporation (IDC), German Cooperation and Development Ministry and KfW Bank.
Capacity Building	Analysing untapped potential and elaborating lists of measures for optimising energy and resource efficiency in private sector.	Mitigation	2012-2015	German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMUB)
Capacity Building	System operation and maintenance course of biomass boiler. The boiler generates thermal energy using grape pulp and root stock	Mitigation	2012-2016	German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMUB)
Capacity Building	System for Land Based Emissions Estimations for Kenya (SLEEK) Workshop: The purpose of the workshop was to provide training on how to estimate GHG emissions and removals in the AFOLU sector.	Mitigation	October 25th – 28th 2015.	Australia
Capacity Building	Agriculture & Land Use (ALU) software for calculating emissions in the AFOLU sector	Mitigation	15-19 August 2016	USAID

4.3 SUPPORT NEEDS

4.3.1 Financial Support Needed

South Africa's NDC (DEA, 2015c) presents the support needed for climate change mitigation and adaptation actions and reports that a key challenge is to catalyse the financing of and investment towards a low-carbon and a climate-resilient economy. In this regard, the NDC shows indicative scales of finance and investment required for climate change mitigation and adaptation based on specific sector initiatives. The financial investments required by South Africa will enable and support the technology and capacity building required in order to govern, regulate, install and operate these technologies.

A summary of the financial support that South Africa needs (or has requested) in order to develop its response to climate change is presented in **Table 38** (below). The table classifies the support needed in terms of the sector or cross-cutting area, together with the outcome/purpose of the activity.

Table 38: Financial Support required

Sector and acitivty	Reference to policies and measures	Specific type of support requested				Funding amount broken down by preferred type	
		General	Technology	Training	Loan	Grant	In-kind
Renewable energy, including off-grid and mini grid	Energy Efficiency and Demand Side Management Municipality Programme	X				X	
Biogas and bio-fuels	National Industrial Biofuels Strategy (NIBS)	X				X	
Rural energy, including off-grid and mini grid	Integrated National Electrification Programme (INEP)	X				X	
Renewable energy	Renewable Energy Independent Power Producer Procurement (REIPPP) Programme	X				X	
Water Conservation and Demand Management	Working for Water and Working on Wetlands	X				X	
Integrated Fire Management	Working on Fire	X				X	
Land Restoration	Land Policy and Working for Water	X				X	
Sustainable transport	Intelligent Transport System (ITS)	X				X	
Rural adaptation projects and plans	Climate Change Awareness Campaign and the National Adaptation Strategy (in the process of Development)	X				X	
Bio-digestion demonstration centre	South African National Energy Development Institute (SANEDI)	X				X	
Local government climate change adaptation: A municipal support project	National Climate Change Response Policy	X				X	

Sector and acitivty	Reference to policies and measures	Specific type of support requested				Funding amount broken down by preferred type	
		General	Technology	Training	Loan	Grant	In-kind
Integrated Energy, Environment, Empowerment-Cost Optimisation Methodology (iEEECOTM) flagship programme	National Climate Change Response Policy	X				X	
ElectricVehicles and Hybrid Electric Vehicles	Green cars to the Department of Environmental Affairs' vehicle fleet as well as to South Africa in general	X				X	
Carbon Capture and Storage	National climate change response Policy	X				X	
Decarbonisation of the electricity sector	National Climate Change Response Policy	X				X	

4.3.2 Technical and Capacity-Building Needs

Constraints and gaps, mainly related to initiation, implementation and scaling-up of the mitigation actions include the lack of MRV methodologies to validate and verify the emission reduction potential of projects (e.g. projects in waste, energy and transport) and institutional arrangements and human capital to effectively implement projects under the Flagship Programmes. Technical and capacity-buildings needs identified for South Africa are recorded in Table 39 (below).

Table 39: Summary of non-monetized Support Needs

Activity	Type of Support	Focus
Localisation of climate change mitigation technologies	Technical	Mitigation and Adaptation
Costing of Technologies	Capacity Building	Mitigation and Adaptation
Alignment of the GHG emissions inventory compilation process with the South African Standard Quality Assessment Framework of Statistics South Africa.	Capacity Building	Mitigation
Performing Mitigation Potential Analysis (MPA)	Capacity Building	Mitigation
Compilation of greenhouse gas inventories for domestic and international reporting	Capacity Building	Mitigation
Training of Provincial and Local Government on projects design and implementation	Capacity Building	Mitigation and Adaptation
Development and maintenance of greenhouse gas inventory management systems for data storage and archiving	Capacity Building	Mitigation
Testing of CO2 storage across different cap rocks in the country	Technical	Mitigation
Partner to lead the Climate Change Adaptation Small Grants Project.	Capacity Building	Adaptation
Use of waste material (wood, paper, cardboard, textiles, plastics, rubber/tyres, industrial sludge, municipal sewage sludge, and animal meal and fats) as a fuel source in the industrial sector.	Technology	Mitigation
Energy/waste recovery from furnaces and kilns.	Technology	Mitigation
Test the potential installation of combined cycle generation technologies/carbon capture and storage (CCS) systems at existing industrial facilities.	Technology	Mitigation
Development of MRV methodologies to validate and verify the emission reduction potential of projects (e.g. projects in waste, energy and transport)	Capacity Building	Mitigation
Institutional arrangements and human capital to effectively implement projects under the Flagship Programme.	Capacity Building	Mitigation and Adaptation

4.3.3 Technology Needs Assessment

Technology transfer is a key aspect of achieving the country's developmental goals. In 2007, the Department of Science and Technology (DST) completed a Technology Needs Assessment (TNA), which identified and assessed environmentally sound technologies which would reduce the impact of climate change and the rate of GHG emissions.

The Department of Science and Technology in collaboration with DEA is currently working on an updated version of the TNA which is a two-year project envisaged for completion in 2017. The outcomes 2007 TNA study will be reported in detail in South Africa's Third National Communication report to the UNFCCC.

5. SUPPORT RECEIVED FOR PREPARATION OF BUR

South Africa requested support from the Global Environmental Facility (GEF) to compile and publish BUR-1. Due to the delay of funding process, the approved funding from GEF for BUR-1 was reallocated to compiling BUR-2.

5.1 CAPACITY BUILDING AND TECHNICAL SUPPORT RECEIVED

South Africa appointed a service provider to compile BUR-1, while BUR-2 was developed internally by the Department of Environmental Affairs within the Chief Directorate for Climate Change Monitoring and Evaluation. This enabled the country to strengthen capacity building within the DEA. The South African government represented by the DEA applied and received full-size project funding for the development of the TNC and BUR. DEA applied part of the funding received from GEF, to appointed two (2) contract staff to assist in compiling both BUR-2 and the Third National Communication (TNC). The quality control of BUR-2, the 5th National GHG Inventory were enabled by appointing external service providers, through funding provided by the GEF using UNEP, as the implementing agency.

5.2 CHALLENGES AND CONSTRAINTS

The main challenge that South Africa faced during the compilation of BUR-2 was during the data collection process. This affected the accuracy and completeness of the National GHG Inventory, as elaborated on in more detail under the discussion on capturing data in the National Climate Change Response Database (NCCRD) in **section 6.3** in the MRV in South Africa Chapter. Other constraints included (a) the lag phase in the release of annual reports or statistics from various stakeholders making it a challenge to obtain data for the latest years; (b) issues of confidentiality and the supply of emissions data from data sources without the activity data or details of the methodology; (c) the lack of frequent and consistent land use change data and classifications across the years; (d) data availability and (e) the uncertainty of the data. The main constraint for the AFOLU sector was that land use change data was required and the new maps were developed while the inventory was being prepared. This land use data was therefore provided very late in the compilation process which lead to delays in the completion of the AFOLU sector estimates as well as the combined sector estimates.

6. MEASUREMENT, REPORTING AND VERIFICATION IN SOUTH AFRICA

6.1 SOUTH AFRICA'S CLIMATE CHANGE MONITORING AND EVALUATION SYSTEM

6.1.1 An Overview of South Africa's Climate Change Monitoring and Evaluation System

Based on the requirements of the National Climate Change Response Policy (DEA, 2011a) and the National Development Plan (NPC, 2011), South Africa's overall climate change monitoring and evaluation system addresses the measurement, monitoring and evaluation of climate change impacts and responses and aids in compiling the National GHG Inventory.

The National Climate Change Response Monitoring and Evaluation System is broadly composed of the three elements shown in **Figure 27** (below).

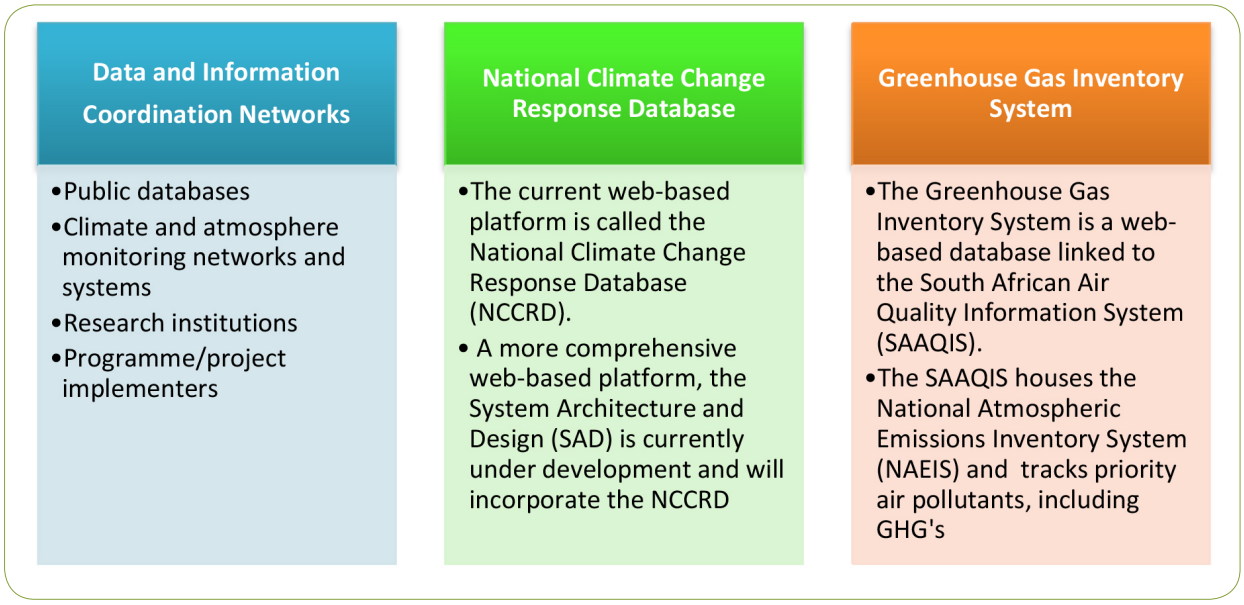


Figure 27 : Main elements of South Africa's Climate Change MRV system

In South Africa, Measurement, Reporting and Verification (MRV) is framed in terms of "Monitoring and Evaluation" (M&E). The 'monitoring' component of M&E is viewed to encompass MRV as a whole, while the 'evaluation' component focuses on the continuous assessment of the implementation and success of responses to climate change. The National Climate Change Response M&E System covers all other aspects of climate change M&E and includes the GHG inventory as a key component of this system.

It is through this overall system that monitoring of all climate change information, policies, strategies and actions will be undertaken, including information for the Carbon Tax, the Carbon budgets and Pollution Prevention Plans. **Figure 28** (below) provides a comprehensive overview of the South Africa's climate change monitoring and evaluation system.

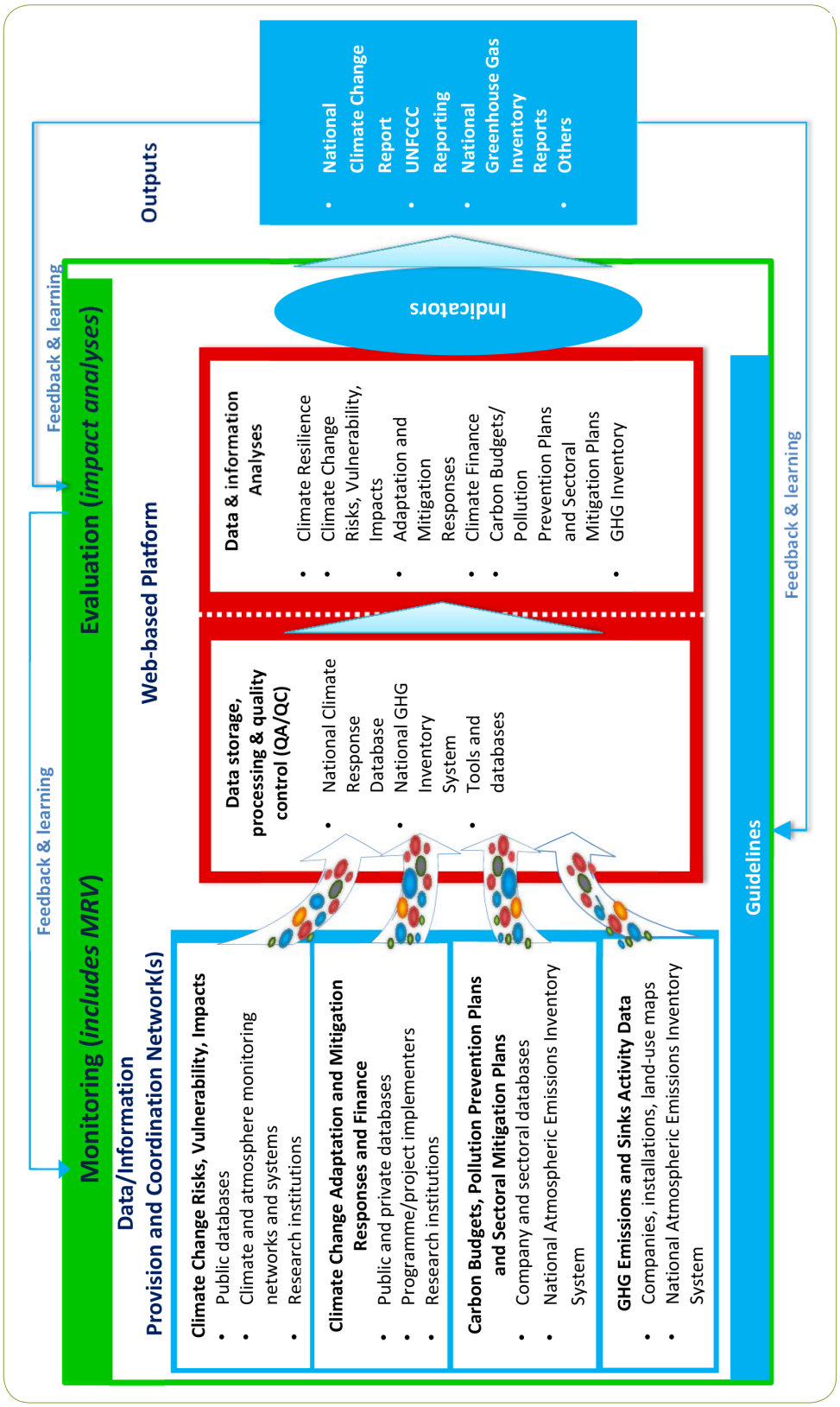


Figure 28: South Africa's National Climate Change Responses M&E System

The individual components of the M&E system are described in more detail below and additional information is also available in 'Theme B of South Africa's 1st Annual Climate Change Report' (DEA, 2016d).

6.1.2 The National Climate Change Response Database

The NCCRD currently serves only as a basic monitoring tool. Since 2013, data capturing was performed by contracted data collection and entry officers. **Figure 29** and **Figure 30** provide examples of the information and reports drawn from the NCCRD; on climate change mitigation and adaptation response actions as well as research undertaken.

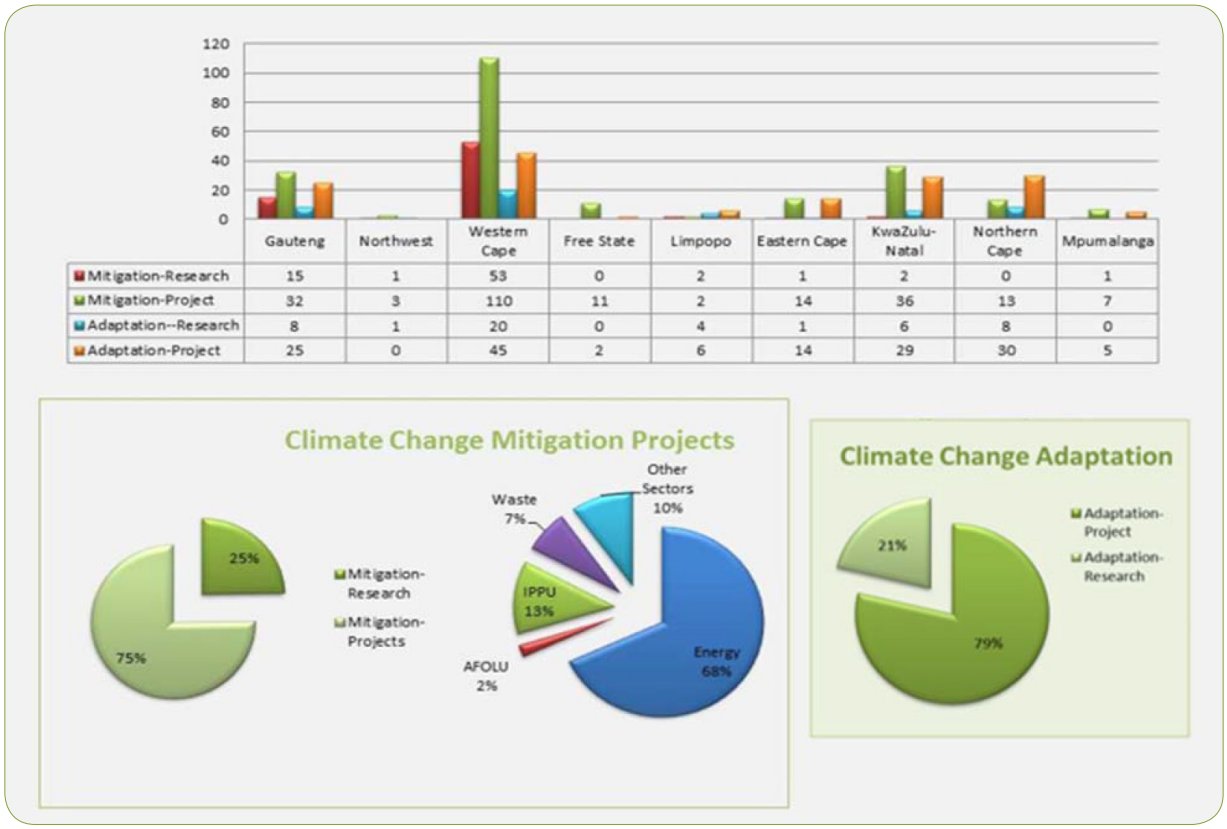


Figure 29: Mitigation and adaptation – NCCRD output results for each sector(DEA, 2016g)

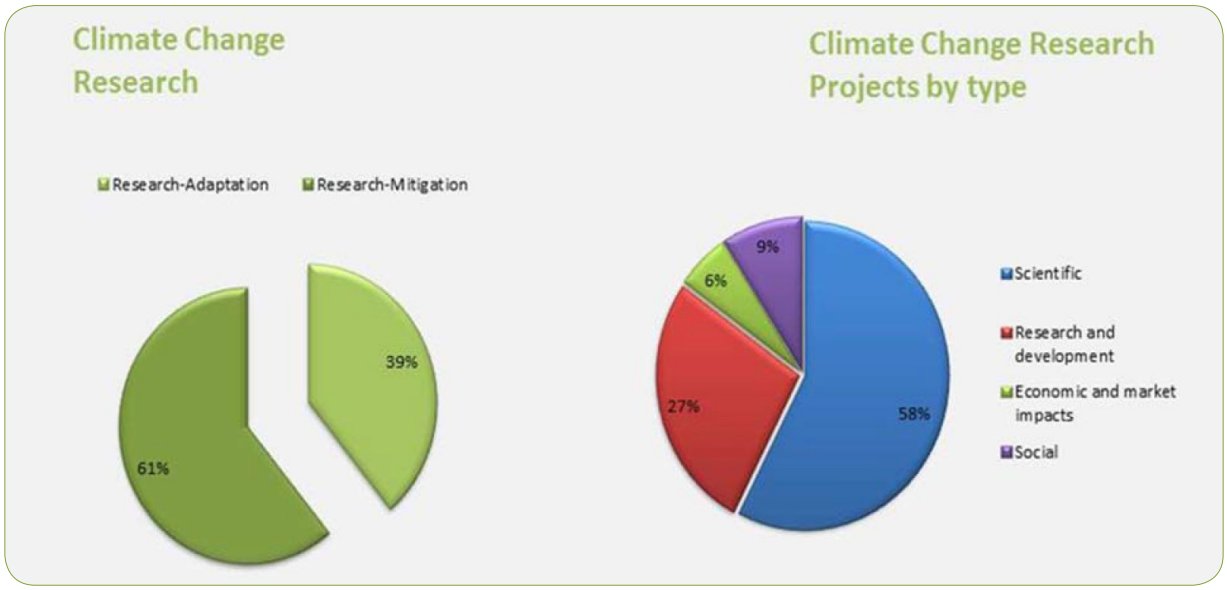


Figure 30: Climate change research – NCCRD output results for types of research(DEA, 2016g)

6.1.3 Tracking Transition to a lower-carbon economy

The approach to tracking South Africa's transition to a lower-carbon economy is based on a tiered approach, as shown in **Figure 31** (below). Specific indicators and data for each tier include:

Tier 1: country level information that provides a top-down perspective;
Tier 2: indicators and data required to track mitigation at sectoral, sub-sectoral and company levels, including Pollution Prevention Plans for companies with carbon budgets and progress towards achieving the Desired Emission Reduction Outcomes (DEROs) in key economic sectors; and
Tier 3: specific data and indicators for individual response measures, such as a programme or an individual project which contributes directly to climate change mitigation.

Tier 1: Country level indicators: Indicators that track the extent to which the country is achieving a lower-carbon economy.

Tier 2: Sectoral, sub-sectoral & company level indicators: This tier tracks the desired emission reduction outcomes and implementation of company-level mitigation plans.

Tier 3: Response measure level indicators: Indicators of the impact of individual response measures.

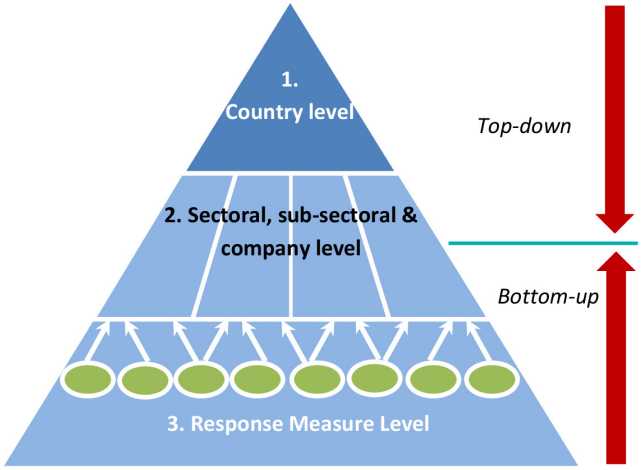


Figure 31: The tiered approach to tracking transition to a lower carbon economy

Core indicators to be tracked for Tier 1 and 2 are listed in **Table 40** below. In addition to these core indicators, other indicators may be identified, analysed and reported from time to time, as deemed necessary.

Table 40: Core Tier 1 and Tier 2 indicators to be tracked through the M&E system annually

Indicator Group	Tier 1: Country Level	Tier 2: Sectors, Sub-sectors and Companies
Sustainable carbon levels	National GHG emissions profile	Sector, subsector or company annual GHG profile
	Net change in the national GHG profile	Net change in the GHG profile of the sector, subsector or company
	Collective mitigation impact of all response measures	Collective mitigation impact of response measures
Lower carbon productivity	Carbon intensity of the economy	Carbon intensity of the sector or subsector
	Energy intensity of the economy	Carbon intensity of service or product delivered by the sector, subsector or company
Lower carbon consumption	Per-capita GHG emissions	—
Lower carbon resourcing	Proportion of renewables and carbon-free energy to total primary energy	Proportion of renewables or zero-carbon energy to total energy use
	Carbon intensity of energy supply	Energy use
		Energy intensity of production or service-delivered
Lower carbon sector growth	Growth in green jobs nationally	Growth in green sector or subsector jobs

6.1.4 Tracking Transition to a climate-resilient South Africa

South Africa's approach to climate adaptation will be achieved *"through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity"* (DEA, 2011a).

Consistent with the requirements of the NCCRP (DEA, 2011a), tracking the transition to a climate resilient society is based on three building blocks which are further unpacked into key elements as shown in **Figure 32.**

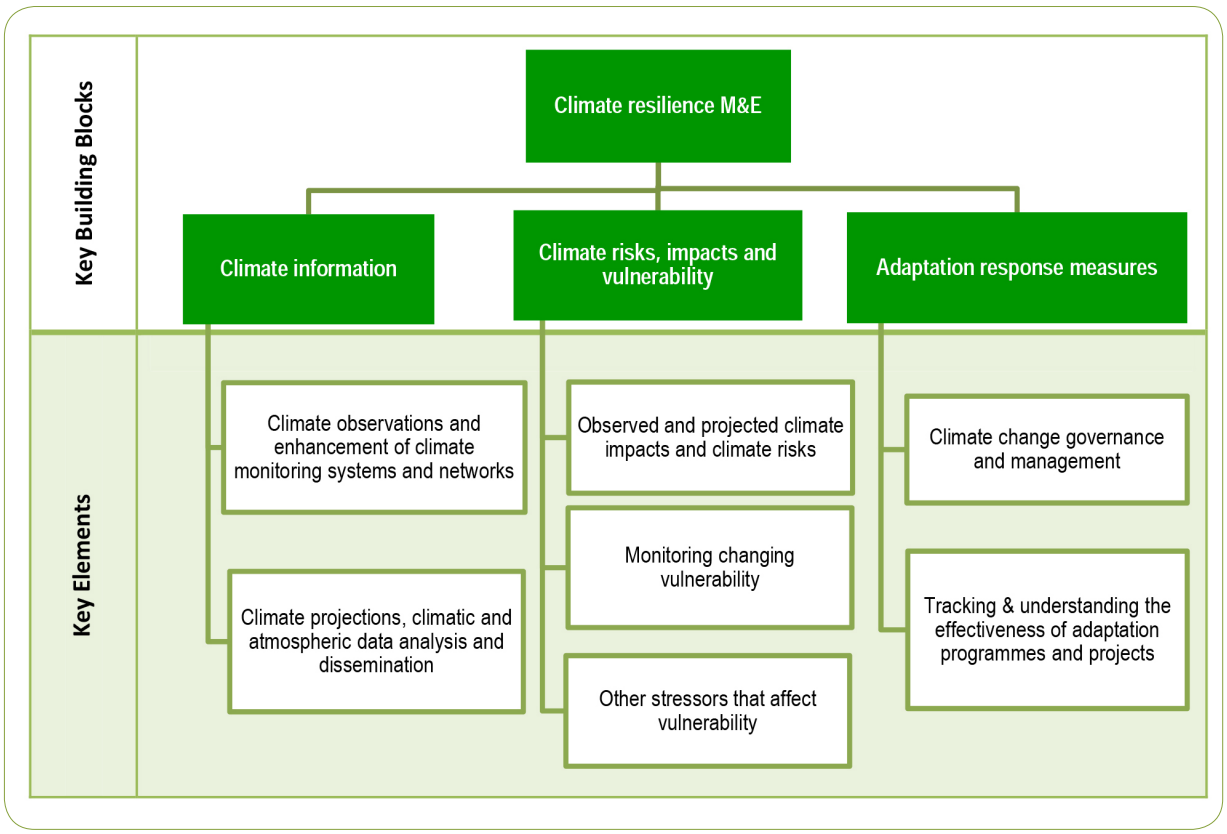


Figure 32: Building blocks and key elements of M&E of climate resilience (DEA, 2016d)

The information necessary to monitor and evaluate climate resilience covers the following elements:

- Development of desired adaptation outcomes;
- Mapping the state of knowledge under desired adaptation outcomes;
- Tracking the progress in implementation under each desired adaptation outcomes; and
- Evaluating the effectiveness of the activities undertaken

Tracking South Africa's transition to a climate resilient society will also encompass:

- Compilation and communication of existing relevant quantitative and qualitative data / information that could usefully indicate whether the country's social, economic and environmental systems are becoming more resilient to climate change over time; and
- Generation of lessons learned that will enhance stakeholders' understanding of the country's climate change impacts, risks and vulnerabilities, which in turn could help to identify approaches that are effective in reducing those impacts, risks and vulnerabilities.

6.1.5 Tracking climate finance

The overall approach to tracking climate finance flow will incorporate both top-down monitoring of climate finance from source-level and bottom-up monitoring of finance at the final point of impact as follows:

Top-down: the collection and tracking of climate finance information through the funder or the implementing agency; and
Bottom-up: focusing on collecting information at the level of the response measures.

This includes collecting financial or cost information together with information collected for tracking adaptation and mitigation response measures as described in the sections above.

Correlating the bottom-up and top-down finance / cost information will assist in assessing the extent to which climate finance is meeting the objectives of transparency, effectiveness and proper financial planning. **Figure 33** illustrates this overall approach to climate finance M&E.

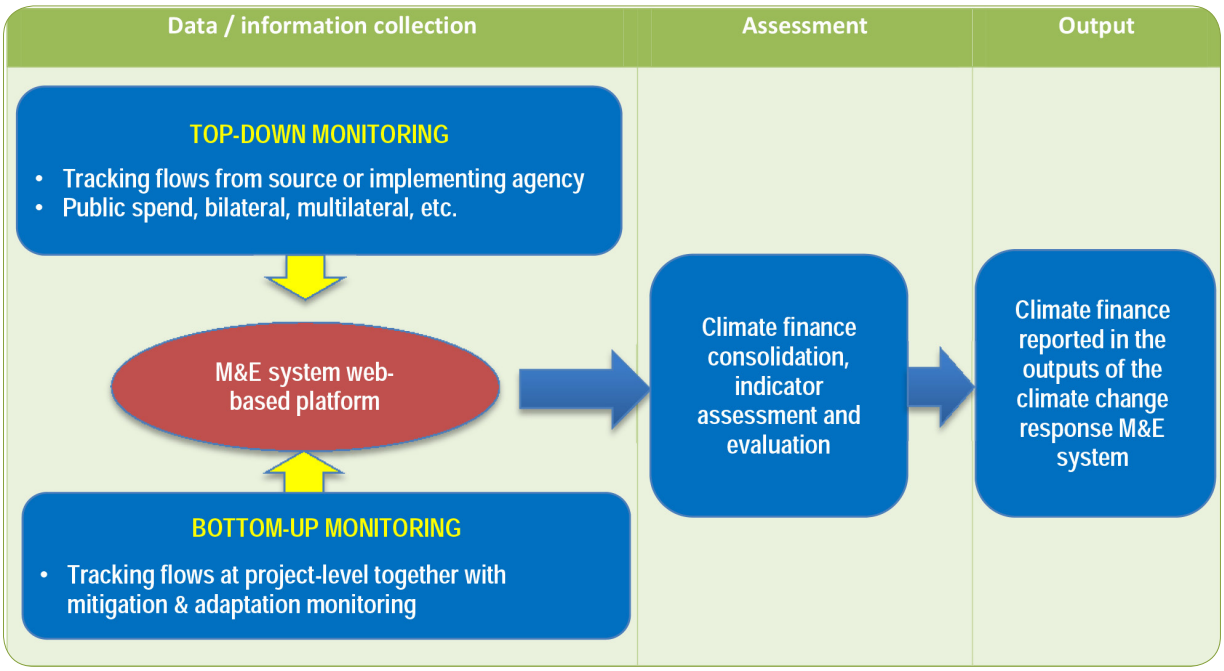


Figure 33: The overall approach to M&E of climate finance (DEA, 2016d)

6.1.6 National GHG Inventory System

During the compilation of the 2010 National GHG Inventory several challenges affected the accuracy and completeness of the inventory, such as:

- Application of lower tier methods due to unavailability of disaggregated activity data;
- Lack of well-defined institutional arrangements; and
- An absence of legal and formal procedures for reporting GHG emission data and information.

In an effort to respond to these challenges, South Africa is implementing a GHG Improvement Programme (GHGIP), which includes a series of sector-specific projects aimed at improving the quality and accuracy of the National GHG Inventory as reported in the National Greenhouse Gas Inventory Chapter. There are more than 15 partners included in this programme for implementation between 2015 and 2018, with a budget of approximately R32 million. The majority of the projects included in the GHGIP are donor funded. Key among these, is the development of the National GHG Inventory System (NGHGIS) to manage and simplify our climate change reporting obligations.

The NGHGIS will give structure to the data collection and analysis, as well as all relevant information related to climate change in the most consistent, transparent and accurate manner for both internal and external reporting and will ensure:
the sustainability of the inventory preparation,
consistency of reported GHG emissions; and
improved standard and quality of the National GHG Inventory.

The NGHGIS includes six key processes enhancing aspects of data management, documentation control and governance, namely:

- Documentation of inventory preparation, planning, management, review, implementation and improvement of the inventory;
- Legal and collaborative arrangements between the national GHG entity and the institutions that are custodians of key source data;
- A process and plan for implementing quality assurance and quality control procedures;
- The alignment of the NGHGIS with the South African Standard Quality Assessment Framework;
- A process to ensure that the National GHG Inventory meets the standard inventory data quality principles of accuracy, transparency, completeness, consistency and comparability; and
- A process for continuous improvements of the National GHG Inventory.

The NGHGIS is made up of the following two components, as illustrated in **Figure 34** (below):

i. Process governance, data management and reporting component which include linkages to the South African Air Quality Information System (SAAQIS) and the National Atmospheric Emissions Inventory System (NAEIS), embedded in the broader SAAQIS. The NAIES is the primary mechanism through will the mandatory reporting of priority air pollutants and GHG emissions takes place;

ii. Institutional arrangements component, which outlines the institutional arrangements and sets up the National Inventory Unit (NIU). The NIU will include sector experts, quality assurance and control specialists, inventory co-ordinator, among others, and will be coordinated by the DEA.

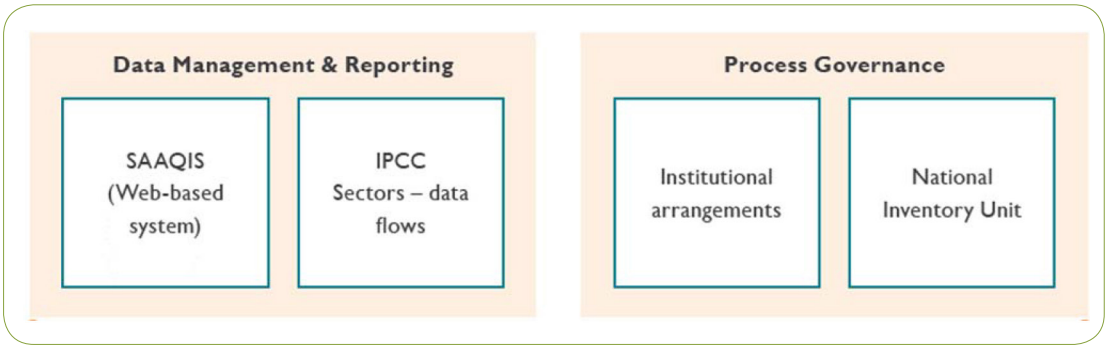


Figure 34: Schematic of the two systems making up the National GHG Inventory System (DEA, 2016d)

6.1.7 National Atmospheric Emissions Inventory System

The NAEIS is managed by the South Africa Weather Services (SAWS) and serves as an electronic filing cabinet to manage atmospheric emissions inventory reporting forms submitted by regulated facilities.

The NAEIS is intended to provide a reporting platform for

- Mandatory reporting of GHG emission;
- Supporting South Africa's reporting obligations to the UNFCCC;
- Industry GHG reporting and verification for carbon tax purposes;
- GHG monitoring, reporting, verification and evaluation, as well as measuring mitigations plans; and
- Envisaged reporting of energy data to support the Department of Energy reporting requirements.

The NAEIS also provides for broader air quality-related reporting focusing on priority air pollutants and other atmospheric emission, for:

- Regulated industries as required by the South African Air Quality Act;
- Reporting of atmospheric emissions from other sectors; and
- Compilation of National Emissions profiles in line with air quality management plans

The NAEIS is structured to capture reporting from the Energy, Industrial Processes and Product Use (IPPU) and Waste sectors and does not currently include GHG emissions reporting from Agriculture, Forestry and Other Land Use (AFOLU).

6.1.8 AFOLU Capacity Building Project for Measurement, Reporting and Verification

The AFOLU sector is multi-functional and diverse; with the additional unique characteristic of being both a source and potential sink for GHGs. To this end, the Commonwealth of Australia provided fast start finance to the Government of South Africa to implement a Measuring, Reporting and Verification Capacity Building project for the land sector. The MRV of AFOLU project team has since developed a MRV of AFOLU Strategic Plan (2016-2020) (DEA, 2015d).

The long-term strategic objective for the development and implementation of the AFOLU sector MRV system is to enhance South Africa's capacity to transparently monitor and report emissions from land use and the impact of mitigation actions. The strategy also defines processes needed for data collection, analysis and establishing sharing arrangements for future compilations of domestic and international reports. Furthermore, to develop a framework of tracking / monitoring activities in managed lands, both those that drive GHG emissions (sources) and those that lead to sequestration of CO2 (sinks). The MRV of AFOLU is a subset of the web-based climate change M&E system.

In addition to developing in-house capacity to compile the National GHG Inventories for the AFOLU sector, a central achievement of the capacity building project includes developing MRV guideline to describe:

- The data and information required to enable quantitative analysis of the impact of mitigation response measures in the AFOLU sector;
- indicators for tracking the extent to which response measures contribute to transitioning South Africa to a low-carbon economy and climate-resilient society; and
- the process of establishing institutional arrangements for data collection, analysis and established sharing arrangements.

The MRV of AFOLU project has contributed to South Africa's First Climate Change Annual Report; and is currently assessing AFOLU response measures from the LandCare programme as part of the CC M&E System pilot project.

Further donor funding, from the UK Government, was applied for research towards the development of a GHG emissions baseline for the AFOLU sector (DEA, 2015e), for assessing the potential to produce biochar and its application to South African soils as a mitigation measure (DEA, 2015f) and for the development of potential verification standards and methodologies for carbon offset projects in the AFOLU sector (DEA, 2016h).

6.1.9 MRV of GHG Emissions for the Carbon Tax

It is envisaged that the GHG emissions data reported onto the NAEIS system will form the basis for confirming the carbon tax liabilities of entities. Companies will use the NEAIS to self-report GHG emissions, and the South African Revenue Services (SARS) will have access to this information for carbon tax purposes.

The South African carbon tax is been designed such that companies reporting for carbon tax purposes are likely to be the same companies mandated by the Department of Environmental Affairs to report their atmospheric emissions under the Air Quality Act. The approach is also consistent for companies that will be assigned carbon budgets under the broader Climate Change M&E System as well as those that will be reporting energy management plans in terms of the Department of Energy's mandatory energy reporting regulations.

Guaranteeing the linkages between the various reporting regimes mentioned above ensures consistency in the quantification, assessment and reporting of GHG emissions for carbon tax purposes. It means that similar companies shall be subjected to similar mix of measures and most importantly, administrative risk in terms of managing the system in the short-to-mid-term are reduced substantially. The GHG emissions data reported through the NAEIS would enable verification and auditing of tax returns submitted to SARS. The carbon tax liability will apply to GHG emissions resulting directly from fuel combustion, gasification and from non-energy industrial processes, emitted at an entity level.

A schematic overview of the proposed structure for MRV of GHG emissions for the carbon tax is provided in **Figure 35** (below).

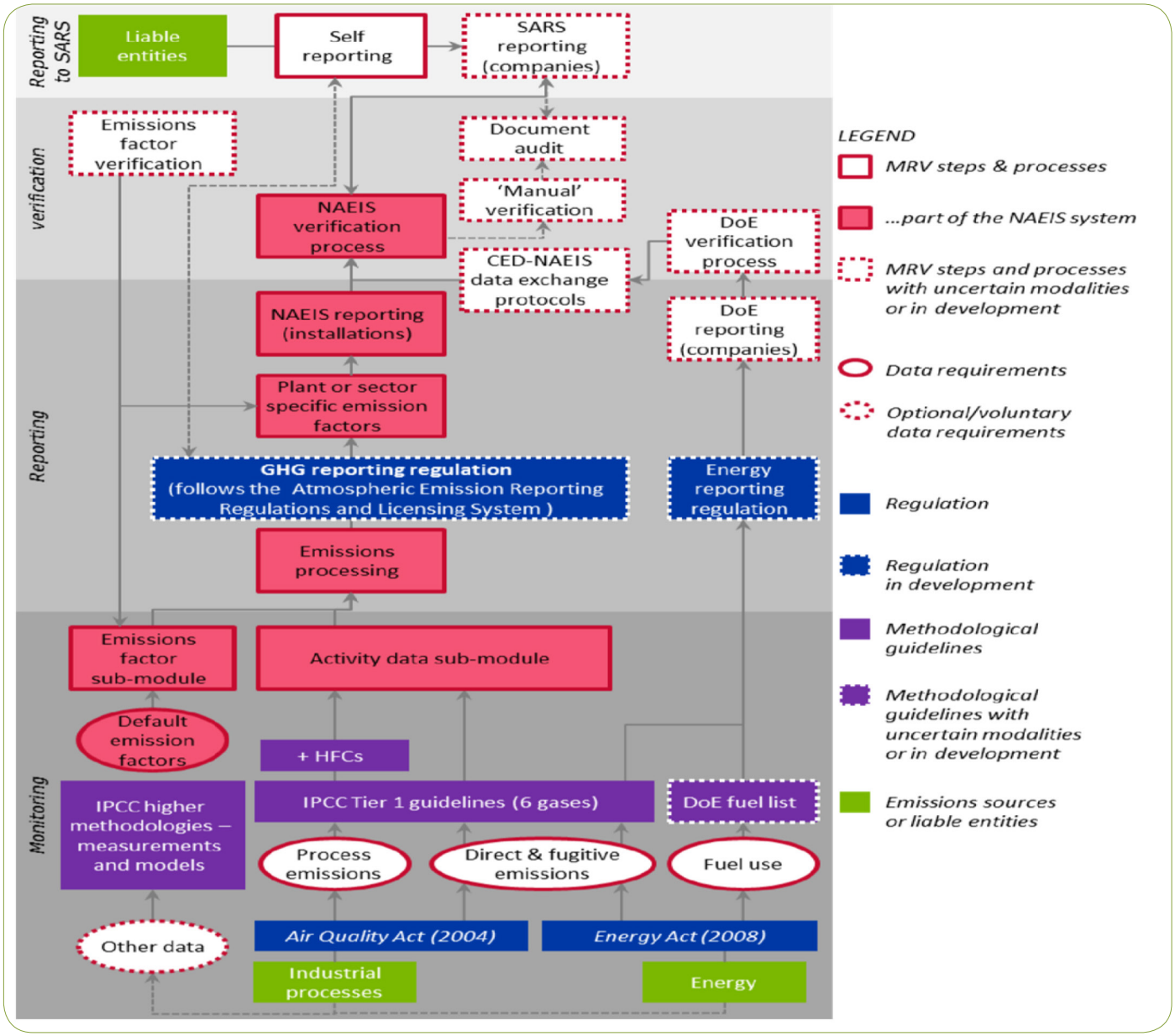


Figure 35: Schematic overview of the proposed carbon tax MRV system (Source: DEA, undated).

Three main data streams that would be used in order to verify and audit reported tax liabilities are described in the Table 41 table below.

Table 41: Overview of the data streams to be used for carbon tax purposes

Data Stream	Purpose	Monitoring	Reporting	Use of thresholds	Responsibility
Fuel use	Quantifies GHG emitting fuel inputs.	Monitored according to a fuel list being developed by the DoE and is expected to cover conventional fuels as well as some special process fuels listed in the NAEIS (e.g. in coal-to-liquid processes).	Company level	Stationary combustion devices with a total installed thermal input capacity of 10 Megawatts (MW).	DEA (DoE will collect the energy data, but the GHG emissions calculation will be processed in the NAEIS).
Process emissions	Quantifies GHG emitted as an integral part of industrial processes.	Monitored according to the IPCC Tier 1 methodological guidelines, covering six gases (CO2, CH4, NOx, PFCs, HFCs and SF6) with the additional monitoring of HFCs for refrigeration.	Company level	Product-specific as per IPCC source categories.	DEA.
Direct emissions	Quantifies actual GHG emissions from fuel use or industrial processes.	Monitored according to the bare minimum IPCC Tier 1 methodological guidelines or IPCC higher tier methods such as models or measurements.	Company level	No (based on sectoral and activity definitions).	DEA (via local authorities).

These data streams will enable both a top-down or bottom-up approach to the MRV of GHG emissions for the carbon tax. Fuel use and process emissions data, combined with benchmarks and reference emissions factors can be considered top-down methodologies. In these approaches, GHG emissions are not only calculated from data provided, or derived from, installation- or company-level information but also from sectoral and/or international data (e.g. sectoral benchmarks and IPCC emissions factors). Direct emissions data is a bottom-up approach, with the reported GHG emissions obtained directly from installation- or company data. Top-down approaches, or so-called default or Reference Approach, may be less accurate and therefore, emitters risk being under- or over-charged for tax. Therefore, the draft carbon tax legislation proposes that installations or companies may develop and use alternative methodologies, that must be approved, which can go beyond the IPCC guidelines and provide more accuracy. Currently the proposed carbon tax and related MRV system are largely based on IPCC Tier 1 methodologies.

The Government has identified key institutions, mandated to play a leading role in the implementation of the Carbon Tax and these include:

National Treasury (NT) – responsible for the overarching design and carbon tax policy development, which includes the various elements of the tax such as thresholds, allowances and rate;
Department of Environmental Affairs (DEA) – responsible for the coordination and management of GHG reporting and the authoritative entity on development and implementation of the MRV system. The DEA will work closely with the Department of Energy (DoE), as a joint implementation partner in the carbon tax MRV to assist SARS with verifying the tax returns. The draft mandatory GHG Reporting Regulations describes how this process is to be undertaken;

Department of Energy – responsible for the coordination and management of company level energy reporting and maintains the Central Energy Database. The DoE is mandated in terms of the Energy Act (Act 34 of 2008) to collect and analyse energy and fuel use data, as well as information on energy efficiency improvements. The reported energy data will be captured into the NAEIS system as input for tax liability verification. The Designated National Authority (DNA) is responsible for administering the carbon offsets scheme and is hosted by the DoE; and
South African Revenue Service (SARS) – is mandated to administer tax collection and to conduct tax liability assessment through the Customs and Excise Act (Act No. 91 of 1964).

The institutional arrangements and information flows for the Carbon Tax are illustrated in **Figure 36** below.

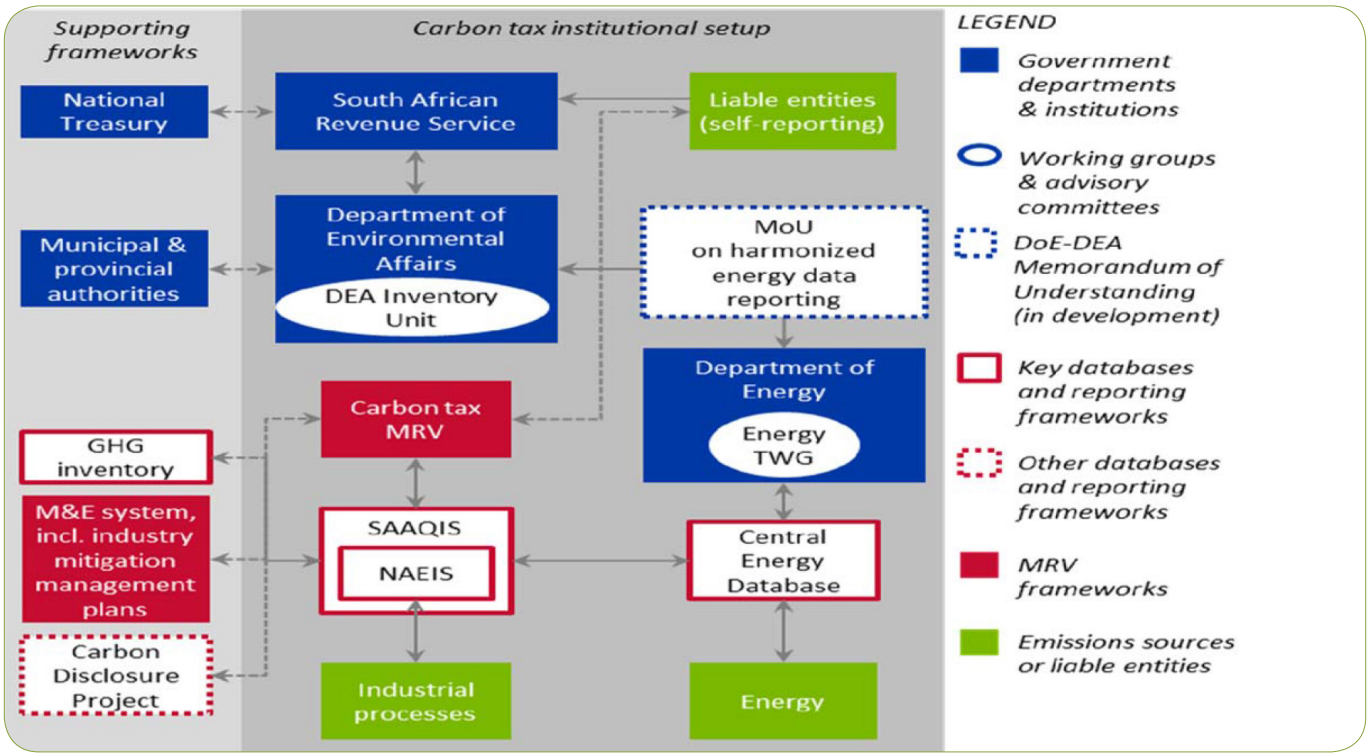


Figure 36: Institutional setup for MRV of carbon tax (Source: DEA, undated)

6.2 DEVELOPMENT OF MRV AND EVALUATION IN SOUTH AFRICA; AN UPDATE FROM BUR-1

The development of the M&E system is rolled-out in a phased approach, as depicted in **Figure 37** (below), and is planned for completion in 2020.

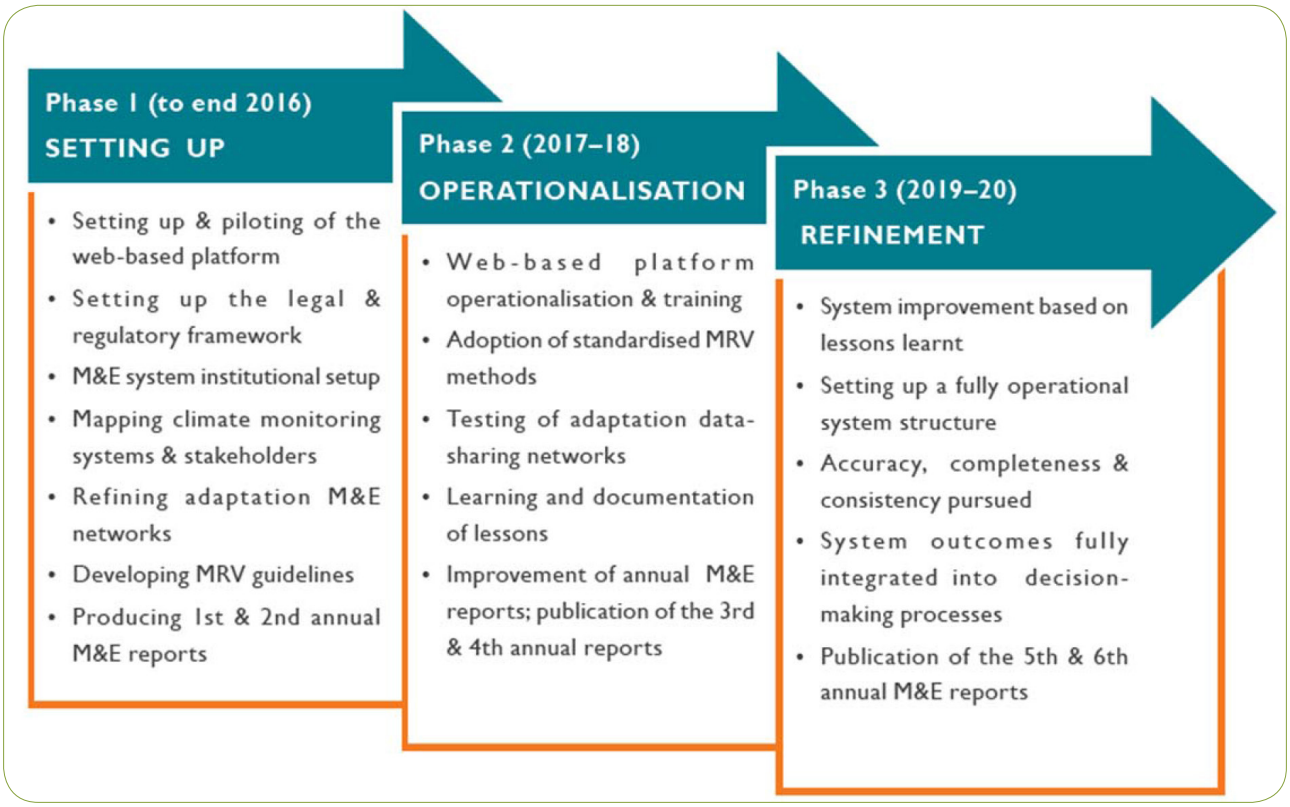


Figure 37: Phased implementation of the climate change M&E System (Source: DEA, 2016b).

The chronological update of milestones reached in this development process, which follow-on from the progress report presented in Table 35 in BUR-1, is presented in **Table 42** (below).

Table 42: Development of Climate Change MRV and Evaluation in South Africa, update from BUR-1

Year	Milestones Reached
2014	BUR •South Africa submits its first BUR to the UNFCCC in December 2014. M&E System Development •Setting-up Phase 1 of the M&E system implementation initiated.
2015	BUR •A Technical Analysis (TA) for BUR1 under the International Consultation and Analysis (ICA) process •was conducted in May 2015 and the summary report is published on UNFCCC website. M&E System Development •The development of an M&E platform initiated. GHG Inventory •DEA publishes draft National Greenhouse Gas Emissions Reporting Regulations for public comment (Gazette No. 38857)
2016	M&E System Development •Development of technical M&E guidelines, namely: •Technical guidelines for monitoring, reporting and verification of greenhouse gases by Industry for the GHG inventory •Six volume series of M&E guidelines for assessment of mitigation policies and actions: •Volume 1: Overall Policies, Strategies and laws guidelines •Volume 2: Waste Sector guidelines •Volume 3: Energy Sector guidelines •Volume 4. Transport Sector guidelines •Volume 5. Agriculture, Forestry and other land use guidelines •Volume 6: Industrial processes guidelines •Development of the web-based System Architecture and Design (SAD). The SAD details how the web-based climate change M&E system will handle climate change response information on mitigation, adaptation and climate change finance. When up and running, the web-based M&E system will be the national central depository and portal of climate change information in South Africa. GHG Inventory •DEA publishes a Declaration of Greenhouse Gases as Priority Air Pollutants for public comment (Gazette No. 39578); draft Regulations on National Pollution Prevention Plans, for public comment (Gazette No. 39578); and draft National Greenhouse Gas Emissions Reporting Regulations for public comment (Gazette No. 40054). •National Climate Change Report •Publication of South Africa's first Annual Climate Change Report (Themes A – I): •Theme A: Synopsis of South Africa's 2015 Annual Report on Monitoring Climate Change Response •Theme B: South Africa's Climate Change Monitoring and Evaluation •Theme C: Climate Change Trends, Risks, Impacts and Vulnerabilities •Theme D: Tracking South Africa's to a lower Carbon Economy •Theme E: Monitoring the Adaptation Landscape in South Africa: Desired Adaptation Outcomes, Adaptation Projects and Intended Nationally Determined Contribution •Theme F: Climate Finance •Theme G: Climate Change Adaptation Governance and Management •Theme H: Near term Priority Climate Change Flagship Programmes •Theme I: Key Outcomes of Cop 21

7. ADDITIONAL INFORMATION

This chapter presents a collection of additional detail (over and above that reported in Chapters 1 – 6) of work that has been undertaken to address a changing climate in South Africa. The information presented below gives a brief background and overview of the initiatives and describes the process approach and progress made, to follow on from information presented in BUR-1.

7.1 SOUTH AFRICA'S NATIONALLY DETERMINED CONTRIBUTION

South Africa submitted its intended nationally determined contribution (INDC) to the UNFCCC in September 2015 which considers both the country's development needs and climate change imperatives (DEA, 2015c). The NDC elaborates on mitigation and adaptation responses as well as climate finance contribution and needs. The mitigation component (M-NDC) and the adaptation component (A-NDC) are discussed in sections 7.2 and 7.3 respectively. The support component of the NDC (S-NDC) identifies some of the key programmes that require scaling up to enable South Africa to transition to a low carbon and climate resilient economy and society. South Africa's Flagship Programmes form the basis of the programmes identified to be scaled up further.

7.2 NAMAS AND NATIONAL CLIMATE CHANGE NEAR-TERM PRIORITY FLAGSHIP PROGRAMMES

The mitigation component of the nationally determined indicators (M-NDC) that require scaling-up to enable South Africa's greenhouse gas emissions to peak between 2020 and 2025, plateau for approximately a decade and decline in absolute terms thereafter (DEA, 2015c) include:

Renewable Energy Independent Power Producer Procurement Programme;
Solar photovoltaics, solar water heaters and wind power;
Decarbonised electricity by 2050;
Carbon capture and storage;
Energy efficiency and advanced bio-energy; and
Investment in public transport infrastructure and electric and hybrid electric vehicles.

Nationally Appropriate Mitigation Actions (NAMAs) are one of the cornerstones of international climate negotiations. In the South African context, there is a complete overlap in the thematic areas included in NAMAs and those comprising the mitigation Flagship Programmes. As a result, South Africa's NAMAs are nested and developed within the Near-term Priority Flagship Programmes and are the building blocks or components of these programmes. The initial set of Climate Change Near-term Priority Flagship Programmes, first described in the National Climate Change Response Policy (DEA, 2011a), is made up of 43 distinct components in total. Each of these programmes has sub-programmes, which can be disaggregated further into distinct projects, implemented typically at provincial and municipal scale. South Africa's Climate Change Near-term Priority Flagship Programmes are described in detail in South Africa's 1st Annual Report on Climate Change Report (DEA, 2016e).

South Africa envisages scaling-up M-NDCs through the successful implementation of the following mitigation Flagship Programmes:

7.2.1 Renewable Energy Near-term Priority Flagship Programme

In 2010, the Department of Energy, National Treasury and the Development Bank of Southern Africa collaborated to set up the Independent Power Producer (IPP) office and designed the Renewable Energy Independent Power Producers Procurement (REIPPP) Programme. The Renewable Energy Near-term Priority Flagship Programme is based on the REIPPP Programme, and the renewable energy targets specified in South Africa's Integrated Resource Plan for 2010-2030 (DoE, 2011), namely 13,225MW of renewable energy generation by 2025 and 17,800 MW of renewable energy to be in place by 2030. This amounts to approximately one fifth of the county's predicted demand.

The overarching National Development Plan (NPC, 2011) calls for a 'greater mix of energy sources and a greater diversity of independent power producers (IPPs) in the energy industry', acknowledging that future energy market will look very different to the present state.

The REIPPP Programme has been running since 2011 and 4 successful bidding rounds have already been completed, with a total of 92 successful projects (a map of the projects can be viewed on: http://energy.org.za/knowledge-tools/map-of-sites). Over the past five years, remarkable strides have been made with establishing renewable energy as a vital contributor to the country's economic infrastructure and climate change response through the REIPPP Programme. By November 2015, 43 REIPPP facilitated projects were fully operational, adding 2,062 MW to the national electricity grid. These include:

13 fully operational wind farm developments feeding 953 MW into the national grid;
27 solar photovoltaic developments generating 995MW;
1 Concentrated Solar Power plant generating 100MW;
2 hydroelectric power plants totalling 14.3MW; and
more than 400 wind turbines creating electricity throughout South Africa.

Prior to 2010, renewable energy technology options played a minimal role in South Africa's energy mix, mainly in the form of demonstration or pilot projects. The electricity mix in 2010 included less than 0.5% capacity from renewables when excluding the existing large-scale hydro capacity, and by November 2015 the REIPPP Programme has propelled renewable energy into the mainstream with 13,098 GWh been generated from these technologies since the first project became operational.

The resultant GHG emission reductions totalled 13.3 Mt CO_2e reduction from the inception of the REIPPP Programme (i.e. 2011 to November 2015).

The REIPPP Programme is introducing renewable energy into the national grid faster and cheaper than new-build coal fired power plants. Construction times for projects average less than two years, and the electricity price paid to projects has declined 68% within three years. The price of wind energy in Bid Window 4(a) was R619/MWh, almost 40% cheaper than forecast prices for Eskom's new-build coal plants Medupi and Kusile.

Benefits for host communities include billions of Rand invested in socio-economic development from funds provided through these projects, and local communities (within a 50km radius of REIPPP developments) are already substantial beneficiaries of the renewable energy generated, with an average shareholding of 10.5% in renewable projects. This constitutes more than four times obligated minimum of 2.5%, which forms part of the criteria of the REIPPP Programme. The total projected value of goods and services to be procured from broad-based black economic empowerment suppliers is more than R101bn. Significant job creation has resulted from the REIPPP Programme and this will continue to grow as the allocation expands and renewable energy development escalates.

According to National Treasury, as of October 2015, the 92 projects selected as part of the REIPPP Programme are attracting R193bn in private sector investment totalling a forecast contribution of 6,327 MW of capacity to the national grid. Of this 28% (R53.2bn) is from foreign investment, which equates to 85.8% of the total direct foreign investment in South Africa last year. During the first year of the REIPPP Programme investment in renewable energy in South Africa grew 20,500% in one year, i.e. between 2011 and 2012 (Source: http://www.energy.org.za/news/246-reaping-rewards-sa-reippp).

Country-specific achievements for renewable energy to date include:

- South Africa has a world-first wind atlas, with high-definition map which allows Independent Power Producers to identify the best sites for wind energy development;
- Renewable energy production has resulted in GHG emission reductions equivalent to 13.3 million tonnes of carbon dioxide equivalents;
- The 2014 United Nations Environment Programme put South Africa among the top 10 countries for renewable energy investments;
- Research into the sustainability of decentralised renewable energy systems (DEA, 2014d); and
- According to a report by the CSIR, wind energy produced net savings of R1.8 billion in the first half of 2015 and was also cash positive for Eskom by R300 million. Collectively wind energy and solar power (photovoltaic) saved R4 billion from January to June 2015.

Renewables are expected to contribute both to grid and off-grid electrification, transport fuels and electricity demand-side management through fuel switching, for example, from electric geysers to solar water heaters.

7.2.2 Energy Efficiency and Energy Demand Management Near-term Priority Flagship Programme

The Energy Efficiency and Energy Demand Management (EEDM) Near-term Priority Flagship Programme is one of the most complex of the Flagship Programmes due to the importance of energy security and access to all sectors of South Africa's economy and society. The National Energy Efficiency Strategy (NEES), a consolidated national framework developed to guide the development and implementation of energy efficiency practices in South Africa, was first released in 2005 (DoE, 2005). A revision of the NEES, currently underway, is expected to be completed in 2017 and will contain a revised set of energy intensity goals specific to sectors and also covering the South African economy as a whole (DoE, 2016c).

The Municipal Energy Efficiency (EE) programme has been operational since 2009, as a component of the EEDM Flagship Programme, and is implemented and managed by the Department of Energy. The programme provides grant support to municipalities for implementing energy efficiency measures in the infrastructure sector. The EEDSM programme is financed by National Treasury through the Division of Revenue Act and also receive support from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through the South African-German Energy Programme (SAGEN). The Municipal EE Programme is one of the world's largest and most successful energy efficiency programmes implemented on local government level, and is rolled out through the EPWP Working for Energy initiative. A total of 60 different municipalities, from all nine provinces, have participated in the programme achieving cumulative energy savings of 499 GWh, equivalent to 477,050 tCO2e.

The Industrial Energy Efficiency (IEE) Project was established in 2010 in response to the growing need to improve energy efficiency in South Africa. The project aimed to support industry in improving its energy performance, thereby alleviating the country's acute power shortage while at the same time improving productivity, competitiveness and reducing CO2 emissions. The IEE is implemented by the National Cleaner Production Centre of South Africa within the CSIR, and in partnership with the Department of Trade and Industry (dti), the Department of Energy (DoE), UNIDO, the Swiss Secretariat for Economic Affairs (SECO) and the UK Department of International Development. The project was designed to help transform industry energy use patterns – helping to adopt a more systematic and holistic approach to energy management within organisations and plants. The 1st phase of the IEE ran from 2010 – 2015 and targeted five sectors, namely Automotive, Agro-Processing, Mining, Chemicals and Liquid Fuels, and Metals and Engineering.

The South African Government contributed USD 4,371,585 and the Government of Switzerland USD 1,928,000 to fund this flagship programme and project have achieved 1.3 Mt CO2e of GHG emission reductions through 1,342 GWh energy saved between 2010 and 2014.

7.2.3 Carbon Capture and Storage Near-term Priority Flagship Programme

The Carbon Capture and Sequestration (Storage) Near-term Priority Flagship Programme has three key components, led by the Head of the South African Centre for Carbon Capture and Storage, a division of SANEDI, an agency of the Department of Energy (DoE). The implementation of the CCS Near-term Priority Flagship Programme is governed by the South African CCS Roadmap, as endorsed by Cabinet. A key milestone in the rollout of the CCS Flagship Programme is the Pilot CO2 Storage Project (PCSP). The objective of the PCSP is to inject approximately 10,000 tonnes of CO2 per year into a selected geological storage site.

The first test injection is scheduled to be completed by 2019 but is contingent on a number of factors relating to the exploration programme. The test injection will be the first time that CO2 will be injected into a South African geological formation. An integrated demonstration that involves all four stages of CCS, namely capture, transport, injection, storage and monitoring is envisaged thereafter as a bridge between proving the feasibility of CCS in South Africa and commercial rollout. The demonstration is planned to inject approximately 100,000 tonnes of CO2 per year.

7.2.4 Transport Near-term Priority Flagship Programme

Transport is one of the fastest growing sources of GHG emissions in South Africa. Emissions from transport-related fossil fuel combustion accounted for 11% of the emissions generated from the energy sector. Road transport, encompassing private, freight and public transport vehicles, generates the majority of transport related emissions.

Key Components and Activities of the Transport Near-term Priority Flagship Programme, include:

- Upgrading passenger rail infrastructure and services – the Passenger Rail Agency of South Africa (PRASA) has been allocated R11.2 billion for its rolling stock fleet-renewal programme, a 10-year initiative, and the agency is expected to receive the first 44 train sets by 2019;
- Upgrading freight rail infrastructure and services - Transnet's rail infrastructure upgrade programme is set to spend R500 billion over the next decade. Funding has been allocated to rail projects and general freight to support the growth in volumes. Part of this programme focuses on revitalising branch lines in small and rural areas;
- Expanding road based public transport – the Department of Transport and Local Municipalities are establishing the Bus Rapid Transport (BRT) System in major cities, as a component of the Public Transport Strategy approved by Cabinet in March 2007. Capital investment into BRT systems totalled R32bn between 2006 and 2014 (DoT, 2015). Currently, 4 of the 13 cities have BRT services in operation, and construction has begun in eThekwini, Rustenburg and Mbombela. George Municipality is scheduled to complete its full city-wide network by 2018. Buffalo City, Ekurhuleni, Mangaung, Msunduzi and Polokwane completed their public transport network development planning and have started with network development;
- High speed rail- Gautrain rapid rail link – is one of the largest transportation projects in South Africa, with 80 km mass rapid transit railway linking Pretoria, Centurion, Midrand, Johannesburg, the East Rand and OR Tambo International Airport. An integrated intermodal transport system has been built around the Gautrain, aimed at providing alternative public transport to car-users and therefore to attract private car-users to the train. Feasibility studies are underway to look at expanding the Gautrain services to other parts of Gauteng;
- Non-motorised Transport (NMT) Programme – implemented by DEA and Municipalities aims to assist cities to promote walking and cycling through infrastructure demonstration projects. Infrastructure development has been completed in 8 municipalities in KwaZulu-Natal and also Orlando, Soweto. In 2016, the DEA and KfW launched phase 2 of the NMT programme to extend the existing bicycle networks and intermodal urban transportation networks;
- Shova Kalula National Bicycle programme – being driven by the Department of Transport, with the introduction of the pilot programme in 2001 to improve mobility and access to basic services in rural, remote and poorly resourced areas. More than 950,000 bicycles have been distributed to date, in all nine provinces. The focus going forward is to assist 21 district municipalities in developing NMT infrastructure and facilities; and
- Taxi Recapitalisation Programme - implemented by the Department of Transport (DOT) was introduced in 2005 to bring about safe and reliable taxi operations by introducing new taxis. Operators are paid to scrap their vehicles and buy new ones. A total of 135,894 taxis had been scrapped by end of March 2013, leaving 81,735 that still needed to be scrapped under the programme. The programme is currently under review, the DOT is undergoing a consultation process on its recommendations with provinces and the taxi industry.

7.2.5 Waste Management Near-term Priority Flagship Programme

South Africa generated approximately 108 million tonnes of waste in 2011, of which 98 million tonnes was disposed to landfills. On the wastewater side, South Africa processes approximately 5,128.8 million litres daily.

The Waste Management Flagship Programme places emphasis on mitigation projects that are at implementation stage or at advanced design stages in local municipalities. The programmatic diversion of waste in local municipalities is still a very new concept, and as such there are currently no projects under implementation.

DEA commissioned a waste diversion strategy focusing on the diversion of solid waste away from landfill and use of alternative waste management options from September 2015 to August 2016. The development of these strategies was undertaken in partnership with GIZ and six municipalities; Rustenburg, Emfuleni, uMhlathuze, Msunduzi, Mbombela Local Municipalities and Mangaung Metro Municipality (MMM)). These strategies are to be incorporated into the Integrated Waste Management Systems (IWMSs) of the participating municipalities.

The Waste Flagship Programmes also focuses on waste-to-energy initiatives implemented at local government level.
Table 43 details the actual projects and activities included under the Waste Management Flagship Programme to date.

Table 43: Waste-to-Energy mitigation projects under the Waste Management Flagship Programme

Responsible entity/ owner	Name	Description	Energy output (MW)	GHG abated by 2035 (ktCO2e)
City of Johannesburg	Alternative waste treatment	Biogas production and electricity generation	40. 0	35,002
	Robinson Deep Landfill Gas (LFG) project	Project is included in the REI4P	5.5	5,573
	Marie Louise LFG project	Project is included in the REI4P	6.6	6,687
	Linbro Park LFG project	Project is included in the REI4P	3.3	3,192
	Goudkoppies LFG project	Project is included in the REI4P	3.3	3,192
	Ennerdale LFG project	Project is included in the REI4P	0.5	484
Johannesburg Water	Northern Works Waste Water Treatment Works (WWTW)	Biogas production and onsite combined heat and power use (CHP)	1.1	1,133
	Driefontein WWTW	Biogas production and CHP	0.8	770
	Bushkoppie WWTW	Biogas production and CHP	2.1	2,023
eThekwini	Bisasar Green Waste Treatment	Biogas production	2	1,944
	Buffelsdraai LFG project	Landfill gas to electricity plant	8	7,369
City of Cape Town	LFG extraction and utilisation	Programme of activities registered as Coastal Park LFG under CDM	2	1,842
Ekurhuleni	Ekurhuleni LFG Programme	Landfill gas-to-electricity programme in five landfill sites	6	5,637

7.2.6 Vertically-Integrated Nationally Appropriate Set of Mitigation Actions

Where Phase 1 of the Climate Change Near-term Priority Flagship Programme encompassed the operationalisation of programmes identified in the NCCRP (DEA, 2011a), Phase 2 addresses the scaling-up of vertically-integrated nationally appropriate set of mitigation actions (V-NAMAs). As South Africa's climate change response landscape is dynamic, evolving and expanding, many new measures have been implemented since 2011, distinguishing themselves as game changers, but initially not recognised as flagship programmes. To this end, in January 2016, DEA invited national departments to nominate existing and new climate-relevant programmes and projects, to be recognised as Climate Change Flagship Programmes. The call was coordinated by the Chief Directorate: Climate Change Monitoring and Evaluation- Near-term Priority Flagship Directorate.

There are now thirteen Climate Change Flagship Programmes Priority Areas incorporating the first set of Flagship Programmes and key sectoral measures described in other sections of the NCCRP. The Climate Change Flagship Programmes Priority Areas, illustrated in **Figure 38** (below), also form the basis for the South Africa engagement with the Green Climate Fund (GCF) and other key engagements with multilateral climate finance/ funding mechanisms and opportunities.

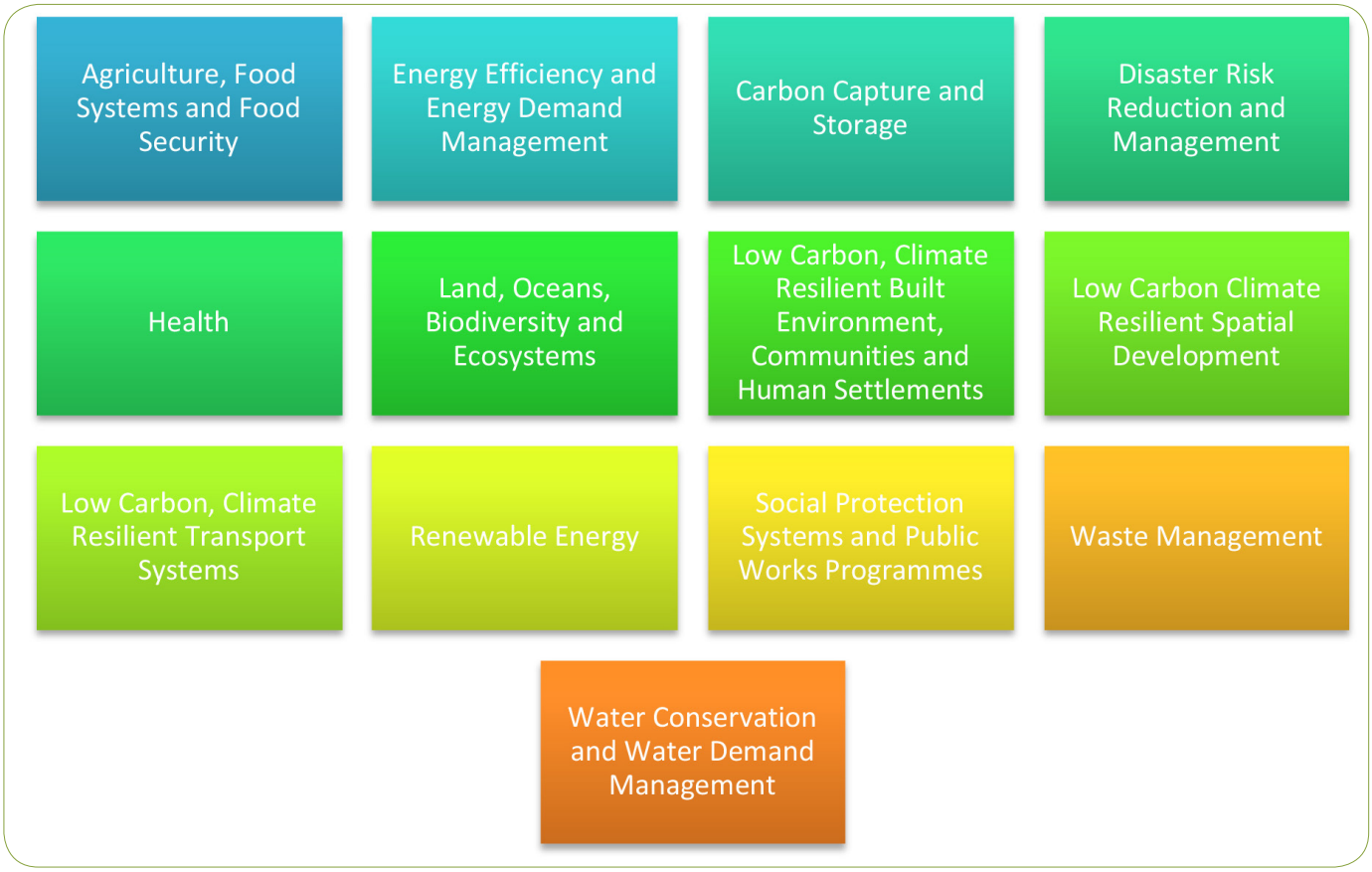


Figure 38: South Africa's Expanded Climate Change Response Priority Areas (DEA, 2016e).

The DEA continues to work with national departments and other spheres of government, state-owned entities, industry associations and not-for-profit organisations, to scale up and implement Flagship Programmes.

7.3 ADAPTATION

South Africa's INDC (DEA, 2015c) elaborates on six goals to achieve the adaptation component of our nationally determined contributions (A-NDC) which included; developing a National Adaptation Plan, integrating climate considerations into national development, sub-national and sector policy frameworks, building institutional capacity for climate change response planning and implementation, developing an early warning, vulnerability and adaptation monitoring system for key climate vulnerable sectors and geographic areas, the development of a vulnerability assessment and adaptation needs framework, and the communication of past investments in adaptation for education and awareness as well as for international recognition.

7.3.1 Adaptation Actions – the National Adaptation Strategy

South Africa has embarked a process to develop the National Adaptation Strategy (NAS) which will conform to the requirements for developing the National Adaptation Plans as per the UNFCCC guidelines.

The strategy recognises that climate change is a threat to national development and it proposes a concerted programme of adaptation activities and actions to deal with the negative impacts posed by climate change. The NAS aims at creating an enabling implementation framework, for adaptation in the country and the strategic objectives of the NAS are:

- Build climate resilience and adaptive capacity to respond to climate change risk and vulnerability;
- Provide strategic leadership and guidance on the integration of climate change adaptation responses into current and future development objectives for the country; and
- Optimise policy, planning and implementation coherence to ensure balanced outcomes and improve current planning for climate change adaptation.

The development of the NAS is premised on a three-phased approach, as illustrated in Figure 39(below).

Figure 39: Phases in the development of the NAS

Phase 1: Inception

The NAS is building on the work that currently exists in the country and Phase 1 involved undertaking a status quo analysis on adaptation work being done, in order to identify the barriers and constraints that need to be addressed. The development of the NAS is a participatory process, which involves extensive stakeholder engagement, therefore in the initial stages stakeholder identification was undertaken.

This phase was concluded on 31 March 2016 and the outcomes of Phase 1 were:

- Consolidate research compendium (Status Quo Analysis);
- Updated Stakeholder database;
- Establishment of the NAS Task Team and NAS Reference Group; and
- Multi Stakeholder kick-off Inception Workshop.

Phase 2: Development and Consultation

This Phase comprised both the drafting of the strategy and further consultations with the key stakeholders. The drafting of the NAS involved continuous revising based on inputs received from various stakeholders. Extensive stakeholder engagement was conducted across the country with sectors, provinces, local government and civil society.

Nine major strategic priorities were identified in the development process and these priorities speak to all provinces, sectors, local governments, private sector and civil society. The strategic priorities are as follows:

- Reduce Human Vulnerability and Build Human Adaptive Capacity;
- Reduce Economic Vulnerability and Build Economic Adaptive Capacity;
- Ensure Resilient Physical Capital;
- Ensure Resilient Natural Capital;
- Ensure Institutional Support for Climate Adaptation;
- Enhance Public-Private-Civil Society Collaboration and Stewardship;
- Enable Substantial Flow of Climate Finance;
- Improve Our Understanding of Climate Change Impacts and their Development Implications; and
- Build Capacity and the Awareness Necessary for Effective Action.

Phase two was concluded by 31 March 2017 and the outcomes of Phase 2 included:

- Development of the Strategic Priorities;
- Draft NAS;
- 18 Provincial Consultation Workshops (two workshops in each province);
- Bilateral meetings with sectors; and
- NAS Task Team and NAS Reference Group established.

Phase 3 – Finalisation

Phase 3 will be undertaken in the 2017/18 financial year and it will involve finalising the draft NAS and submitting it to Parliament for Cabinet approval.

Phase 3 will be finalised by 31 March 2018 and the expected outcomes are:

- Further stakeholder consultation (through the gazetting process);
- Final approved NAS; and
- Submission of the National Adaptation Plan to the UNFCCC.

7.3.2 Long Term Adaptation Scenarios-Flagship Research Programme

The Long-Term Adaptation Flagship Research Programme (LTAS) aims to respond to the South African National Climate Change Response Policy (NCCRP) White Paper (DEA, 2011a) by undertaking adaptation scenario planning for South Africa under plausible future climate conditions and development pathways (DEA, 2015g). The LTAS Phase 1 (2011-2013) developed and compiled impacts assessments and identified broad response options and research needs for key sectors, i.e. water, agriculture and forestry, human health, marine fisheries and biodiversity as identified by the NCCRP. The LTAS analysed climate trends over the last five decades and climate projections for 2030, 2050 and 2100. Climate projections, derived from a range of modelling approaches and scenarios were simplified into four fundamental climate future scenarios to describe South Africa's climate to the end of this century, namely warmer/wetter; warmer/drier; hotter/wetter; hotter/drier. These broad and consensus climate futures provide a framework within which users of climate information can position a wide range of specific climate change and impact projections which results depend on a range of emission scenarios, global climate models and downscaling techniques. In essence, the LTAS Phase 1 produced reports on impact and climatic scenarios, that evaluate how changes in the climate may affect key climate sensitive sectors (water, agriculture & forestry, biodiversity and ecosystems), identified adaptation options and opportunities, including key policies, measures, practices and technologies to prevent undesirable consequences of climate change, and integrated these adaptation responses in policies, plans and programmes.

The LTAS Phase 2 (2013-2014) focussed on developing national and sub-national adaptation scenarios for South Africa based on the four fundamental climate change scenarios described above. These adaptation scenarios consist of narratives that describe the type of adaptation and development pathway that South Africa, and in particular certain areas of the country, will need to achieve under a particular climate future. Priority sub-national areas of high vulnerability and in need of specific adaptation responses were identified and a suite of win-win (no-regret) adaptation responses suitable to modelled climate futures. In addition to the impacts assessments and identification of broad response options Phase 2 identified further research needs and made recommendations on the implications of Climate Change Adaptation for Human settlements, the Southern African Development Community (SADC), Food security, Climate Information and Early Warning Systems, Disaster Risk Reduction and Management and Economics.

During LTAS Phase 3 (2017-2020) the Long-Term Adaptation Scenarios will be reviewed, and will be guided by stakeholder consultations, literature review and roundtable outcomes. This project will gather climate change science knowledge, capacity, impacts and adaptation options across the country, and identify further gaps to be addressed. More emphasis will be given to cross-sectoral issues such as socio-economics and livelihoods, climate change and sustainable development, governance and implementation, adaptation goals and actions. A series of technical papers is anticipated followed by reports and further research studies.

7.4 CAPACITY BUILDING: LET'S RESPOND TOOLKIT

Local government faces with the challenge of ensuring sustainable socio-economic development while ensuring that communities become resilient and adapt to the uncertainties posed by climate change. To this end, the DEA in partnership with SALGA, intensified its capacity building and awareness programme through the roll out of the Let's Respond Toolkit. The Local Government Climate Change Adaptation Support Programme- Let's respond Toolkit provides guidelines for incorporating climate change issues into municipal Integrated Development Plans (IDPs) resulting in effective community climate change response actions. Through the support provided by GIZ, the roll-out of the Toolkit programme gained momentum and a three-phased approach was taken through Provincial structures.

In **Phase 1,** undertaken in 2015/2016, the Let's Respond Toolkit was rolled-out to 12 Districts and 57 Local Municipalities, namely:

Limpopo Province (5 Districts and 22 Local Municipalities);
Mpumalanga Province (3 Districts and 17 Local Municipalities); and
North-West Province (4 Districts and 18 Local Municipalities).

In **Phase 2,** undertaken in 2016/2017, the Let's Respond Toolkit was rolled-out to 11 Districts and 50 Local Municipalities, namely:

Free State Province (4 Districts and 18 Local Municipalities);
Northern Cape Province (5 Districts and 26 Local Municipalities); and
Gauteng (2 Districts and 6 Local Municipalities).

Phase 3 will be conducted over the 2017/2018 period and will cover 21 Districts and 98 Local Municipalities in KwaZulu-Natal (10 Districts and 43 Local Municipalities), Eastern Cape (6 Districts and 31 Local Municipalities) and Western Cape (5 Districts and 24 Local Municipalities).

A website has been developed to serve as a repository for the workshop proceedings and can be accessed through this address: http://www.letsrespondtoolkit.org/home. The purpose of the website is to provide stakeholders with information and tools to respond to climate change at local levels in South Africa.

7.5 CAPACITY BUILDING: 2050 PATHWAY CALCULATOR

The 2050 Calculator is an interactive and transparent tool first developed by the United Kingdom's Department of Energy and Climate Change (DECC) and refined for South African conditions through collaboration between the British High Commission and the DEA. It allows users to develop low-carbon energy pathway to 2050, by choosing their own combination of energy trajectories for each economic sector, and to see the consequences of these choices. It can be used by expert and non-expert audience.

The 2050 Calculator project is comprised of the web-based 2050 Pathways Calculator, the MY2050 Calculator and an offline version of the MY2050 Calculator. The purpose of this project was to provide a user-friendly resource for professionals, students and the general public to view the interactions and linkages across the economy and the impacts of the energy system and associated greenhouse gas emissions. The project was designed to be used for awareness and education and not for policy development.

The 2050 Pathways Calculator was completed in 2014 and can be found online at www.2050pathways.environment.gov.za. Both an interactive web-based application and downloadable Excel version are available from the site. It provides a comprehensive view across the key economic sectors in terms of both demand and supply. The intended audience for the 2050 Pathways Calculator are those with knowledge of energy systems and an interest to view inter-linkages of the economy and the associated greenhouse gases of the energy system.

The MY2050 Calculator was completed in 2015 and can be found online at www.my2050.environment.gov.za. This is a simplified version of the 2050 Pathways Calculator that includes attractive graphics and sounds to enhance the experience. The audience for the MY2050 has been public schools, more specifically, learners in grades 9 to 11 and the learning aims are critical thinking skills, analytical enquiry, working with others to solve problems and advocating for policy change at local and/or national level through discussion and debate.

Noting that internet and computer accessibility is limited in public schools an offline set of activities was produced with the same learning aims as the MY2050 Calculator. The outcomes of these tools are to learn about climate change and energy, major sources of greenhouse gases, options to reduce greenhouse gases and trade-offs of life-style choices that might be necessary to reach the selected low-carbon scenario. The DEA has partnered with the Fundisa for Change programme, a national initiative to enhance transformative environmental learning through teacher education, to share the resources and train teachers from around the country. In addition, schools have been visited and science festivals have been attended to facilitate interactive workshops with learners..

7.6 M&E IN THE AGRICULTURE, FORESTRY AND OTHER LAND USE SECTOR

Where the monitoring and evaluation in the AFOLU sector was included as additional information in Chapter 7 of BUR-1, this information is now included under the National GHG Inventory System, please refer to **section 6.3.2** (above).

7.7 PARTNERSHIP FOR MARKET READINESS

Following on from the information presented in BUR-1 regarding South Africa's approach for assistance from the Partnership for Market Readiness (PMR) to build readiness capacity for implementing a carbon tax. South Africa submitted draft Market Readiness Proposals (MRP) in August and November 2014, and submitted the final version on 16 February 2015, for stakeholder engagement and final approval. Implementation funding was allocated in March 2015, to support South Africa to assess the impact and refine the design features of a proposed carbon tax and complementary offset mechanism.

The PMR agreed to provide the following technical support:

- To provide assistance with determining the linkages and potential interaction between different government policies including the carbon tax, Integrated Resource Plan (IRP) and carbon budgets as proposed in the National Climate Change Response White paper;
- To review and provide technical comments on the carbon tax proposals as announced in Budget 2012;
- To provide some assistance in evaluating the economic modelling work that had been completed by the Treasury;
- To help with the development of a domestic offset system and propose how such a scheme could be expanded to a regional level; and
- To explore alternatives for CDM programme given the restrictions post 2012 on SA's ability to access carbon market from the EU ETS.

South Africa provides periodic update on progress made and reported on the status and challenges faced with monitoring and reporting facility-level emissions and in compiling the National GHG Inventory. Please refer to section 6.3 (above) for progress made in developing the National Atmospheric Emissions Inventory System. Draft regulations requiring mandatory reporting of GHG emissions were published for public comment in the Government Gazette in June 2015 and June 2016. The development of country-specific emission factors and reporting guidelines are currently underway. Technical assistance was provided through the PMR on setting emissions intensity benchmarks for the South Africa carbon tax. The study focused on the following energy-intensive industries which account for a large share of industrial emissions in South Africa: iron and steel, ferroalloys, cement, crude oil production, coal to liquid (CTL), gas to liquid (GTL), chemicals, pulp and paper and sugar (PMR, 2014).

REFERENCES

CIA. (2015). South Africa – in The World Factbook. Central Intelligence Agency. Washington D.C, USA. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/geos/sf.html [Accessed 20 December 2016].

COGTA. (2015). National Disaster Management Centre Annual Report 2014 – 2015. Department of Cooperative Governance & Traditional Affairs. Pretoria, South Africa.

CTF. (2013). Climate Investment Funds: Update of CTF Investment Plan for South Africa. Clean Technology Fund. Washington D.C., USA.

DAFF. (2015). Draft Climate Change Sector Plan for Agriculture, Forestry and Fisheries. Department of Agriculture, Forestry and Fisheries. Pretoria, South Africa.

DBSA. (2013). Green Fund Annual Report 2012/2013. Development Bank of South Africa. Midrand, South Africa. Retrieved from http://www.sagreenfund.org.za/wordpress/wp-content/uploads/2014/12/Green_Fund_Annual_Report.pdf [Accessed 21 December 2016].

DBSA. (2016). SA Green Fund - Capacity Development Projects. Development Bank of Southern Africa Midrand, South Africa. Retrieved from http://www.sagreenfund.org.za/wordpress/capacity-development-projects/# [Accessed 21 December 2016].

DEA. (2011a). National Climate Change Response Policy White Paper. In Government Gazette No.34695 GN. No 757 of 19 October 2011. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.gov.za/sites/default/files/34695_gen757.pdf [Accessed 20 December 2016].

DEA. (2011b). National Waste Management Strategy. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/nationalwaste_management_strategy.pdf [Accessed 22 December 2016].

DEA. (2012a). National Waste Information Baseline Report – 2nd Draft. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from http://sawic.environment.gov.za/documents/1295.pdf [Accessed 22 December 2016].

DEA. (2012b). Municipal Solid Waste Tariff Strategy. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from http://sawic.environment.gov.za/documents/1352.pdf [Accessed 23 December 2016].

DEA. (2012c). REDISA Industry Waste Tyre Management Plan (II-WTMP). In Government Gazette No. 35927, G.N. No.988 of 30 November 2012. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/gazetted_notices/nema_waste_act59of2008_gn988_no35927.pdf [Accessed 23 December 2016].

DEA. (2013a). National Organic Waste Composting Strategy: Draft Guideline Document for Composting. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from http://sawic.environment.gov.za/documents/1825.pdf [Accessed 23 December 2016].

DEA. (2014a). GHG National Inventory Report: South Africa 2000-2010. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/2000_2010_nationalghginventoryreport.pdf [Accessed 20 December 2016].

DEA. (2014b). South Africa's 1st Biennial Update Report. Pretoria, South Africa: Department of Environment Affairs. Retrieved from https://www.environment.gov.za/sites/default/files/reports/sa1stbiennialupdatereport.pdf [Accessed 20 December 2016].

DEA. (2014c). Freight Shift from Road to Rail Report. Pretoria, South Africa: Department of Environmental Affairs. Retrieved from https://www.environment.gov.za/sites/default/files/docs/publications/freightshift_roadtorail.pdf

DEA. (2014d). Sustainability of Decentralised Renewable Energy Systems Report. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/decentralised_renewableenergysystems_report.pdf [Accessed 23 December 2016].

DEA. (2014e). South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/mitigationreport.pdf [Accessed 20 December 2016].

DEA. (2014f). Mitigation Report Appendix C. Energy Sector. In South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/appendixC_%20energysector.pdf [Accessed 20 December 2016].

DEA. (2014g). Mitigation Report Appendix D – Industry Sector. In South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/appendixD_industrysector.pdf [Accessed 20 December 2016].

DEA. (2014h). Mitigation Report Appendix E – Transport Sector. In South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/appendixE_transportsector.pdf [Accessed 20 December 2016].

DEA. (2014i). Mitigation Report Appendix F – Waste Sector. In South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/appendixF_wastesector.pdf [Accessed 20 December 2016].

DEA. (2014j). Mitigation Report Appendix G – Agriculture, Forestry and Other Land Use (AFOLU) Sector. In South Africa's Greenhouse Gas Mitigation Potential Analysis. Department of Environmental Affairs. Pretoria. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/appendixG_afolusector.pdf [Accessed 20 December 2016].

DEA. (2015a). A National Climate Change Monitoring and Evaluation system of the AFOLU Sector. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/nationalclimatechange_monitoringevaluationsystem_afolusector.pdf [Accessed 23 December 2016].

DEA. (2015b). Research Synopsis Report- South African National Terrestrial Carbon Sink Assessment. Department of Environmental Affairs Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/nationalterrestrial_carbonsinks_synopsisreport.pdf [Accessed 23 December 2016].

DEA. (2015c). South Africa's Intended Nationally Determined Contribution (INDC). Department of Environmental Affairs Pretoria, South Africa. Retrieved from http://www4.unfccc.int/submissions/INDC/Published%20Documents/South%20Africa/1/South%20Africa.pdf [Accessed 20 December 2016].

DEA. (2015d). Strategic Plan – Measurement, Reporting and Verification: AFOLU Sector (2016-2020). Pretoria, South Africa: Department of Environmental Affairs.

DEA. (2015e). Research Report: Towards the development of a GHG emissions baseline for the agriculture, forestry and other land use (AFOLU) sector in South Africa. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/carbonoffset_standardsandmethodologies.pdf [Accessed 23 December 2016].

DEA. (2015f). Research Report: Assessment of the potential to produce biochar and its application to South African soils as a mitigation measure. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/biocharreport2015.pdf [Accessed 23 December 2016].

DEA. (2015g). Long-Term Adaptation Scenario: Together Developing Adaptation Responses to Future Climates. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/ [Accessed 22 December 2016].

DEA. (2016a). The Calculation of Country Specific Emission Factors for the Stationary Combustion of Fuels in the Electricity Generation Sector. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/publications/calculationofcountryspecificemissionfactors.pdf [Accessed 22 December 2016].

DEA. (2016b). Strategic Climate Fund Policy: Improvement of the Greenhouse Gas Emissions Inventory for the Agricultural Sector. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/publications/strategicclimate_policyfund_report.pdf [Accessed 23 December 2016].

DEA. (2016c). Survey on economy-wide fuel consumption with emphasis on demand-side sectors. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/publications/surveyoneconomy-widefuelconsumption_ondemand-sidesectors.pdf [Accessed 23 December 2016].

DEA. (2016d). Theme B: South Africa's Climate Change monitoring and Evaluation System. In South Africa's 1st Annual Climate Change Report. Pretoria, South Africa: Department of Environmental Affairs. Retrieved from https://www.environment.gov.za/ [Accessed 22 December 2016].

DEA. (2016e). Theme H: Near-Term Priority Climate Change Flagship Programme. In South Africa's 1st Annual Climate Change Report. Department of Environmental Affairs. Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/reports/themeH_flagship_programme.pdf [Accessed 22 December 2016].

DEA. (2016f). The Green Fund. Department of Environmental Affairs. Pretoria, South Africa. Available (online) at https://www.environment.gov.za/projectsprogrammes/greenfund [Accessed 23 December 2016].

DEA. (2016g). NCCRD data and information. Pretoria, South Africa: Department of Environmental Affairs.

DEA. (2016h). Research Report: Development of potential verification standards and methodologies for carbon offset projects in the AFOLU sector in South Africa. Department of Environmental Affairs Pretoria, South Africa. Retrieved from https://www.environment.gov.za/sites/default/files/docs/afolu_research_report.pdf [Accessed 22 December 2016].

DEA. (2017a). Chapter 1 Synopsis- South Africa's 2nd Annual Climate Change Report. Department of Environmental Affairs Pretoria, South Africa.

DEA. (2017b). GHG National Inventory Report for South Africa (2000-2012) draft. Department of Environmental Affairs. Pretoria, South Africa.

DME. (1998). White Paper on Energy Policy of the Republic of South Africa. Department of Minerals and Energy. Pretoria, South Africa. Retrieved from https://www.gov.za/sites/default/files/whitepaper_energypolicy_1998_0.pdf

DME. (2003a). Integrated Energy Plan for the Republic of South Africa. Department of Minerals and Energy. Pretoria, South Africa. Available (online) at http://www.energy.gov.za/files/iep_frame.html [Accessed 22 December 2016].

DME. (2003b). White Paper on Renewable Energy. Department of Minerals and Energy Pretoria, South Africa. Retrieved from http://www.energy.gov.za/files/policies/whitepaper_renewables_2003.pdf [Accessed 23 December 2016].

DoE. (2005). Energy Efficiency Strategy of the Republic of South Africa. Department of Energy. Pretoria, South Africa. Retrieved from https://www.gov.za/documents/energy-efficiency-strategy-republic-south-africa-0 [Accessed 23 December 2016].

DoE. (2007). Biofuels Industrial Strategy of the Republic of South Africa. Department of Energy. Pretoria, South Africa. Retrieved from http://www.energy.gov.za/files/esources/renewables/biofuels_indus_strat.pdf(2).pdf [Accessed 23 December 2016].

DoE. (2011). Integrated Resource Plan for Electricity 2010-2030. Revision 2. Department of Energy. Pretoria, South Africa. http://www.energy.gov.za/IRP/irp-2010.html [Accessed 23 December 2016].

DoE. (2013). 2012 Integrated Energy Planning Report: Draft for

Public Consultation. In Government Gazette No. 36690 G.N. NO. 513 of 24 July 2013. Department of Energy. Pretoria, South Africa. Retrieved from https://www.gov.za/documents/national-energy-act-2012-integrated-energy-planning-report-draft [Accessed 23 December 2016].

DoE. (2014a). The National Solar Water Heater Programme. Department of Energy. Pretoria, South Africa. Retrieved from https://solarwaterheating-programme.co.za/About [Accessed 23 December 2016].

DoE. (2014b). South African Biofuels Regulatory Framework - draft position paper. In Government Gazette No. 37232, G.N. 24 of 15 January 2014. Department of Energy. Pretoria, South Africa. Retrieved from http://www.energy.gov.za/files/policies/Draft_position_paper_on_the_SA_Biofuels_Reg_Frmwrk.pdf [Accessed 23 December 2016].

DoE. (2016a). Integrated Energy Plan. Revision 1 released for public consultation. In Government Gazette No 40445 of 25 November 2015. Department of Energy. Pretoria, South Africa. Retrieved from https://www.gov.za/documents/national-energy-act-integrated-energy-plan-25-nov-2016-0000 [Accessed 23 December 2016].

DoE. (2016b). Integrated Resource Plan Update - Assumptions, Base Case Results and Observations. Revision 1, released for public consultation. In Government Gazette No 40445 of 25 November 2015. Department of Energy. Pretoria, South Africa. Retrieved from http://www.energy.gov.za/files/irp_frame.html [Accessed 23 December 2016].

DoE. (2016c). Post-2015 National Energy Efficiency Strategy. Draft Version 1.2. In Government Gazette No. 40515, G.N. No 948 of 23 December 2016. Department of Energy. Pretoria, South Africa. Retrieved from https://www.gov.za/documents/post-2015-national-energy-efficiency-strategy-comments-invited-24-dec-2016-0000 [Accessed 23 December 2016].

DoE. (2016d). Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. Department of Energy. Pretoria, South Africa. Retrieved from http://www.energy.gov.za/files/events_overview%20IPP.html [Accessed 23 December 2016].

DoT. (2007). Public Transport Strategy. Pretoria, South Africa: Department of Transport.

DoT. (2015). National Land Transport Strategic Framework 2015-2020. In Government Gazette No. 39092. Department of Transport. Pretoria, South Africa. Retrieved from http://www.transport.gov.za/Portals/0/Annual%20Reports/2015/DoT%20SP%202015-2020.pdf

DoT. (2016). Green Transport Strategy for 2016-2021 - draft. In Government Gazette No. Department of Transport. Pretoria, South Africa. Retrieved from https://www.caia.co.za/wp-content/uploads/2016/08/Draft%20GTS%20Revised%20v5.pdf [Accessed 22 December 2016].

DST. (2010). South African Risk and Vulnerability Atlas. Department of Science and Technology. Pretoria, South Africa.

Dti. (2011). Introduction of Amendments to the National Building Regulations to Introduce Requirements for Energy Usage in Buildings. National Building Regulations and Building Standards Act, 1977 (Act 103 of 1997). Government Gazette No. 34586. GR. No 711 of 9 September 2011. Department of Trade and Industry. Pretoria, South Africa.

Dti. (2014). Compulsory Specification for Energy Efficiency and labelling of electrical and electronic apparatus (VC 9008). National Regulator for Compulsory Specifications Act (Act 5 of 2008). Government Gazette No. 38232, G.N. No. 944 of 28 November 2014. Department of Trade and Industry. Retrieved from https://www.gov.za/documents/national-regulator-compulsory-specifications-act-compulsory-specification-energy-0 [Accessed 22 December 2016].

EC-DEDEA. (2011). Eastern Cape Climate Change Response Strategy. Department of Economic Development and Environmental Affairs. Bhisho, South Africa: Eastern Cape.

Eskom. (2014). Concentrating Solar Power (CSP). Available (online) at http://www.energy.org.za/data-and-tools/project-database/ [Accessed 18 January 2017].

Eskom. (2015). Integrated Report – Fact Sheet. Eskom Holdings Limited. Johannesburg, South Africa. Retrieved from http://www.eskom.co.za/IR2015/Documents/Eskom_fact_sheets_2015.pdf [Accessed 22 December 2016].

FS-DESTEA. (2015a). Climate Change Status Quo Report for the Free State Province. Free State Provincial Department of Economic, Small Business Development, Tourism and Environmental Affairs Bloemfontein, South Africa.

FS-DESTEA. (2015b). Vulnerability Assessment for Free State Province. Free State Provincial Department of Economic, Small Business Development, Tourism and Environmental Affairs. Bloemfontein, South Africa.

GCIS. (2013). Chapter 6. Economy. In South Africa Yearbook 2012/13. Twentieth edition. Prepared by N. Bhaktawar, L. van Niekerk, A. Vermeulen, & J. Hefez (Eds.) Government Communication and Information System. Pretoria, South Africa: ISBN 978-621-41371-7. Retrieved from http://www.gcis.gov.za/content/resourcecentre/sa-info/yearbook2012-13 [Accessed 22 December 2016].

GCIS. (2014). Chapter 6 Economy. In South African Yearbook 2013/14. Prepared by E. Tibane, A. Vermeulen, M. Honwane, & D. Takalani (Eds.), Government Communication and Information System. Pretoria, South Africa. Retrieved from http://www.gcis.gov.za/content/resourcecentre/sa-info/yearbook2013-14 [Accessed 22 December 2016].

GDARD. (2012). Gauteng Climate Change Response Strategy and Action Plan. Department of Agriculture and Rural Development: Gauteng Province. Johannesburg, South Africa.

GEF. (n.d.). GEF Project Database. Global Environmental Facility. Retrieved from http://www.thegef.org/gef/project_list [Accessed 17 January 2017].

IFC. (n.d.). IFC Project Database. International Finance Corporation. Retrieved from http://ifcextapps.ifc.org/ifcext/spiwebsite1.nsf [Accessed 17 January 2017].

IPCC. (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Prepared by S. Eggleston, L. Buendia, K. Miwa, T. Ngara, & K. Tanabe (Eds.) Intergovernmental Panel on Climate Change. Hayama, Japan. Retrieved from http://www.ipcc-nggip.iges.or.jp/public/2006gl [Accessed 22 December 2016].

IPCC. (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Intergovernmental Panel on Climate Change. New York City, USA: Cambridge University Press. Retrieved from http://www.ipcc.ch/pdf/special-reports/srex/SREX-FrontMatter_FINAL.pdf [Accessed 22 December 2016].

IPCC. (2014). 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol. Prepared by T. Hiraishi, T. Krug, K. Tanabe, N. Srivastava, B. Jamsranjav, M. Fukuda, & T. Troxler (Eds.) Intergovernmental Panel on Climate Change. Kanagawa, Japan. Retrieved from http://www.ipcc-nggip.iges.or.jp/public/kpsg/pdf/KP_Supplement_Entire_Report.pdf [Accessed 22 December 2016].

KZN-DEA. (2013). Report to the National Climate Change Committee- Progress Report on Climate Change Activities of the KZN. Department of Environmental Affairs: Province of KwaZulu Natal. Durban, South Africa.

KZN-DEDTEA. (2014). Kwa-Zulu Natal Draft Climate Change Action Plan. Kwa-Zulu Natal Department of Economic Development, Tourism and Environmental Affairs. Durban, South Africa.

L-DEDET. (2013). Limpopo Green Economy Plan including Climate Change Response. Polokwane, South Africa: Department of Economic Development, Environment and Tourism: Limpopo Province.

L-DEDET. (2015). Limpopo Provincial Climate Change Response Strategy. Polokwane, South Africa: Department of Economic Development, Environment and Tourism, Limpopo Province.

Mather, A., & Theron, A. (2011). Recent Extreme Events Along the Coast of South Africa. Durban: eThekwini Municipality.

MP-DARDLEA. (2015). Climate Support Programme- Adaptation Strategies for the Mpumalanga Province. Mpumalanga Province Department of Agriculture, Rural Development, Land and Environmental Affairs. Nelspruit, South Africa.

Naidoo, C. (2011). Financing Climate Change. Prepared for the Development Bank of Southern Africa, Midrand, South Africa.

National Treasury. (2010). Carbon Tax Discussion Paper. Pretoria, South Africa.

National Treasury. (2013). Carbon Tax Policy Paper (Draft for Public Consultation). Pretoria, South Africa.

National Treasury. (2014). Carbon Offsets Paper (published for Public Comments). Pretoria, South Africa.

National Treasury. (2015a). Carbon Tax Bill (published for Public Comment). Pretoria, South Africa.

National Treasury. (2015b). Supporting the Transition to a Green Economy: Draft Public Environmental Expenditure Review and Framework Policy Paper. Government Technical Advisory Centre. Pretoria, South Africa:

National Treasury. (unpublished). Summary of Bilateral Financial Support Received/Committed between 2000 and 2014. Pretoria, South Africa.

National Treasury. (unpublished). Summary of Multilateral Financial Support Committed/Received between 2000 and 2014. Pretoria, South Africa.

NC-DENC. (2015). Climate Change Status Quo for the Northern Cape Province. Northern Cape Province Department of Environment and Nature Conservation. Kimberley, South Africa.

NC-DENC. (2016). Vulnerability Assessment for the Northern Cape. Northern Cape Province Department of Environment and Nature Conservation. Kimberley, South Africa.

NDMC. (2015). National Disaster Management Centre Annual Report 2014/15. National Disaster Management Centre. Department of Cooperative Governance & Traditional Affairs. Pretoria, South Africa.

NPC. (2010). South Africa's Development Indicators. National Planning Commission. Pretoria, South Africa.

NPC. (2011). National Development Plan: Vison 2030. National Planning Commission. Pretoria, South Africa. Retrieved from http://www.nationalplanningcommission.org.za/Pages/NDP.aspx [Accessed 12 January 2017].

NW-READ. (2015). Climate Support Programme - Adaptation Strategies for the North West Province. North West Provincial Department of Rural, Environmental and Agricultural Development MMabatho, South Africa.

PMR. (2014). Emissions intensity benchmarks for the South African carbon tax- Technical Support Study. Prepared by Y. Lozynskyy, M. Neelis, P. Blinde, Y. Lewis, B. Cohen, A. van der Merwe, & I. Patel for the Partnership for Market Readiness. Utrecht, Netherlands.

REEEP. (n.d.). REEEP Projects. Renewable Energy and Energy Efficiency Partnership. Available (online) at http://www.reeep.org/projects [Accessed 17 January 2017].

RSA. (1996). Constitution of the Republic of South Africa (Act No. 108 of 1996). In Government Gazette No. 17678. GN No.2083. Government Printers of South Africa. Pretoria, South Africa. Retrieved from https://www.gov.za/sites/default/files/Act108of1996s.pdf [Accessed 12 December 2016].

RSA. (2004). National Environment Management: Air Quality Act (Act No. 39 of 2004). In Government Gazette No. 27318, GN No. 169 of 24 February 2005. Pretoria, South Africa: Department of Environmental Affairs. Retrieved from https://www.gov.za/documents/national-environment-management-air-quality-act [Accessed 12 December 2016].

RSA. (2005). Intergovernmental Relations Framework Act. Government Printers of South Africa. Pretoria, South Africa.

SANEDI. (2016). South African Centre for Carbon Capture and Storage. South African National Energy Development Institute. Available (online) at http://www.sacccs.org.za/ [Accessed 18 January 2017].

SAPIA. (2016). Cleaner fuels II. South African Petroleum Industry Association. Available (online) at http://www.sapia.org.za/Key-Issues/Cleaner-fuels-II [Accessed 18 January 2017].

SARB. (2014). South African Exchange Rate – Rand per US Dollar. South African Reserve Bank. Available (online) at https://wwwrs.resbank.co.za/webindicators/ExchangeRateDetail.aspx?DataItem=EXCX135D [Accessed 23 December 2016].

Stats-SA. (2014a). South Africa's 2014 Mid-Year Population Estimate. Report P0302. Statistics South Africa. Pretoria, South Africa. Retrieved from http://beta2.statssa.gov.za/publications/P0302/P03022014.pdf [Accessed 23 December 2016].

Stats-SA. (2014b). Gross Domestic Product 4th Quarter 2014. Statistical Release P0441. Statistics South Africa. Pretoria, South Africa. Retrieved from http://www.statssa.gov.za/?page_id=1854&PPN=P0441&SCH=6123 [Accessed 23 December 2016].

Stats-SA. (2015). Environmental Economic Accounts Compendium. Report No.: 04-05-20, March 2015. Statistics South Africa. Pretoria, South Africa. Retrieved from http://www.statssa.gov.za/publications/Report-04-05-20/Report-04-05-202015.pdf [Accessed 23 December 2016].

Stats-SA. (2017). Environmental Economic Accounts Compendium - EEA Compendium Tables 2017. Report No.: 04-05-20, March 2017. Statistics South Africa. Pretoria, South Africa. Retrieved from http://www.statssa.gov.za/?page_id=1854&PPN=Report-04-05-20 [Accessed 20 April 2017].

Turok, I. (2012). Urbanization and Development in South Africa: Economic Imperatives, Spatial Distortions and Strategic Responses. International Institute for Environment Development. London, United Kingdom.

UNDP. (2015). Human Development Index Report: The Rise of the South. United Nations Development Programme. New York City, USA. Retrieved from http://hdr.undp.org/en/media/HDR_2015_EN_complete.pdf [Accessed 19 January 2017].

UNDP. (2016). Technical Note 1. Human Development Index (HDI). United Nations Development Programme. New York City, USA. Retrieved from http://hdr.undp.org/sites/default/files/hdr2016_technical_notes_0.pdf [Accessed 23 December 2016].

UNFCCC (2016). Clean Development Mechanism (CDM) Methodologies. United Nations Framework Convention on Climate Change. (online) Available at https://cdm.unfccc.int/methodologies/index.html [Accessed 29 February 2017].

VCS. (2016). Project Database. Voluntary Carbon Standards Available (online) at http://www.vcsprojectdatabase.org/#/projects [Accessed 29 February 2016].

WC-DEADP. (2008). A Climate Change Strategy and Action Plan for the Western Cape. Western Cape Department of Environmental Affairs. Cape Town, South Africa.

WC-DEADP. (2016). Climate Change Response Framework for the Agriculture Sector for the Western Cape. Western Cape Department of Environment Affairs and Development Planning. Cape Town, South Africa.

WRI (2014). Greenhouse Gas Protocol: Policy and Action Standard – an accounting and reposting standard for estimating the greenhouse gas effects of policies and actions. Prepared by Davis Rich, Pankaj Bhati, Jared Finnegan, Kelly Levin and Apurba Mitra of the World Resources Institute for the Greenhouse Gas Protocol. USA. ISBN 978-1-56973-840-5. Available at http://www.wri.org/publication/policy-and-action-standard [Accessed 29 February 2017].

NOTES

473 Steve Biko Street
Environmental House
Pretoria,0001

Postal Address
Private Bag X447
Pretoria
0001

Publishing date: December 2017

www.environment.gov.za