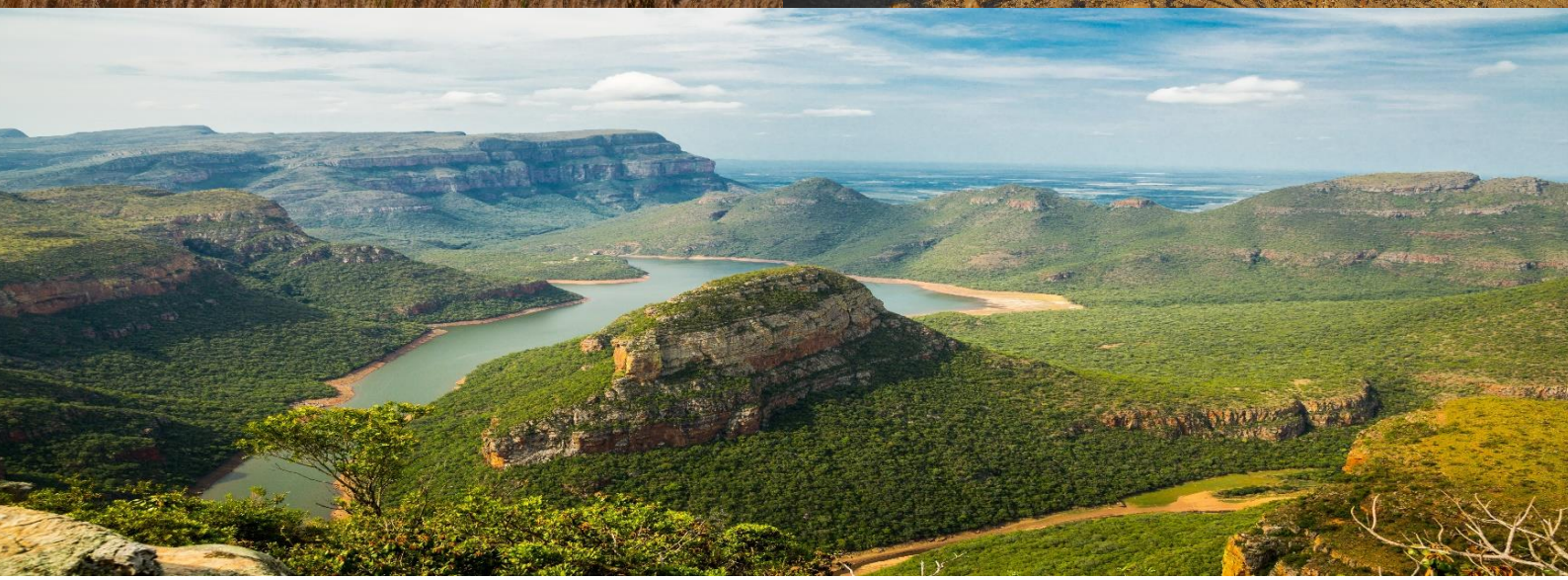
SOUTH AFRICA'S 5th BIENNIAL UPDATE REPORT (BUR-5) TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)



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forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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MINISTERIAL FOREWORD

The government of South Africa through the Department of Forestry, Fisheries and the Environment is pleased to submit the fifth and final Biennial Update Report (BUR-5) to the United Nations Framework Convention on Climate Change. The BUR-5 reports on Greenhouses Gas emissions from 2000 to 2020 including the impact of our mitigation policies and measures up to 2020 as well as financial, capacity building and technology transfer and development support needed and received by 31 December 2020. This final BUR is a key milestone in terms of reporting to the UNFCCC as Parties now transition to report under the Paris Agreement through Biennial Transparency Reports (BTRs). The first BTR of South Africa which will be submitted by 31 December 2024, will report on progress made in implementing and achieving the targets in our updated first Nationally Determined Contribution under the Paris Agreement which was submitted to the UNFCCC in September 2021. The BTR will report on progress made from 1 January 2021 to 31 December 2022.

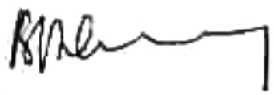
In line with South Africa's National Climate Change Response Policy, South Africa is committed to making its fair contribution to the global effort to stabilise GHG concentration in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social, and environmental development to proceed in a sustainable manner. Equally, through the implementation of our updated NDC, South Africa is also committed to contributing to the global efforts of meeting the objectives of the Paris Agreement whilst ensuring that the overriding national priorities of poverty eradication, reducing unemployment, and addressing inequalities as outlined in the National Development Plan, are met.

To this end, South Africa has been implementing key policies and measures including the Integrated Energy Plan, Integrated Resources Plan, National Energy Efficiency Strategy, Green Transport Strategy, Waste Management Strategy, the National Forests Act and the Carbon Tax Act. South Africa is also in the process of enacting the Climate Change Bill which will be the key legislative instrument in enforcing climate change response in South Africa. Furthermore, the Presidential Climate Commission (PCC) is committed to the implementation of the just transition to a lower carbon economy. The PCC published the Just Transition Framework in 2022 which provides recommendations about the principles to guide the transition, policies, and governance arrangements to give effect to the transition.

As reported in this BUR and our National Inventory Report, South Africa's GHG emissions excl. FOLU were 464 980 Gg CO_2e in 2000. These increased to a peak of 558 546 Gg CO_2e in 2009 and decreased to 468 812 Gg CO_2e in 2020. The GHG emissions including FOLU were estimated to be 442 125 Gg CO_2e in 2020. The annual GHG emissions with emission reductions from domestic policies and measures are within the peak, plateau and decline GHG emissions trajectory range, for the 2010 to 2020 period.

South Africa still further hopes to receive sufficient financial support to implement its NDC under the Paris Agreement including for the implementation of the Just Energy Transition Plan as reported in this BUR. Over the reporting period for 2020, South Africa had received in excess of USD$ 703 million in bilateral support and US$ 469 million from multilateral sources that support or benefit climate change actions in the country. The bilateral support was in the form of grants, technical assistance and loans, while the multilateral support was mainly in the form of grants. South Africa is grateful for the support that has been received and further looks forward to the 1st Global Stocktake under the Paris Agreement during COP 28 that will take place in Dubai in the United Arab Emirates.

In conclusion, the South African government wishes to thank all those who contributed to the development and finalisation of this BUR including the various South African Government Departments and Municipalities, the State-Owned Entities as well as the Non-Government Organisations.



Barbara Creecy

Minister: Forestry, Fisheries and the Environment (South Africa)

EXECUTIVE SUMMARY

The Republic of South Africa submits its 5th Biennial Update Report (BUR-5) 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:

1) National Circumstances.
2) National Greenhouse Gas Inventory.
3) Mitigation actions and their effects.
4) Finance, Technology and Capacity Building Needs and Support Received.
5) Support received for the preparation of the BUR.
6) Measurement, Reporting and Verification.
7) Additional Information.

Each chapter is summarised below and highlights the progress made in South Africa's response to climate change, since reporting in the 4th BUR and Third National Communication (TNC).

ES1 National Circumstances

This chapter provides information on South Africa's population, economy, energy dynamics and climate variability impacts to provide context on the country's opportunities and challenges in addressing climate change. South Africa is located at the southern tip of Africa and is bordered by the Atlantic Ocean to the west and the Indian Ocean to the south and east. Its neighbouring countries are Namibia, Botswana, Zimbabwe, Mozambique, eSwatini and Lesotho. The country experiences both subtropical (inland regions) and temperate climates (coastal regions) with a mean daily temperature of 20°C. South Africa's population grew by 5.48% over the period 2017-2020. In the year 2017, the country had a total population of 56.52 million people, 58.78 million people in 2019 and 59.62 people million in 2020. The rate of unemployment grew by 2.3%between 2017 and 2020 to 29% in 2020. South Africa's GDP declined from USD 349 554 billion in 2017 to USD 301 900 billion in 2020 due to challenges brought by the COVID-19 global pandemic. There was a 5.12% decline in the primary energy supply amounting to 340 810.31 TJ of energy for the period 2017 to 2019. In terms of land and agriculture, the total commercial agriculture area remained relatively constant at 46.4 million hectares for the period 2017-2020. In terms of waste, the total amount of waste generated in South Africa doubled over the period 2017(i.e., 54.2 million tonnes) to 2020 (i.e., 108 million tonnes). Overall, South Africa is characterised by an emerging economy and is ranked as the world's largest exporter of gold, platinum and natural resources. Mining, finance, trade and government services are the main drivers impacting the country's GDP and economic growth.

South Africa's carbon dioxide (CO_2) emissions per capita are ranked as the highest per capita emissions in Africa, as well as the developing world. This is strongly attributed to South Africa's predominant reliance on fossil fuel-based energy generation systems (to a large extent, thermal power generated from coal and diesel generated power) and heavy emissions from the transport and mobility sector. The increase in the number of extreme weather events (attributed to global warming and climate change), such as floods and droughts recorded around the country, are currently projecting the future narrative of climate change impacts – deepening the conditions of poverty and food insecurity for many South Africans living in rural and urban poor communities. As a result, the South African government must prioritise green investments to catalyse the country transitioning to a low carbon economy, which will reduce vulnerability risks, catastrophic impacts of climate change, alleviate poverty and improve livelihoods and wellbeing. South Africa, as a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), remains committed in stabilising the greenhouse gas (GHG) concentration in the atmosphere and halting the global average warming below 2°C above pre-industrial levels.

The Department of Forestry, Fisheries and the Environment (DFFE), formerly known as the Department of Environment, Forestry and Fisheries (DEFF), plays a central coordinating and policy-making role as the designated authority for environmental conservation and protection in South Africa. The work of the DFFE is underpinned by the Constitution of the Republic of South Africa (Act 108 of 1996), the National Development Plan (NDP) (NPC, 2011), the National Environmental Management Act (NEMA) (Act 4 of 2004), National Environmental Management: Air Quality Management Act (NEM: AQA) (Act No. 39 of 2004), National Climate Change Response Policy (NCCRP) (DEA, 2011) and other relevant legislation and policies applicable to government in addressing environmental management, including climate change.

The DFFE is responsible for coordinating the work on the preparation of the Biennial Update Reports (BURs) under the Chief Directorate: International Climate Change Relations and Reporting. This function has been restructured, as it was previously under the Climate Change Monitoring and Evaluation Chief Directorate. The Project Steering Committee (PSC), established by the Director General of the DFFE, continues to support contributing authors in providing technical inputs and oversight on the compilation of these reports. This includes reviewing and commenting on the content of the reports, to ensure that they accurately reflect national circumstances.

ES2 National GHG Emissions Inventory

The National Greenhouse Gas (GHG) Inventory for South Africa is presented for the period of 2000 to 2020. The Inventory covers all four of the Intergovernmental Panel on Climate Change (IPCC) sectors, namely, Energy; Industrial Process and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste.

South Africa's GHG emissions since 2000 increased by 0.8% by 2020. The Energy sector is the largest contributor to emissions, with an increase by 2.2% between 2000 and 2020. However, emissions from the sector did decline by 6.8% in 2020, with these reductions attributed to the reduced travel and trading during the COVID-19 lockdown restrictions. There was an overall decrease in IPPU emissions in 2020 due to a decrease in the mineral industry of 18.4% since 2019. There was a 3.9% decline in emissions from agriculture (excl. FOLU) and a 39.7% decline in emissions including FOLU between 2000 and 2020. The other cattle population has declined by 12.5% since 2014 which contributes to the decline in emissions to 2020. The Land sector sink declined between 2000 and 2008, after which it increased to 2020. The sink was largest in 2016 due to increasing forest land and reduced losses through fuelwood collection and biomass burning. Emissions have increased from the Waste sector and are attributed to the growing population (Figure ES2.1).

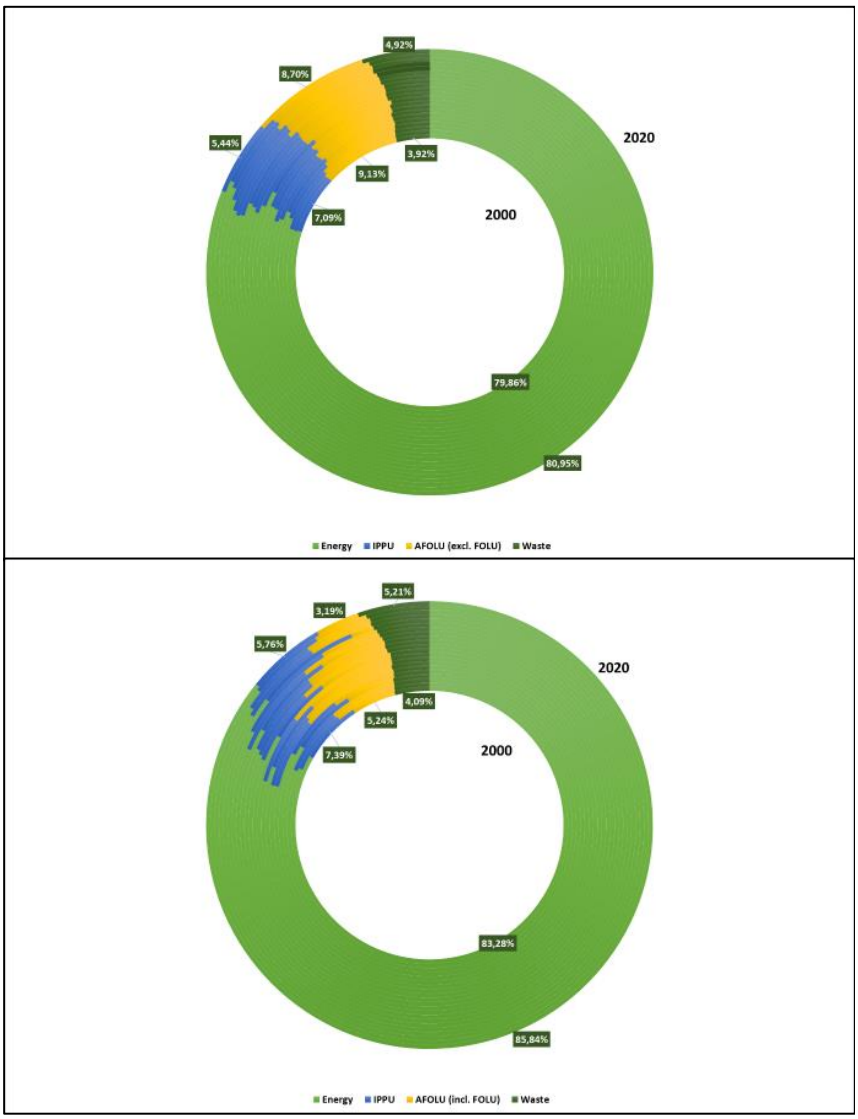


Figure ES2.1: Sector contribution to total emissions excluding FOLU (top) and including FOLU (bottom) in South Africa between 2000 and 2020.

The gas contributing the most to South Africa's emissions (excl. FOLU) was CO_2 and this contribution has decreased from 84.8% to 83.6% between 2000 and 2020. The contribution from methane (CH_4) has increased from 12.2% to 12.4% between 2000 and 2020. Nitrous oxide (N_2O) contribution to the emissions (excl. FOLU) increased from 2.8% in 2000 to 3.0% in 2020. F-gases contributed 1.1% to overall emissions (excl. FOLU) in 2020.

South Africa has conducted uncertainty analysis for the inventory. A trend uncertainty between the base year and 2020, as well as a combined uncertainty of activity data and emission factor uncertainty was determined using an Approach 1. The total uncertainty for the inventory was determined to be between 8.13% and 8.77% including FOLU, with a trend uncertainty of 6.71%. Excluding FOLU reduced the overall uncertainty to be between 6.64% and 7.32%, with the trend uncertainty reduced to 6.21%. The main challenge in the compilation of South Africa's GHG inventory remains the availability of accurate activity data. The Department of Forestry, Fisheries and Environment (DFFE) is in the process of implementing the National Greenhouse Gas Improvement Programme (GHGIP). The programme consists of a series of sector-specific projects that will result in improvements in activity data, country-specific methodologies and emission factors used in the most significant sectors.

ES3 Mitigation Actions and Their Effects

The purpose of this chapter is to provide an information update about the progress of the country to reduce Greenhouse Gas (GHG) emissions through the implementation of supporting policies and actions for the reporting period of 2010 to 2020. Implementation of domestic policies and programmes accounted for 97% (416 Mt CO_2e) of the accumulative emission reductions for this period. Projects from international market mechanisms (IMMs) accounted for the remaining 3% (11 Mt CO_2e). The effects of mitigation actions have contributed to keeping South Africa's GHG emission trajectory within the Peak; Plateau and Decline (PPD) range as set out in the 2015 Intended National Determined Contribution between 398 Mt CO_2e and to 583 Mt CO_2e (Figure ES3.1).

Domestic mitigation has increased from 23 Mt CO_2e in 2010 to 47 Mt CO_2e in 2020 due to the progress achieved for the Renewable Energy Independent Power Producer Procurement Programme (IPP Renewables); the natural gas fuel switch programme and afforestation which accounted for 87% of the annual domestic emission reductions in 2010 and 76% in 2020. Overall, the decline of GHG emissions and emission reductions has been constrained due to the negative economic impacts of declining grid connected electricity generation and supply and the broader electricity crisis which began in 2007.

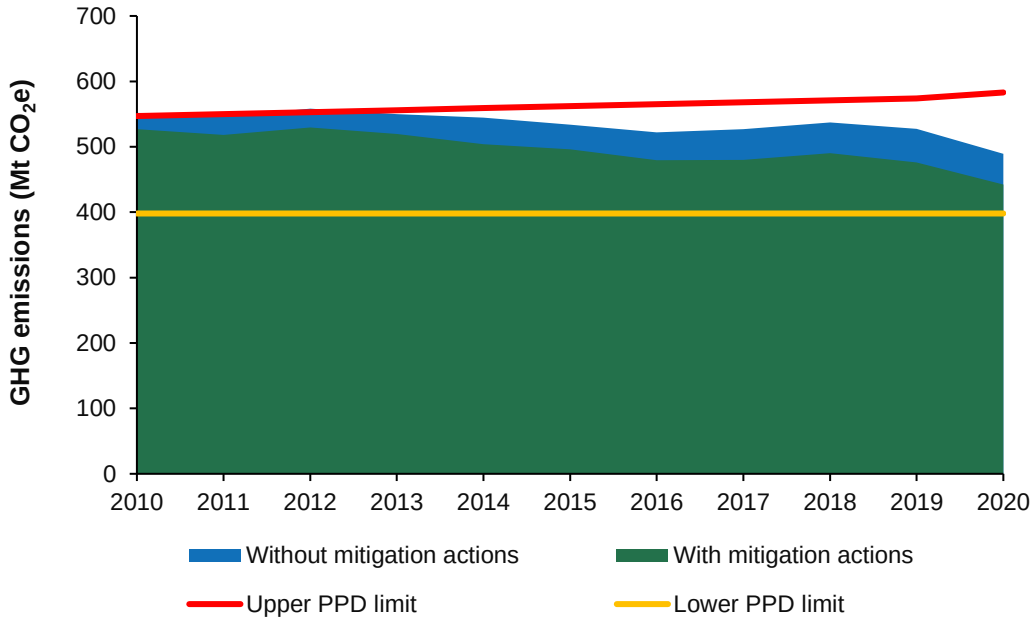


Figure ES3.1: Annual GHG emissions with or without emission reductions from domestic mitigation actions and the PPD range for the 2010 to 2020 period**.**

The Presidential Climate Commission (PCC) has committed to the implementation of the just transition to a lower carbon economy. The PCC published the Just Transition Framework in 2022 which provides recommendations about the principles to guide the transition, policies and governance arrangements to give effect to the transition.

Planned policy instruments under the Climate Change Bill were previously mentioned in BUR-4. The Bill is under review; before it is enacted by Parliament for implementation. Policy instruments include sectoral emission targets, carbon budgets and mitigation plans which in the long term are expected to support substantial reductions of GHG emissions in the industrial sector. Meanwhile, there have been improvements made under the Carbon Tax Act. Notable changes include gazetting of the Regulations for the Greenhouse Gas Emissions Intensity Benchmarks in 2020 for purposes of Section 11 for the Performance Allowance and amendments to the Carbon Offsets Regulations in 2021. A complete set of methodological guidelines which includes carbon sequestration was published by DFFE in 2022 for quantifying GHG emissions from all emission categories which supplements the South African National GHG Emission Reporting Regulations.

Sectoral contributions to accumulative emission reductions for the 2010 to 2020 amount to 223.36 Mt CO_2e in the Energy sector (52%); 17.96 Mt CO_2e in the IPPU sector (4%); 11.45 Mt CO_2e in the Waste sector (3%) and 173.71 Mt CO_2e in the AFOLU sector (41%). IPP Renewables and fuel switching account for the bulk of energy sector emission reductions. Government has committed to reviewing primary energy sector policies, the Integrated Resource Plan and Integrated Energy Plan. Improvements to AFOLU sector policies that also affect afforestation and reforestation activities include the National Forests Amendment Act 1 of 2022 and the Master Plan for the Commercial Forestry Sector

in South Africa 2020-2025. The National Forests Amendment Act 1 of 2022 serves to provide for clear definitions of natural forests and woodlands; to provide for public trusteeship of forestry resources and to increase the promotion and enforcement of sustainable forest management. The Master Plan for the Commercial Forestry Sector in South Africa 2020-2025 seeks to provide a short to medium term action plan for economic revitalisation of the commercial forestry sector.

ES4 Financial resources, technology transfer, capacity building and technical support received and needs

The chapter provides an update from the previous Biennial Update Reports (BURs) on financial, capacity and technical support received and needed by South Africa. The current update in the BUR-5 provides detailed information on the breakdown of the international bilateral and multilateral financial support recorded for the year 2020. The report also includes financial support needed (or requested) by South Africa to develop its response to climate change by sector, as well as a description of non-monetised technical and capacity-building received by the country. Capacity needs identified by the technical team of experts (TTE), in consultation with South Africa, were outlined in the chapter. Technology needs were described in the context of South Africa's Just Energy Transition and associated innovation and technologies needed to support this transition in the South African economy and in terms of hydrogen-related technologies and opportunities to support the deployment of these technologies.

ES5 Support received for the preparation of the BUR

South Africa received multilateral financial support from the Global Environment Facility (GEF) to develop the 5th Biennial Update Report (BUR-5) as well as 4th National Communication (FNC) of South Africa. The total amount of funding received was USD 852 000. The funding was administered using the UNEP as the implementing agency. Some the funding received for the preparation of BUR-5 was used to subject the BUR-5 to an independent review process, as well as the printing of BUR-5 copies. A Project Coordinator (PC) to support with the coordination of BUR-5 compilation will be hired by the DFFE but paid from the budget of BUR-5/NC4 on a two-year contract. The country also received capacity-building support for preparation of the BUR from the Consultative Group of Experts (CGE), the UNFCCC secretariat as well as United Nations Environment Programme Global Support Programme (UNEP GSP).

ES6 Measurement, reporting and verification in South Africa

The South African National Climate Change Information System (NCCIS) is a web-based platform for tracking, analysis and enhancement of the country's progress towards a climate resilient society and low carbon economy. The NCCIS, also known as the country's Monitoring and Evaluation (M&E) System, was launched in August 2019 and is composed of a number of modules that are designed to facilitate access to data and information to track progress towards a low carbon and climate resilient society. The NCCIS is now fully operational, with progress made in the institutionalisation of the system. The NCCIS serves as a national central depository and portal of climate change information in South Africa providing information that is key to informing domestic and international reporting.

Progress has also been made in the institutionalisation of sub-national frameworks at a provincial level. Through the support of external donor funding the Mpumalanga Climate Change Response Database has been developed. Similar processes are also underway in three other provinces namely KwaZulu-Natal, Western Cape and Northern Cape.

The institutional arrangements for the Measurement, Reporting and Verification (MRV) of GHG inventories and mitigation actions is discussed in this chapter. The 2020 inventory included activity data directly from industry via the South African GHG Emissions Regulation Reporting System (SAGERS) through the GHG Reporting Programme. SAGERs has been upgraded to integrate the submissions and annual reporting of pollution prevention plans (mitigation plans) and carbon budgets as combined or separate submissions.

A set of Verification Guidelines for the validation and verification of GHG emissions has been produced. Additionally, a carbon sequestration (“S”) component has been introduced into the Carbon Tax Act (Act No. 15 of 2019). Verification procedures for the sequestration accounting is being compiled and will be incorporated into the Verification Guidelines.

ES7 Additional Information

The chapter provides a description of the additional actions undertaken to address a changing climate in South Africa which were not presented in the BUR-5 in Chapters 1-6. The chapter provides an overview of the National Adaptation Strategy (NAS), progress in South Africa in terms of the Climate Change Bill, which covers both adaptation and mitigation and an overview of the country’s Economic Reconstruction and Recovery Plan.

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AF	Adaptation Fund
AFOLU	Agriculture, Forestry & Other Land Use
ARC	Agricultural Research Council
BRT	Bus Rapid Transit
BTR	Biennial Transparency Report
BUR	Biennial Update Report
BUR-3	Third Biennial Update Report
BUR-4	Fourth Biennial Update Report
CBIT	Capacity-Building Initiative for Transparency
CBT	Climate Budget Tagging
CCM&E	Climate Change Monitoring and Evaluation Unit
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CDP	UK-based organisation- formerly the Carbon Disclosure Project
CERs	Certified Emission Reductions
CFA	Climate Finance Accelerator
CGE	Consultative Group of Experts
CH_4	Methane
CHP	Combined Heat and Power Combustion Systems
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CoC	Centres of Competence
CoGTA	Cooperative Governance and Traditional Affairs
CPI	Consumer Price Index
CS	Country Specific Emission Factor
CSA	Climate Smart Agriculture
CSIR	Council for Scientific & Industrial Research
CSP	Concentrated Solar Power
CTLs	Coal-to-liquids
DAFF	Department of Agriculture, Forestry & Fisheries (now DFFE and DALRRD)
DALRRD	Department of Agriculture, Land Reform and Rural Development
DAOs	Desired Adaptation Outcomes
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries (DEFF) (now DFFE)
DF	IPCC Default Emission Factor
DFFE	Department of Forestry, Fisheries and the Environment (previously DEFF)
DMR	Department of Minerals & Resources (now DMRE)
DMRE	Department of Mineral Resources and Energy
DoE	Department of Energy (now DMRE)
DOM	Dead Organic Matter
DoT	Department of Transport
DPME	Department of Planning, Monitoring and Evaluation in the Presidency
DPWI	Department of Public Works and Infrastructure
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EEPA	Energy Environment Partnership Africa
EF	Emission Factor

EGIP	Embedded Generation Investment Programme
EPWP	Expanded Public Works Programme
FAO	The Food and Agriculture Organisation of the United Nations
FASA	Fertiliser Association of South Africa
FOD	First Order Decay
FOLU	Forestry and Other Land Use
FSA	Forestry South Africa
FSV	Facilitative Sharing of Views
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFT	Green Finance Taxonomy
Gg	Gigagram = 10^9 grams or 10^3 tonnes
GHG	Greenhouse Gas
GHGIP	National Greenhouse Gas Improvement Programme
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
Gondwana	Gondwana Environmental Solutions International
GS	Gold Standard
GTCs	Gas-to-chemicals
GTI	GeoTerraImage, Pty Ltd.
GTLs	Gas-to-liquids
GWh	Gigawatt hours
GWPs	Global Warming Potentials
HFCs	Hydrofluorocarbons
HSRM	Hydrogen Society Roadmap
HWP	Harvested Wood Products
ICA	International Consultation and Analysis
ICAT	Initiative for Climate Action Transparency
IDM	Integrated Demand Management
IDP	Integrated Development Plan
IMCCC	Inter-Ministerial Committee on Climate Change
IMM	International Market-Based Mechanisms
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
IPPU	Industrial Processes and Product Use
IPTN	Integrated Public Transport Network
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
LEDS	Low Emissions Development Strategy
LFG	Landfill Gas
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land-Use Change, & Forestry
M&E	Monitoring and Evaluation
MCA	Multi-criteria Analysis
MJ	Megajoule
MODIS	Moderate Resolution Imaging Spectroradiometer
MPA	Mitigation Potential Analysis
MRV	Measurement, Reporting & Verification
$MtCO_2e$	Million tonnes of Carbon Dioxide Equivalents
MTN	Mobile Telephone Networks
MW	Megawatt
N	Nitrogen
N_2O	Nitrous Oxide

NA	Not Applicable
NAEIS	National Atmospheric Emissions Inventory System
NAP	National Adaptation Plan
NBI	National Business Initiative
NC	National Communications
NCCAS	National Climate Change Adaptation Strategy
NCCIS	South African National Climate Change Information System
NCCRP	National Climate Change Response Policy
NCPC	The National Cleaner Production Centre
NDC	Nationally Determined Contribution
NDMC	National Disaster Management Centre
NDP	National Development Plan
NE	Not Estimated
NEM: AQA	National Environmental Management: Air Quality Act
NEES	Post 2015 National Energy Efficiency Strategy
NGERs	National Greenhouse Gas Emission Reporting Regulations
NGHGIS	National GHG Inventory Management System
NGOs	Non-governmental Organisations
NH_3	Ammonia
NIRs	National Inventory Reports
NLTA	National Land Transport Act
NLTTA	National Land Transportation Transition Act (repealed)
NMVOCs	Non-methane Volatile Organic Compounds
NO	Not occurring
NO_x	Oxides of Nitrogen
NPC	National Planning Commission
NRF	National Research Foundation
NT	National Treasury
NTCSA	National Terrestrial Carbon Sinks Assessment
NWMS	National Waste Management Strategy
ODS	Ozone Depleting Substances
PAGE	Partnership for Action on Green Economy
PAMs	The Policies and Measures
PATPA	Partnership on Transparency in the Paris Agreement
PCC	Presidential Climate Commission
PFCs	Perfluorocarbons
PGMs	Platinum-group metals
PPP	Pollution Prevention Plans
PSC	Project Steering Committee
PSEE	Private Sector Energy Efficiency Programme
PV	Solar Photovoltaics
QA	Quality Assurance
QC	Quality Control
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SAGERS	South African Greenhouse Gas Emissions Reporting System
SAISI	South African Iron and Steel Institute
SALGA	South African Local Government Association
SAMI	South African Minerals Industry
SANAS	South African National Accreditation System
SAR	Second Assessment Report
SASSA	Solar Academy of Sub-Saharan Africa
SANBI	South African National Biodiversity Institute

SF_6	Sulphur Hexafluoride
TTE	Technical Team of Experts
UNEP	United Nations Environment Programme
UNEP GSP	United Nations Environment Programme Global Support Programme

1. National Circumstances

1.1. Introduction

South Africa, like many other developing countries, is particularly vulnerable to the effects of climate change. As such, South Africa is making significant strides toward becoming a low-carbon and climate-resilient society. As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), the South African government, in collaboration with other climate change stakeholders and role players, recognises the importance of achieving the Convention's ultimate objective of stabilising greenhouse gas (GHG) concentrations in the atmosphere, thereby reducing carbon footprints and preventing dangerous anthropogenic interference in the climate system.

South Africa's continued efforts to adequately respond to climate change are evident through many projects and programs addressing climate change under the clear guidance of South Africa's National Climate Change Response Policy (NCCRP) (DEA, 2011) and the National Development Plan (NDP, 2011), which include mainstreaming climate change into development policies and plans and effective monitoring and reporting of GHG emissions, mitigation, and adaptation actions. This Biennial Update Report (BUR) on national circumstances expands on the work initiated and contained in the BUR4 and the third National Communication.

According to the NCCRP (DEA, 2011), the South African government considers climate change as one of the major threats to sustainable development. The government believes that if climate change continues unabated, it has the potential to jeopardise progress toward South Africa's own development goals, as well as the Sustainable Development Goals (SDGs). Therefore, efforts to address the impacts of climate change must be intensified and the UNFCCC must be further adhered to (DEA, 2011).

This following table offers an overview of essential data points of South Africa's landscape during the year 2020. It provides insights into the country's geographic attributes, environmental conditions, social demographics, economic performance, energy sector, land use, agriculture, and waste management statistics. These indicators serve as reference points for understanding South Africa's characteristics, making it a resource for those seeking a quick and comprehensive snapshot of the nation's profile in 2020.

Table 1.1: Key indicators for South Africa in 2020

Key indicator	2020	Source
General		
Latitude	22° S – 35° S	GCIS, 2020
Longitude	17° E – 33° E	
Area	1 219 602 km²	
Environment		
Mean daily temperature	20°C	GCIS,2020
Annual average rainfall	500mm	GCIS, 2020
Social		
Population	59.62 million	StatsSA, 2020
Population growth rate	1.27%	Aaron O'Neill,2022
Female life expectancy at birth	68.5	StatsSA, 2020 GCIS, 2020
Male life expectancy at birth	62.5	
Infant mortality rate	23.6 per 1000 live births	
Unemployment rate	29%	GCIS, 2020
Total number of people living with HIV	7.8 million	StatsSA, 2020 GCIS, 2020
Human development index	0.709	UNDP, 2020
Economic		
GDP	301.9 billion USD	World Bank, 2020a; World Bank, 2020b
GDP per capita	5,090.72 USD	
GNI per capita, PPP (current international $)	13140 USD	
Energy sector		
Primary energy supply	6 317 557,69	DMRE, 2019
Access to electricity (% of population)	84.4%	World Bank, 2020
Energy power consumption (kWh per capita)	4365.92	World Bank, 2019b
Land and agriculture		
Total commercial agricultural area	46.4 million ha	StatsSA, 2020b
Grazing land	36.5 million ha	
Arable land	7.6 million ha	
Total forest area	30 million ha	GCSI, 2020
Forest plantation area	11 950km²	FSA, 2021
Cattle population	12.3 million	DALRRD, 2022
Commercial sheep and goats	20.666 million	
Commercial swine	1.357 million	
Waste		
Waste generated	108 million tonnes	Research and Markets (2021)
Waste to landfill	90%	
Waste recovered and/or recycled	10%	

1.2. Geographic Profile

South Africa is an African nation that occupies the southern tip of the African Continent. South Africa has more than 3,000 km long coastline that extends from the desert border with Namibia in the west to the Mozambique border in the east and is bounded by the Atlantic Ocean on the west coast and the Indian Ocean on the east coast. The country shares borders with Botswana, Namibia and Zimbabwe, while Mozambique and Eswatini are in the north-east. The independent mountain kingdom of Lesotho is completely landlocked within South Africa.

South Africa's surface area covers 1 219 602 km², extending 'from 22°S to 35°S latitude and from 17°E to 33°E longitude'' (GCIS, 2020). The country is divided into three major geographical regions: a broad central plateau, mountain ranges that encircle the plateau to the west, south and east and a narrow strip of low-lying terrain around the coast. Almost two-thirds of South Africa is covered by the Central Plateau (GCIS, 2020). The interior plateau of South Africa rises suddenly to form a series of mountain ranges before descending to sea level. The boundary between these two areas is formed by the Great Escarpment, which ranges in elevation from 2,000 to 3,300 meters (GCIS, 2020). The location map for the Republic of South Africa which shows the great escarpment, and the central plateau is illustrated in Figure 1.1.

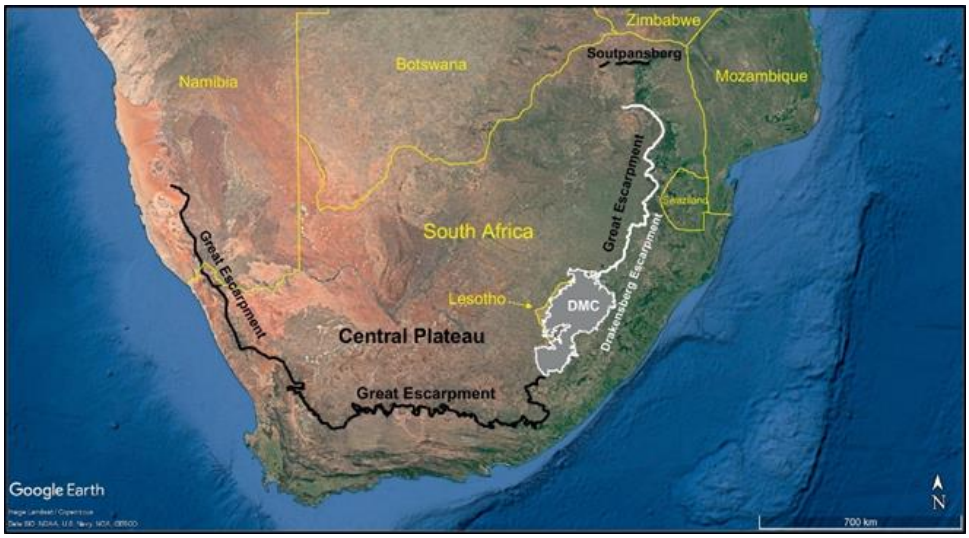

Figure 1.1: Google earth image of Southern African Central Plateau and Great escarpment. Source: CARBUTT (2019)

The fourth Biennial Update Report (BUR-4) presented a brief overview of the prevailing climate conditions in South Africa. The second and third BUR reported on the adverse climate change impacts and natural disasters experienced since 2014 and 2016, respectively and this fifth BUR report offers an updated version of the climate change impacts since that period.

1.3. Climate

South Africa is a semi-arid country, with an average annual rainfall of about 500 mm (GCIS, 2020). Although the Western Cape gets most of its rainfall in winter, the rest of the country is a summer-rainfall region. A subtropical location, moderated by the ocean on three sides of the country and the altitude of the interior plateau, account for the warm temperate conditions. Temperatures in South Africa tend to be lower than in other countries at similar latitudes, owing to greater elevation above sea level. On the interior plateau, at an altitude of 1 694 m (Johannesburg) the average summer temperatures are kept below 30°C. In winter, for the same reason, night-time temperatures can drop to freezing point or lower in some places. South Africa's coastal regions are therefore relatively warm in winter. Temperatures on the country's east and west coasts differ dramatically due to the warm Agulhas Current and the cold Benguela Current, respectively (GCIS, 2020). The detailed mean average temperatures for South Africa's major cities for summer and winter, are shown in Table 1.2.

Table 1.2: Average Temperatures (°C) in South Africa for the year 2020. Source: GCIS (2020)

City	Summer (°C)		Winter (°C)	
	Max	Min	Max	Min
Bloemfontein	31	15	18	-2
Cape Town	26	16	18	7
Durban	28	21	23	11
East London	26	18	21	10
George	25	16	19	8
Johannesburg	26	15	17	4
Kimberly	33	17	19	2
Mthatha	27	17	21	5
Musina	34	22	25	8
Nelspruit	28	18	22	7
Pietermaritzburg	28	19	23	6
Polokwane	28	17	21	5
Port Elizabeth	26	18	20	8
Pretoria	29	18	23	6
Richards Bay	29	21	23	12
Skukuza	33	21	26	6
Thohoyandou	30	20	23	10
Upington	36	20	21	4

The climatic conditions in South Africa range from Mediterranean in the southwest to temperate in the central plateau and subtropical in the north-eastern part of the country. A desert climate can be found in a small area in the north-western part of the country (GCIS, 2020). South Africa has distinct types of geographical landscapes, which influence the climates experienced in one part of the country from the other (GCIS, 2020). Temperatures in South Africa are influenced mostly by elevation, terrain and ocean currents than they are by latitude. Much of the nation experiences warm, sunny days and chilly nights

(GCIS, 2020). Presently, South Africa continues to be subjected to extreme weather events attributed to observed changes in the climate system. South Africa had a warm year in 2020, especially when compared to past years, which can be attributed to above-average rainfall throughout the most parts of the country. Based on data from 26 climate stations, the annual mean temperature anomalies for 2020 were slightly higher on average than the reference period (1981-2010), making it the 13th warmest year on record since 1951. The country is warming at a rate of 0.16 °C every decade, which is statistically significant at the 5% level (SWS, 2021). The annual mean surface temperature deviation for South Africa is illustrated in Figure 1.2 below.

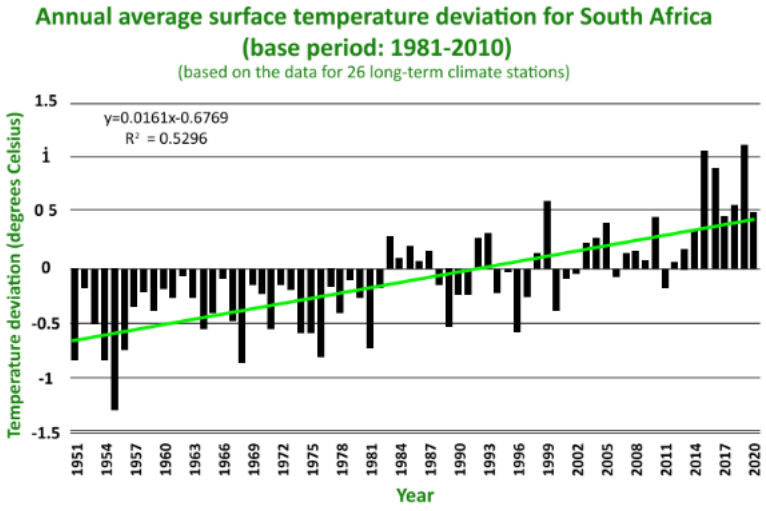

Figure 1.2: Annual average surface temperature deviation for South Africa (base period: 1981-2020). Source: SAWS (South African Weather Services) (2020)

There has been an increase in the frequency and intensity of extreme weather events around South Africa. South Africa has been exposed to prolonged, intensified drought conditions since 2013, as well as flash floods in other parts of the country, which have devastated several sectors and jurisdictions. In 2018, South Africa experienced one of the worst droughts in its history where cities like Cape Town had to implement water restrictions due to a looming day zero disaster, which if it had happened, would have severely affected the city's ability to supply water to its residents. Day zero refers to a scenario where water sources would have been depleted to the point where no water is available to meet the required demands needs.

In regions such as the Eastern Cape and Northern Cape, the recurring droughts experienced from 2015 to 2018 resulted in crop failures and many livestock deaths, which adversely affected the livelihoods of farmers as well as the nation's food and water security. In the year 2017, the Knysna fires were reported to be the worst fire disasters in the history of South Africa. This was attributed to the recurring droughts and gale force winds emanating from climate change (Le Maitre et al., 2019). These fires in Knysna displaced more than 10 000 people and left behind a trail of destruction, not only to the natural environment, but also to properties within the affected areas.

The insurance and forestry industries were the most severely impacted by the fire disaster, which, together with government, suffered at least ZAR 3 billion in direct costs as result of the disaster. In addition, another extreme weather event to note is the Cape Storm that happened in June 2017. During this period, a very uncommon storm with wind speeds of 120km/h and high wave tides of 12 meters, also left behind a trail of destruction, leaving at least 100 schools in the Western Cape severely damaged, several homes flooded and at least 8 people dead. The latest extreme weather event that South Africa experienced, were the flash floods and landslides that happened in the KwaZulu Natal Province in April 2022. As a result of these flash floods and landslides that emanated from extreme rainfall, 448 people were reported dead, with more than 40 000 people displaced and at least 12 000 homes destroyed. All of these extreme weather events have also been attributed to the changes in the global climate due to global warming (Engelbrecht et al., 2022).

1.4. Population Profile

According to mid-year estimates from Statistics South Africa (StatsSA), the population of South Africa in 2020 was 59.62 million. Although Gauteng is the smallest of South Africa's nine provinces, 15.5 million people (26%) live in the province, which comprises of the largest share of the population. KwaZulu-Natal has the second largest population, with an estimated 11.5 million people (19.1%) living in this province. Northern Cape Province remains the province with the smallest share of the population, with approximately 1.29 million people (2.2%) (StatsSA, 2021; GCIS, 2020).

According to (StatsSA, 2020), in 2020, the majority (67.35%) of the population of South Africa lived in urban areas and cities. It is estimated that Gauteng and the Western Cape experienced the largest influx of migrants between 2016 and 2021, of approximately 1 553 162 and 468 568, respectively (StatsSA, 2021). The ongoing migration of people from rural areas to urban areas (towns, cities and metropolises) is expected to continue (DPSA, 2016). Nevertheless, the effects of climate change continue to put pressure on urban governance and service delivery, as the growing urban population requires more services amidst the effects of climate change.

Based on the mid-year population estimates for 2021 from StatsSA (2021), the coronavirus disease 2019 (COVID-19) pandemic has had an influence on mortality and migration into the country since the pandemic began in early 2020. As a result, the crude death rate (CDR) increased substantially between 2020 and 2021 from 8.8 per 1 000 people to 11.6 deaths per 1 000 people, respectively. Furthermore, South Africa witnessed a 34% increase in adult deaths in 2021, resulting in a drop in life expectancy (LE) at birth in 2021 (StatsSA, 2021). Lastly, South Africa's life expectancy at birth for males dropped from 62.4 years in 2020 to 59.3 years in 2021, while life expectancy for females dropped from 68.4 years in 2020 to 64.6 years in 2021(StatsSA,2021).

1.5. Coronavirus Pandemic

The outbreak of COVID-19 has had significant impacts on South Africa, which compounded the triple challenges of poverty, unemployment and inequality. South Africa reported its first case of COVID-19 on the 5th of March 2020 and has since had one of the continent's highest case occurrences. Following that, the South African President, His Excellency, Cyril Ramaphosa announced plans to fight the spread of COVID-19 across the country, which included a risk-adjusted strategy to curtail the spread of coronavirus.

The country's already precarious economic situation became even more insecure, resulting in significant social effects. However, the infection rate later increased, necessitating further limitations, which contributed to significant economic hardships. Nonetheless, the South African government has done an excellent job of making efforts to combat the COVID-19 pandemic. Vaccine distribution has been well underway, giving a glimmer of hope to the normalcy that the country once enjoyed.

According to the National Institute for Communicable Diseases (NICD) of South Africa, vaccines played a significant role in preventing the spread of COVID-19 in the country (NICD, 2022). This is because they provide protection to individuals by lowering their risk of infection or the intensity of their symptoms, as well as at the population level, which is referred to as population herd-immunity. The immunization campaign is a top priority in the fight to stop the spread of COVID-19 (NICD, 2022). There has been over 3 623 962 infections and over 95 835 coronavirus-related deaths reported in the country since the pandemic began. As of 06 February 2022, the South African government has administered at least 30 189 745 doses of COVID vaccines (NICD, 2022).

1.6. Economy

South Africa is classified as an upper middle-income country by the World Bank and it remains one of the largest economies on the African continent. Mining, transportation, energy, manufacturing, tourism and agriculture are South Africa's primary economic sectors. The country is rich in mineral resources and has the largest reported reserves of gold, platinum group metals, chrome ore and manganese ore in the world, as well as the world's second-largest reserves of zirconium, vanadium and titanium (GCIS, 2020).

1.6.1. GDP

As reported by the South African Government's Minister of Finance, Enoch Godongwana, the budget year 2020/2021 was one of the most difficult of the democratic era and was undoubtedly a huge blow to the domestic and global economies (National Treasury, 2022). The restrictions imposed because of the COVID-19 pandemic had a negative impact on the country's economy, which dropped by 7% in 2020 compared with 2019, being one of the largest drops in the country's history (StatsSA, 2021a).

According to data published by the World Bank, South Africa's Gross Domestic Product (GDP) was worth 301.92 billion US dollars in 2020 (see Figure 1.3). Furthermore, South Africa's GDP decreased by 1.5% in the third quarter (Q3) of 2021 (July–September), despite the South African economy growing faster than expected in the first half of 2021 (StatsSA, 2021). According to data published by StatsSA, this major decrease was attributable to the impact of Kwa-Zulu Natal and Gauteng July civil unrest, combined with Covid-19 restrictions during the third wave of the pandemic (StatsSA, 2021).

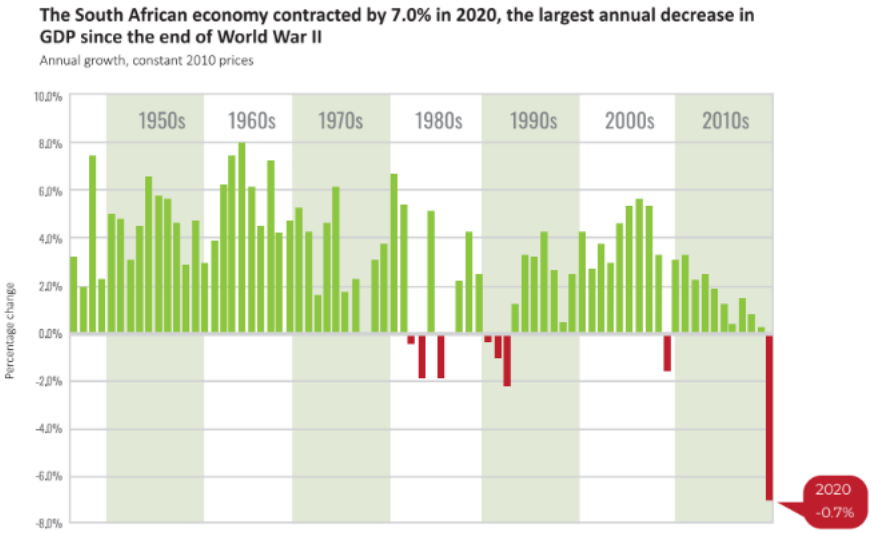

Figure 1.3: The Annual Growth, constant 2010 prices. Source: StatsSA (2021a)

1.6.1.1. Sectoral Performance

The ten South African industries' growth rate analysed in Q3 of 2021 include finance, personal services, government, electricity, gas and water, construction, mining, trade, agriculture, as well as transport and communication. Six of the ten industries saw a drop in production in Q3 of 2021, with agriculture, trade and manufacturing taking the worst of the blow. The agriculture industry saw its biggest drop in production since 2016, with a 13.6% decrease (see Figure 1.4). The trade industry declined by 5.5%, with losses across the board. The manufacturing industry fell by 4.2%, pulled down mostly by civil unrest and global raw material shortages (StatsSA, 2021a). Transport and communications also fell by 2.2%, while the construction industry saw a 0.5% drop in production. On the other hand, 4 sectors experienced gains in production in Q3 of 2021, with finance experiencing the largest gain of 1.2% followed by personal services with a 0.5% gain and lastly, government and electricity, gas & water with a 0.4% gain each.

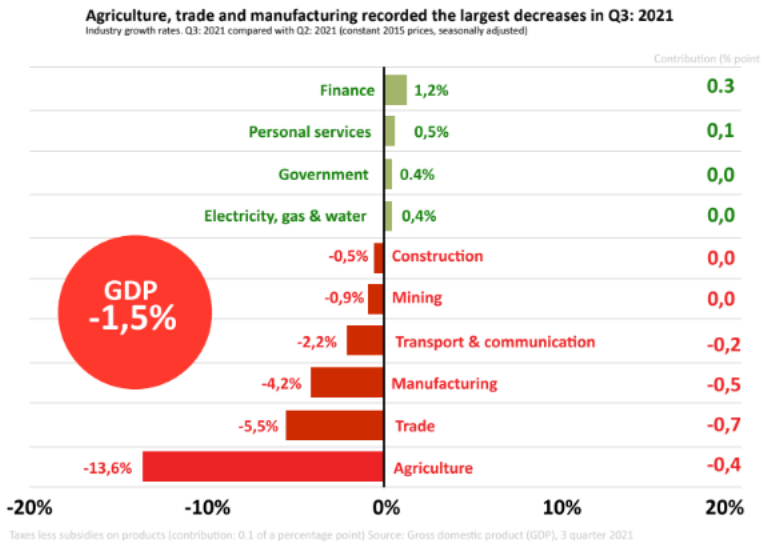

Figure 1.4: Industry growth rates, Q3: 2021 compared with Q2:2021 (constant 2015 prices)
Source: StatsSA (2021a)

1.6.1.2. Infrastructure

South Africa's world-class infrastructure (trains, highways and ports) accounts for most of the continent's economic and industrial infrastructure (Obraztsova, 2021). The public-sector capital expenditure displayed an increasing trend from 2012 to 2016. However, capital expenditure decreased from ZAR 284 billion in 2016 to ZAR 249.6 billion in 2018, with an average decline of 17.2% per year (StatsSA, 2018a). Infrastructure investments facilitate economic activities and thus enable economic growth, job creation and poverty alleviation. Public-sector infrastructure spending over the medium-term expenditure framework period (2021 – 2023) is estimated at ZAR 815 billion (National Treasury, 2020). State-owned companies continue to be the largest contributor to capital investment, with a projected spend of ZAR 314 billion over the next three years. Infrastructural spending also underpins some of the goals of the NDP (NPC, 2011). The provision of service delivery and infrastructural development has a target of 30% as a percentage of GDP by 2030. The breakdown of functional categories of general government expenditure on infrastructure (as a percentage of GDP) is given in Figure 1.5 and Figure 1.6, which shows the annual investment as a percentage of GDP.

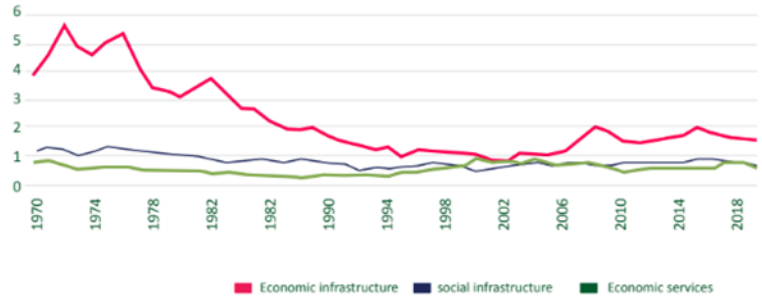

Figure 1.5: Breakdown of functional categories of general government infrastructure spending (percent of GDP). Source: Intellidex (2021)

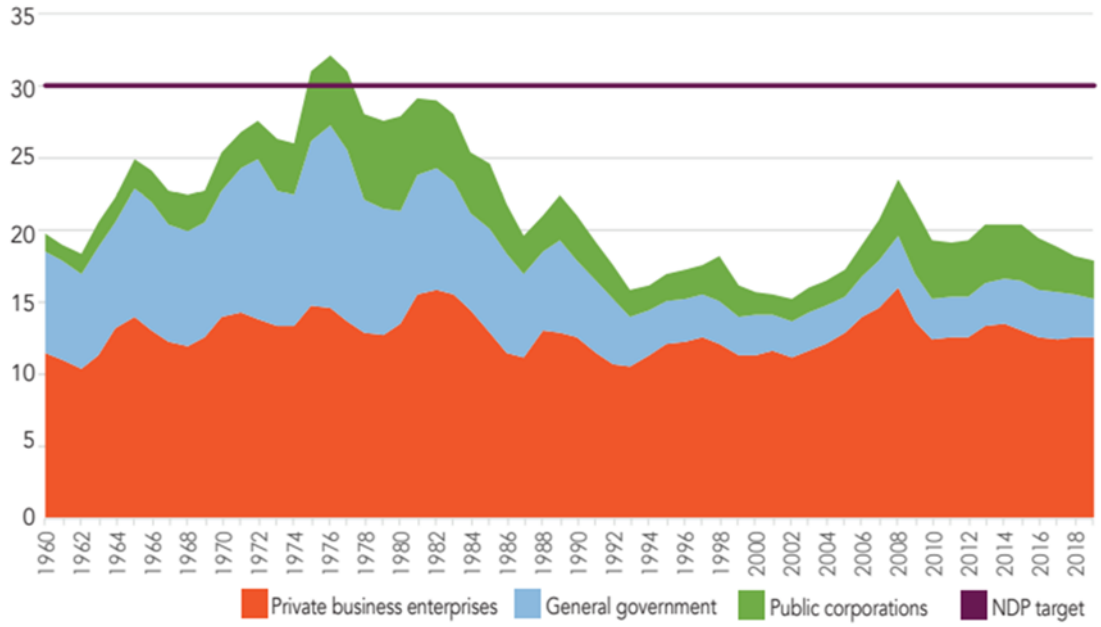

Figure 1.6: Gross fixed capital formation (annual investment as a percentage of GDP). Source: Intellidex (2021)

1.6.1.3. Poverty and Unemployment

South Africa is grappling with the 'triple challenges,' which often refer to the situation of a high level of poverty, inequality and unemployment. Although the country's development framework is based on alleviating poverty and tackling inequality, poverty remains a major national social, economic and political concern. South Africa's poverty challenges are intricately linked to the country's persistently growing unemployment rate, which reached 34.9% in Q3 of 2021 (StatsSA, 2021 (StatsSA, 2020). According to the LCS 2014/15, approximately half of the adult population in South Africa (49.2%) lived below the upper-bound poverty level (UBPL) (StatsSA, 2018). This is despite poverty-relief measures being implemented by government departments and other public-sector institutions, such as providing free government services and social grants.

1.6.1.4. Inequality

South Africa is often regarded as one of the most unequal countries in the world, with a per-capita expenditure Gini coefficient of 0.67 in 2006, which fell to 0.65 in 2015 (StatsSA, 2020). South Africa's wealthiest 10% possesses more than half of the country's income, while the poorest 40% own only 7.2% (Khanyi Mlaba, 2020). The distributions of earnings show the South African labor market's significantly racialised inequality. Black Africans not only have the worst employment prospects, but they also earn the least when they do find employment. Whites, on the other hand, earn far more than any other population groups in South Africa (StatsSA, 2020). The labour market was the largest contributor to overall income inequality, accounting for 74.2%. Female workers in South Africa earn approximately 30% less than male workers on average. According to the survey, males are more likely to be employed and have higher-paying jobs than females (StatsSA, 2020). Figure 1.7 shows two

neighbourhoods outside of Johannesburg depicting wealth and poverty, just separated by a road, evidencing the magnitude of inequality within South Africa's society.

Figure 1.7: Two neighbourhoods outside of Johannesburg (Photograph by Johnny Miller cited in (Pomerantz, 2019)

The Human Development Index (HDI) is an average measure of a country's basic human development achievements, which include life expectancy, education and income. Human development is identified as a critical component of inclusive growth in South Africa's National Development Plan (NPC, 2011). South Africa's HDI increased by 13.1% between 1990 and 2019, rising from 0.627 to 0.709, respectively. South Africa's Human Development Index value in 2019 was 0.709, an improvement from the previous year (0.666) (UNDP, 2020). (Figure 1.8). The increases in life expectancy at birth, mean schooling years and Gross National Income per capita have all contributed to this improvement. As a result, South Africa has made it a priority to accelerate the pace of its economic recovery to address poverty, hunger, unemployment, and inequality.

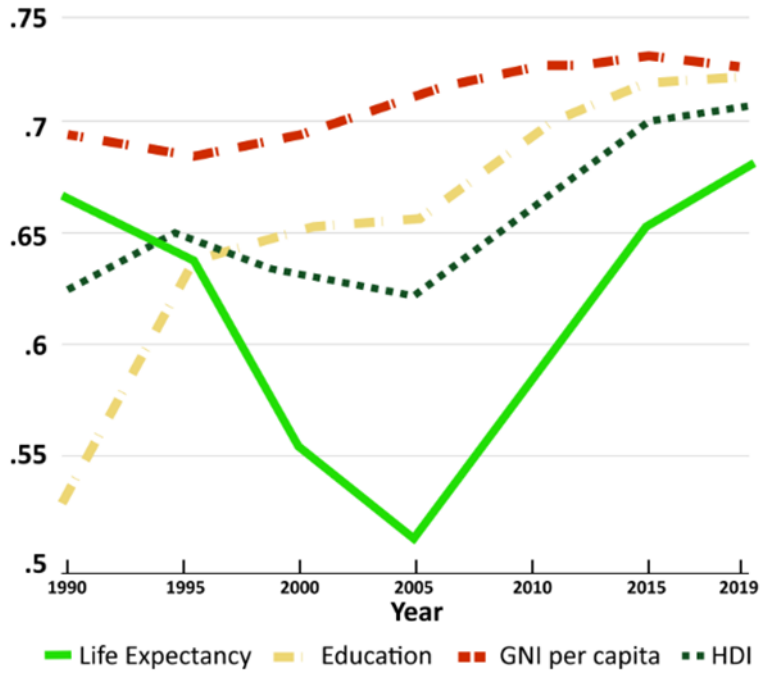

Figure 1.8: South Africa Human Development Index. Source: UNDP (2020)

1.6.2. Energy Sector

South Africa remains one of the world's top suppliers of mineral commodities. As a result, overall energy consumption per unit of GDP is around 50% greater than the global average. This high level of consumption is driven by energy-intensive sectors, as well as the type of coal used in the energy supply system. The South African manufacturing industry currently relies heavily on primary extraction and low-grade processing, making it an energy-intensive industry.

1.6.2.1. Energy Mix

South Africa's energy supply is dominated by coal, which constituted 65% of the primary energy supply in 2018, followed by crude oil with 18% and renewables with 11% (see figure 1.9). Nuclear energy contributed 3%, while natural gas contributed 2% to the total primary supply during the same period. In this context, the primary energy provision comprises domestically sourced production and imports, with the amount exported subtracted from the total. (DMRE, 2022). Coal supplies more than 70% of South Africa's energy needs (electricity and liquid fuels) and according to the Minerals Council South Africa, South Africa has enough coal reserves to last more than a century (GCIS, 2022).

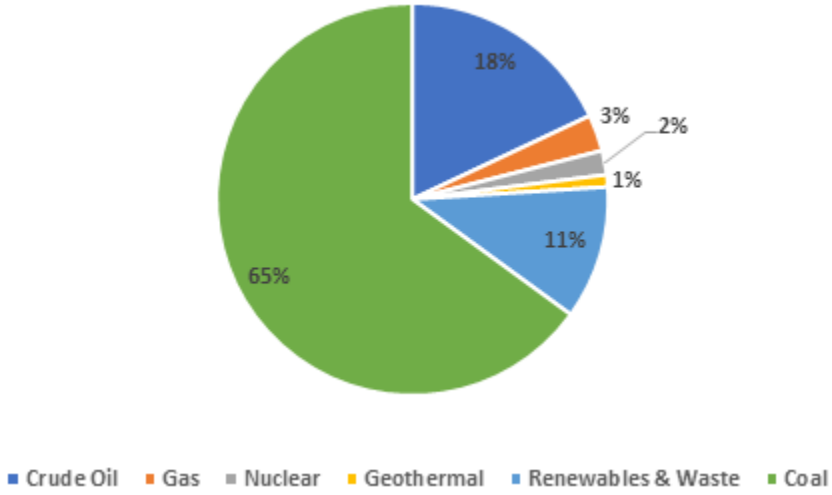

Figure 1.9: Total Primary Energy Supply in South Africa, 2018. Source: DoE Energy Balances (2018)

South Africa continues to pursue an energy mix outlined in the country's energy blueprint, the Integrated Resource Plan (IRP) (DoE, 2019). South Africa's energy capacity remains heavily reliant on fossil fuels such as coal and petroleum. Even though the country continues to use substantial amounts of coal and petroleum resources, it has begun to invest in clean technologies to facilitate the transition from a high to a low carbon economy, while ensuring energy supply security to its citizens (DMRE, 2022).

The South African Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) aims to increase the amount of power available in the electricity system by attracting private sector investment in onshore wind, photovoltaic power, concentrated solar power (CSP), biomass, landfill gas and small hydro technologies. One of the energy mixes outlined in the National Development Plan (NDP) and the Integrated Resource Plan 2010 is the REIPPP programme. Onshore wind power currently dominates energy supply capacity per technology, accounting for 52%, followed by photovoltaic power (36%) and CSP (9%) (DMRE, 2022). The REIPPPP has attracted R209.7 billion in investment (equity and debt), of which R41.8 billion (20%) is foreign investment (DMRE, 2019). Since its inception in 2010, the REIPPPP has grown to become one of the world's most progressive and successful alternative energy programmes (DMRE, 2019). Since the implementation of these renewable energy technology programmes (solar, wind, biomass, small hydro and landfill gas power), facilities have been built around the country, adding clean energy to the national grid (GCIS, 2022).

1.6.2.2. Energy Demand

Energy is the lifeblood of the South African economy and is an important sector of the economy that creates jobs and value by extracting, transforming and distributing energy goods and services throughout the economy. The six sectors identified in this report are industrial, transport, agriculture, residential, commerce and public services. The sector “non-specified” refers to unaccounted energy (energy that has not been categorised into a specific sector) (DMRE, 2022).

According to the DMRE (2022), South Africa's energy sector has been and continues to be at the centre of economic and social development. The energy industry has a direct impact on the economy because it uses labour and capital to produce energy. This role is especially crucial at a time when economic growth and job creation are top priorities in the country. In addition to the economic benefits of the energy industry in general, relatively lower and stable energy prices are particularly important in stimulating the country's economy. Figure 1.10 below depicts the percentage of energy consumed by various sectors of the economy, as well as the energy supply to the various sectors (DMRE, 2022).

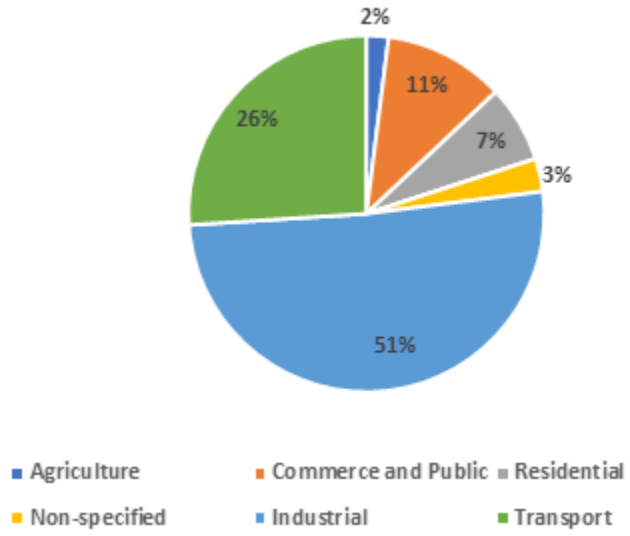

Figure 1.10: Energy Demand per sector, 2018. Source: DoE Energy Balances (2018**)**

1.6.3. South Africa's institutional arrangements for climate change

1.6.3.1. Domestic institutional arrangements

The Republic of South Africa is a constitutional democracy with a three-tiered system of government and an independent judiciary. The national, provincial and local levels of government all have legislative and executive authority in their respective spheres and the Constitution of the Republic of South Africa (RSA, 1996) defines them as distinct, interdependent and interrelated. Local government has more autonomy in terms of raising revenue and developing bylaws that are consistent with the Constitution, as well as national and provincial government policies. The underlying framework for such autonomy is cooperative governance. The Intergovernmental Relations Framework Act (Act 13 of 2005) and associated regulations further supports such autonomy.

Policies such as the National Climate Change Response Policy (NCCRP) (DEA, 2011) provides a clear framework for mainstreaming climate change planning and action across different government spheres. Many government departments and municipalities have begun to mainstream climate change into their strategies, policies and Integrated Development Plans (IDPs), signalling South Africa's preparedness to address climate change while providing services to the people of South Africa.

1.6.3.2. Provincial and Local Government institutional arrangements

The National Climate Change White Paper (NCCWP) reinforces the idea that the environment is a concurrent function of provincial and national government and that provinces will coordinate provincial adaptation and mitigation responses within their respective line departments as well as across municipalities within the province. On a provincial level, environmental departments are tasked with coordinating climate change response actions in collaboration with their respective environmental departments and provincial entities. Most of the lead departments have established provincial climate change structures to allow provincial stakeholders to learn about climate change and coordinate their responses.

Local government is an important sphere of governance within the province since it is the level of government closest to the people. As a result, municipalities coordinate the delivery of services within their communities. Accordingly, the local sphere is the most appropriate level for raising public awareness and assisting communities in building a better, more sustainable environment and enhancing resilience. Under the leadership of the DFFE and the South African Local Government Association (SALGA), district and local municipalities are conducting climate vulnerability assessments and incorporating climate action into their policies, strategies and plans.

1.6.3.3. Institutional Arrangements for the Preparation of the BUR-5

1.6.3.3.1. National Focal Point

The Department of Environmental Affairs (DEA) was renamed the Department of Environment, Forestry and Fisheries (DEFF) upon the announcement of the sixth administration in 2019. The name was changed again in 2021 to the Department of Forestry, Fisheries and the Environment (DFFE), which was still in use at the time of drafting this BUR5.

The DFFE is obliged to give effect to citizens' constitutional right to an environment that is not harmful to their health or well-being, as well as to protect the environment for the benefit of current and future generations. For that aim, the DFFE provides leadership towards sustainability in environmental management, conservation and protection for the benefit of South Africans and the global community.

The DFFE is South Africa's central coordinating and policymaking authority for environmental conservation and protection. The work of the DFFE is endorsed by the Republic of South Africa's Constitution (RSA, 1996), the NDP, the National Environmental Management Act (NEMA) (Act 8 of 2004), National Environmental Management: Air Quality Act (NEM: AQA) (Act 39 of 2004), the NCCRP and any other relevant legislation and policies applicable to address environmental management, including climate change. The department is involved in monitoring national environmental information, policies, programmes and legislation related to climate change and is responsible for providing

guidance and making sure that there is a clear alignment of policies and international obligations when it comes to climate change. The DFFE is responsible for the co-ordination and management of all climate change-related information, notably mitigation, adaptation and monitoring and evaluation programmes.

On behalf of the South African government, the DFFE is responsible for the implementation of the UNFCCC Kyoto Protocol and Paris Agreement. The DFFE has been designated as the UNFCCC National Focal Point, as well as the Political Focal Point for the Global Environment Facility. Under the Chief Directorate: International Climate Change Relations and Reporting, the DFFE leads the work on the preparation of BURs and National Communications (NCs).

1.6.3.3.2. Project Steering Committee (PSC)

The Director General of the DFFE established a standing PSC (see Table 1.3) that continues to provide technical input and oversight on the compilation of these reports (BURs and NCs), as well as assisting contributing authors. The work of the PSC includes reviewing and commenting on technical information to ensure that the reports accurately reflect South Africa's national circumstances. The DFFE chaired over the PSC, which was made up of representatives from the national departments and state agencies, as shown in Table 1.3.

Table 1.3: Project steering committee, involved in the preparation of BUR-5

Project steering committee, involved in the preparation of BUR-5
Department of Forestry, Fisheries and the Environment
Department of Agriculture, Land Reform and Rural Development
Department of Women, Youth and Persons with Disabilities
Department of Cooperative Governance and Traditional Affairs
Department of Health
Department of Higher Education and Training
Department of Human Settlements
Department of International Relations and Cooperation
Department of Mineral Resources and Energy
Department of Planning, Monitoring and Evaluation
Department of Public Enterprises
Department of Public Works and Infrastructure
Department of Science and Innovation
Department of Trade, Industry and Competition
Department of Transport
Department of Water and Sanitation
National Treasury
Statistics South Africa

The PSC meets every four (4) months to evaluate work progress, provide advice on project execution and if necessary, provide overall project direction and oversight. The PSC regularly updates the members of the Intergovernmental Committee on Climate Change and the National Climate Change Committee on the status of the BUR Project (at least once a year). The PSC endorses the BUR and National Inventory Reports (NIRs) before they get submitted to the Cabinet for approval. Following Cabinet approval, the Chief Directorate: International Climate Change Reporting and Relations submits

the reports to the UNFCCC for Climate Change International Relations and Reporting. Subsequently, they undergo an international review process.

The DFFE appointed United Nations Development Programme (UNDP) as the project's executing agency for the preparation of South Africa's BUR5 and NC4. Under this circumstance, UNEP, which is a GEF agency, signed an agreement with UNDP where project funds were transferred to UNDP for the execution of all project activities. The DFFE, particularly the Directorate: Climate Change Development and International Mechanism (CCD&IM) in this case, provides technical guidance and leadership on project design, while UNDP undertakes administrative and project management support functions.

The National Project Manager serves as the Project Management Unit head and is responsible for the effective, efficient and timely implementation of project activities. The National Project Manager reports to the Steering Committee of the DFFE as well as UNEP and coordinates the implementation of all project activities with them. The Project Coordinator (PC) is supposed to be recruited under the BUR5/NC4 GEF funds and will work under the supervision of the project manager, who is the Deputy Director for International Reporting on Climate Change (see Figure 1.11).

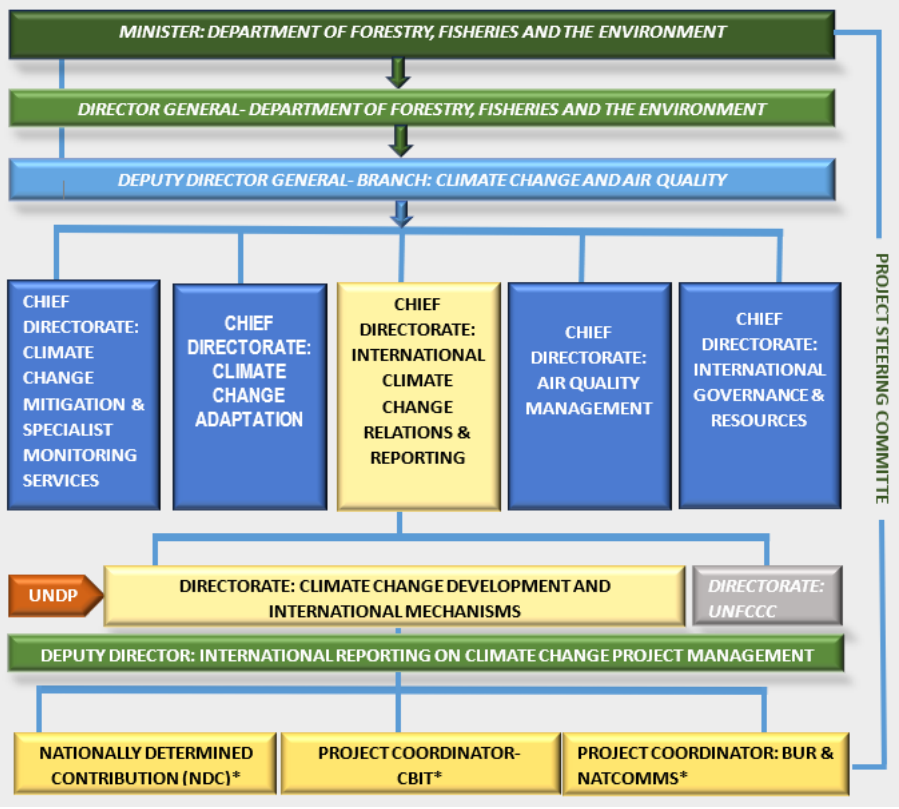

Figure 1.11: Institutional Arrangements for Preparing the BUR-5

Since joining the Convention, South Africa has submitted four (4) Biennial Update Reports (BURs), three (3) National Communications (NCs) and seven (7) National Inventory Reports (NIRs) to the UNFCCC. Regarding the National Inventory Report (NIR), South Africa adopted the 2006 IPCC guidelines when preparing the 2000 NIR, which was included in the 2nd National Communication

submission. The first BUR was submitted in December 2014 together with the NIR, covering GHG emissions from 2000-2010; BUR-2 was submitted in December 2017 with the NIR covering GHG emissions from 2000-2012; BUR-3 was submitted in June 2019 with the NIR covering GHG emissions from 2000-2015 and BUR-4 was submitted in September 2021 together with the 2000–2017 NIR. BUR-1, BUR-2, BUR-3 and BUR-4 have undergone both the Technical Analysis and Facilitative Sharing of Views (FSV) processes of the International Consultation and Analysis (ICA). The Technical Expert Team (TET) conducted the technical analysis, and the results were documented in the summary report. The Facilitative Sharing of Views took place on the sidelines of the Subsidiary Bodies and Conference of Parties (COP) meetings.

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2. National GHG Inventory

2.1. Introduction

This chapter presents a summary of the National Greenhouse Gas (GHG) Inventory ("the inventory") for South Africa for the period of 2000 to 2020. The inventory was compiled in accordance with the International Panel on Climate Change (IPCC) 2006 guidelines for Inventories. The Inventory covers sources of GHG emissions and removals by sinks, resulting from human (anthropogenic) activities for the major greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrogen dioxide (N_2O), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). The indirect greenhouse gases: carbon monoxide (CO), nitrous oxides (NOX) and non-methane volatile organic compounds (NMVOCs) are also included for biomass burning. The gases are reported under four sectors: Energy; IPPU; AFOLU and Waste. Sulphur hexafluoride (SF6) emissions have not yet been included due to a lack of data, however, a threshold for SF6 has been set in amended GHG Emission Reporting Regulations (2020) which will enable the collection of this data from companies for the next inventory. South Africa's main electricity producer, Eskom, started to report SF6 for the 2020 calendar, therefore, there was insufficient data to include it in this inventory. In this inventory, the full-time series back to 1990 was estimated for the AFOLU sector, however, the results of this are not shown since the other sectors still only have data from 2000.

2.2. Summary of Progress on Inventory Since BUR-4

2.2.1. Inventory Improvements

Energy

Updated consumption data in the Road Transport, Manufacturing Industries and Construction, Other Sectors and Non-specified emissions from Energy Production categories were included, particularly for coal, diesel, natural gas and gasworks gas. The updated data was linked to updated fuel allocation for these sectors in the energy balance data from the Department of Mineral Resources and Energy (DMRE).

Under the GHG improvement programme, a fuel consumption study based on Vehicle Kilometres Travelled (VKT) was completed and updated the fuel consumption data for petrol, diesel and natural gas consumption data for Road transport. Lastly, DMRE had updated coal statistics in its South Africa's Mineral Industry (SAMI) report series.

IPPU

Through the introduction of the South African GHG Emissions Reporting System (SAGERS) GHG reporting tool, there have been various additions to the inventory. In the Mineral Industry the category Other Process Uses of Carbonates (OPUC) was added from 2018 and dolomitic lime was added from 2019 to Lime production. In the Chemical Industry Silicon Carbide Production was added in 2019 and an error was corrected in the Titanium Dioxide Production category. Emissions from three new categories were added, namely the Soda Ash Production from 2019, Hydrogen Production from 2018 and Other Chemical Processes from 2020. Lastly, the Metal industry saw the change in activity from primary production to the treatment of secondary raw material under Lead Production.

AFOLU

In the Livestock category, Tier 2 data for enteric fermentation and manure management emission factor calculations for cattle, goats and sheep were incorporated based on a study by the Agricultural Research Council (ARC) (2020). This also led to changes in the livestock categorisation and an update of manure management data. In the Land category various updates were made which included the incorporation of the 1990-2018 land change matrix, inclusion of updated biomass and DOM data from the National Terrestrial Carbon sinks assessment (DEFF, 2020) and various scientific publications, incorporation of new Biomass Conversion and Expansion Factor (BCEF) for plantations, inclusion of country specific Soil Organic Carbon (SOC) reference and stock change data, inclusion of mortality, inclusion of charcoal production and finally the inclusion of CO_2, CH_4 and N_2O from mineral inland wetlands. Aggregated and non-CO_2 emissions on Land category were improved through the updated Livestock category data as these have nitrogen inputs to this category. In addition, Moderate Resolution Imaging Spectroradiometer (MODIS) burnt area data was updated to Collection 6 data. Country specific data was included in the Harvested Wood Products (HWP) calculations.

Waste

In the Waste Sector, the waste generation rate per person was adjusted to align with data in IPCC 2019 refinement values. Waste generation rate per Gross Domestic Product (GDP) value was also adjusted along with the amount of waste sent to Solid Waste Disposal Site (SWDS) as Municipal Solid Waste (MSW) and Industrial waste.

2.2.2. Enhanced Capacity of the DFFE Inventory Team

The national arrangements have not changed but the Department of Forestry, Fisheries and the Environment (DFFE) has enlarged the inventory team, by appointing additional officials, in preparation for the enhanced reporting requirements. Since the last inventory a new inventory co-ordinator was appointed, along with a new Energy, IPPU and Agriculture expert. In addition, an official proficient in statistics was hired to assist with the improvement of the uncertainty analysis. All officials have

undergone various IPCC training courses, including a course on uncertainty analysis. The enlarged team also enabled a more in-depth QC process.

2.2.3. National GHG Emissions Reporting Regulations

The National Atmospheric Emissions Inventory System (NAEIS) has been modified to meet the requirements of the National Greenhouse Gas Emission Reporting Regulations (NGERs), (DEA, 2016). The SAGERS portal has been developed as a tool for the implementation of the online registration and reporting by industry in fulfilment of mandatory NGERs. The portal enhances the data collection process, with this inventory incorporating information from the SAGERS system; however, further data will be included in the next inventory. The inclusion of this data has led to some time-series inconsistencies, but these will be addressed as further data is collected.

2.3. Institutional Context

In South Africa, the DFFE is the central co-ordinating and policy-making authority with respect to environmental conservation. The DFFE is mandated by the National Environmental Management: Air Quality Act (AQA) (Act no. 39 of 2004) (DEA, 2004) to formulate, co-ordinate and monitor national environmental information, policies, programmes and legislation.

In its capacity as a lead climate institution, the DFFE is responsible for co-ordination and management of all climate change-related information, such as mitigation, adaption, monitoring and evaluation programmes, including the compilation and update of National GHG Inventories. The Climate Change and Air Quality branch at DFFE is responsible for the management and co-ordination of GHG inventories.

DFFE is currently responsible for managing all aspects of the National GHG Inventory development. The Director of the Climate Change M&E: GHG Inventory and Systems directorate is the National Inventory Co-ordinator (NIC) as shown in Figure 2.1, with further details provided in Section 6.3 of this report.

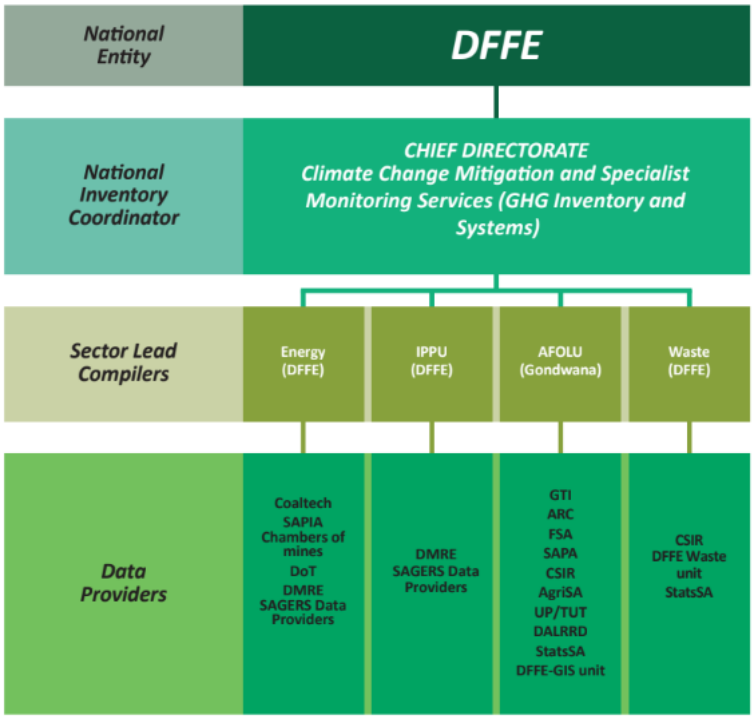


Figure 2.1: Overview of the Institutional Arrangements for Compilation of the National GHG Inventory

2.4. Global Warming Potentials

As GHGs vary in their radiative activity and in their atmospheric residence time, converting emissions into carbon dioxide equivalents (CO_2e) allows the integrated effect of emissions of the various gases to be compared. To comply with international reporting obligations under the UNFCCC, South Africa has chosen to present emissions for each of the major GHGs as CO_2e using the 100-year GWPs contained in the IPCC Second Assessment Report (SAR) (IPCC, 1996) (Table 2.1), so as to comply with international reporting requirements.

Table 2.1: Global Warming Potentials GWPs contained in the IPCC SAR

Greenhouse gas	Chemical formula	SAR GWP
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons (HFCs)		
HFC-23	CHF_3	11 700
HFC-32	CH_2F_2	650
HFC-125	CHF_2CF_3	2 800
HFC-134a	CH_2FCF_3	1 300

2.5. Quality Control and Assurance Procedures

As part of the National Greenhouse Gas Inventory System (NGHGIS), South Africa developed a formal quality assurance/quality control plan (see Appendix 1.A of 2015 NIR (DEA, 2018). This provides a list of QC procedures that are to be undertaken during the preparation of the inventory. In this inventory the relatively new team was provided with QA/QC training and each team member was assigned to a sector. Each quality controller went through the sector calculation files and provided comments. A QA Analyst, assisted with the process of tracking the comments by keeping a log in the front of each file.

2.5.1. Quality Control

The QC procedures were performed by the experts during inventory calculation and compilation. QC measures are aimed at the attainment of the quality objectives. The QC procedures comply with the IPCC good practice guidance and the 2006 IPCC Guidelines. General inventory QC checks include routine checks of the integrity, correctness and completeness of data, identification of errors and deficiencies in documentation, archiving of inventory data and quality control actions. In addition to general QC checks, category-specific QC checks including technical reviews of the source categories, activity data, emission factors and methods are applied on a case-by-case basis focusing on key categories and on categories where significant methodological and data revisions have taken place.

The general quality checks are used routinely throughout the inventory compilation process. Although general QC procedures are designed to be implemented for all categories and on a routine basis, it is not always necessary, or possible, to check all aspects of inventory input data, parameters and calculations every year. Therefore, checks are performed on selected sets of data and processes. A representative sample of data and calculations from every category may be subjected to general QC procedures each year.

2.5.2. Quality Assurance

Quality Assurance, as defined in the IPCC Good Practice Guidance, comprises a “planned system of review procedures conducted by personnel not directly involved in the inventory compilation and development process.” The quality assurance process includes both independent expert review and a general public review (Figure 2.2). The independent expert and public reviews each present opportunity to uncover technical issues related to the application of methodologies, selection of activity data, or the development and choice of emission factors. The independent expert and public reviews of the draft document offer a broader range of researchers and practitioners in government, industry, and academia, as well as the general public, the opportunity to contribute to the final document. The 2000–2020 NIR went through the voluntary UNFCCC review process. The comments received during these processes are reviewed and, as appropriate, incorporated into the NIR or reflected in the inventory estimates.

Figure 2.2: The independent review process for the 2000 – 2020 inventory

2.5.3. Verification

Emission and activity data are verified by comparing them with other available data compiled independently of the GHG inventory system, where available. These include national statistics, measurement and research projects and programmes initiated to support the inventory system, or for other purposes, but producing information relevant to the inventory preparation. The specific verification activities are described in detail in the relevant category sections in the following chapters.

2.6. Data storage and archiving

The NGHGIS for South Africa assists in managing and storing the inventory compilation related documents and processes. The NGHGIS, amongst other things, keeps records of the following:

a) Stakeholder list with full contact details and responsibilities.
b) List of input datasets which are linked to the stakeholder list.
c) QA/QC plan.
d) QA/QC checks.
e) QA/QC logs which will provide details of all QA/QC activities.
f) QC Tools.
g) QC Analysis Tags.
h) Methods and data sources.
i) IPCC categories and their links to the relevant method statements together with details of the type of method (Tier 1, 2 or 3) and emission factors (default or country-specific) applied.
j) Calculation and supporting files.
k) Key references.
l) Key categories.
m) All inventory reports.

The procedures for data storage and archiving are described in detail in the QA/QC plan that has been developed and is discussed in the section 1.7 of the 2020 NIR (DFFE, 2022). The NGHGIS is used to archive inventory data.

2.7. Summary of 2020 National GHG Inventory

2.7.1. National GHG Inventory Emissions for 2020

The 2020 NIR for South Africa provides estimates of South Africa's net GHG emissions for the period 2000 to 2020 and is South Africa's 8th inventory report. This report is to be submitted to UNFCCC to fulfil South Africa's reporting obligations under the UNFCCC. The report has been compiled in accordance with the 2006 IPCC Guidelines, the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (IPCC, 2014a) and the 2019 Refinement.

National emissions of CO_2, CH_4 and N_2O and GHG pre-cursors for 2020 are provided in Table 2.2. Emissions of GHG precursor gases (NOx, CO and NMVOCs) are only estimated from Biomass burning. Global Warming Potentials (GWPs) from the IPCC SAR (IPCC, 1996) were used.

Table 2.2: Summary emission table for South Africa for 2020

IPCC 2006 Category	Emissions and Removals (Gg)								
	Net CO_2	CH_4	N_2O	HFCs	PFCs	NO_x	CO	NMOV	Total GHGs
		(Gg)		Gg CO_2e		Gg			Gg CO_2e
Emissions (incl. FOLU)	**363 676,9**	**2 815,6**	**46,0**	**4 933,1**	**120,4**	**48,7**	**1 093,9**	**53,4**	**442 125,1**
Emissions (excl. FOLU)	**391 992,6**	**2 758,8**	**44,6**	**4 933,1**	**120,4**	**48,7**	**1 093,9**	**53,4**	**468 811,7**
1- Energy	371 409,3	267,3	8,0						379 505,2
1.A - Fuel Combustion Activities	345 085,1	23,9	8,0			NE	NE	NE	348 069,9
1.A.1 – Energy Industries	235 431,4	3,7	3,7			NE	NE	NE	236 662,3
1.A.2–Manufacturing Industries and Construction	33 066,2	2,8	0,7			NE	NE	NE	33 336,2
1.A.3 – Transport	47 223,7	10,8	2,4			NE	NE	NE	48 192,9
1.A.4 – Other Sectors	11 971,2	6,5	0,9			NE	NE	NE	12 398,8
1.A.5 –- Non-Specified	17 392,6	0,2	0,3			NE	NE	NE	17 479,7
1.B - Fugitive emissions from fuels	26 324,3	243,4	NE			NE	NE	NE	31 435,2
1.B.1 - Solid Fuels	37,9	137,8	NE			NE	NE	NE	2 930,7
1.B.2 - Oil and Natural Gas	641,8	NE	NE			NE	NE	NE	641,8
1.B.3 - Other emissions from Energy Production	25 644,5	105,6	NE			NE	NE	NE	27 862,7
1.C - Carbon dioxide Transport and Storage	NE					NE	NE	NE	0,0
1.C.1 – Transport of CO_2	NE					NE	NE	NE	0,0
1.C.2 – Injection and Storage	NE					NE	NE	NE	0,0
1.C.3 – Other	NA					NE	NE	NE	0,0
2 - Industrial Process and Product Use	19 021,0	27,4	2,7	4 933,1	120,4	NE	NE	NE	25 486,1
2.A - Mineral Industry	4 774,3	NE				NE	NE	NE	4 774,3
2.B - Chemical Industry	1 347,5	3,8	2,7			NE	NE	NE	2 263,5
2.C - Metal Industry	11 604,3	23,6	NE	NE	120,4	NE	NE	NE	12 220,4
2.D – Non-Energy Products from Fuels and Solvents Use	1 294,8	NE	NE			NE	NE	NE	1 294,8
2.E – Electronics Industry	NE		NE	NE	NE	NE	NE	NE	0,0

IPCC 2006 Category	Emissions and Removals (Gg)								
	Net CO_2	CH_4	N_2O	HFCs	PFCs	NO_x	CO	NMOV	Total GHGs
		(Gg)		Gg CO_2e		Gg			Gg CO_2e
2.F – Product Uses as Substitutes for Ozone Depleting Substances	NE			4 933,1	NE	NE	NE	NE	4 933,1
2.G –- Other Product Manufacture and Use			NE	NE	NE	NE	NE	NE	0,0
2.H – Other	NA	NA	NA			NE	NE	NE	0,0
3 - Agriculture, Forestry and Other Land Use	-26 788,8	1 465,8	32,6			48,7	1 093,9	53,4	14 088,0
3.A – Livestock		1 369,8	8,4			NA	NA	NA	31 371,7
3.A.1 – Enteric Fermentation		1 313,8				NA	NA	NA	27 589,5
3.A.2 – Manure Management		56,0	8,4			NA	NA	NA	3 782,2
3.B – Land	-28 951,0	56,8	1,4			NA	NA	NA	-27 321,9
3.B.1 – Forest Land	-24 575,2	NE	NE			NA	NA	NA	-24 575,2
3.B.2 – Cropland	2 167,3	NE	NE			NA	NA	NA	2 167,3
3.B.3 – Grassland	-11 084,5	NE	NE			NA	NA	NA	-11 084,5
3.B.4 – Wetlands	-436, 5	56,8	1,4			NA	NA	NA	1 192,6
3.B.5 – Settlements	-1 147,3	NE	NE			NA	NA	NA	-1 147,3
3.B.6 – Other Land	6 125,2	NE	NE			NA	NA	NA	6 125, 2
3. C - Aggregate sources and non-CO_2 emissions sources on land	1 526,9	39,2	22,7			48,7	1 093,9	53,4	9 402,9
3.C.1 - Emissions from biomass burning	IE	39,2	2,7			48,7	1 093,9	53,4	1 649,2
3. C.2 – Liming	942, 3					NA	NA	NA	942,7
3.C.3 – Urea application	584,7					NA	NA	NA	584,7
3. C.4 - Direct N_2O Emissions from managed soils			17,0			NA	NA	NA	5 276,0
3.C.5 - Indirect N_2O Emissions from managed soils			2,3			NA	NA	NA	723,3
3.C.6 - Indirect N_2O Emissions from manure management			0,7			NA	NA	NA	227,5
3.C.7 - Rice cultivations	NO	NO	NO			NA	NA	NA	0,0

IPCC 2006 Category	Emissions and Removals (Gg)								
	Net CO_2	CH_4	N_2O	HFCs	PFCs	NO_x	CO	NMOV	Total GHGs
	(Gg)			Gg CO_2e		Gg			Gg CO_2e
3.C.8 - Other	NO	NO	NO			NA	NA	NA	0,0
3.D - Other	635,2	NA	NA			NA	NA	NA	635,2
3.D.1 - Harvested Wood Products	635,2					NA	NA	NA	635,2
3.D.2 - Other	NO	NO	NO			NA	NA	NA	0,0
4- Waste	35,4	1055,1	2,8						23 045,8
4.A - Solid Waste Disposal		869,2	NE			NA	NA	NA	18 252,8
4.B - Biological Treatment of Solid Waste		0,0	0,0			NA	NA	NA	0,0
4.C - Incineration and Opening Burning of Waste	35,4	10,6	0,2			NA	NA	NA	334,9
4.D - Wastewater treatment and Discharge		175,3	2,5			NA	NA	NA	4 458,1
4. E - Other	NO	NO	NO			NO	NO	NO	
5 - Other									
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3			NE			NE	NE	NE	
5.B - Other			NO			NO	NO	NO	
Memo items									
International bunkers	5 283,1	0,3	0,1	NA	NA	NA	NA	NA	5 331,4
International aviation	2 268,8	0,1	0,0	NA	NA	NA	NA	NA	2 276,7
International water-borne transport	3 014,4	0,2	0,1	NA	NA	NA	NA	NA	3054,7
Multilateral operations	NA	NA	NA	NA	NA	NA	NA	NA	

2.7.2. Changes in Emissions Since BUR-4

Emissions (excl. FOLU) increased by 0.8% between 2000 and 2020 (Table 2.), while emissions (incl. FOLU) decreased by 0.8%. The increase in the emissions excluding FOLU is mainly due to an increase in emissions in the Energy sector, while the FOLU sector also contributed to the decline in the emissions when FOLU was included.

Table 2.3: Changes in South Africa's emissions excluding and including FOLU between 2000 – 2020

	Emissions ($Gg\ CO_2e$)		Change between 2000 and 2020	
	2000	2020	$Gg\ CO_2e$	%
Emissions (excl. FOLU)	464 980.2	468 811.7	3 831.5	0.8
Emissions (incl. FOLU)	445 884.9	442 125.1	-3 759.8	-0.8

2.7.3. Trends in Total Aggregated Emissions Since 2000

Overall emissions (excluding FOLU)

Overall, emissions (excluding FOLU) include those from Energy, Industrial Processes and Product Uses, Livestock, Aggregated and non-CO_2 emissions from Land and Waste. It does not include the sources and removals from the Land and Harvested wood products category (which is termed FOLU in this Report).

2000 – 2020

South Africa's GHG emissions excl. FOLU were 464 980 Gg CO_2e in 2000. These increased to a peak of 558 546 Gg CO_2e in 2009 and decreased to 468 812 Gg CO_2e in 2020 (Figure 2.3).

The annual change data shows that the number of years with a decrease has increased since 2009 and the number of years with consecutive decreases has also increased. The annual growth rate in emissions excl. FOLU was 2.4 % between 2000 and 2009, however between 2010 and 2020 there is a declining trend, with an average annual decline of 2% in emissions excl. FOLU.

Figure 2.3: National GHG emissions (excluding and including FOLU) for South Africa, 2000 – 2020

2.7.4. Emission Trends by Sector

2.7.4.1.1. Energy

The Energy sector is the largest contributor to South Africa's emissions (excl. FOLU), contributing 81% in 2020. Energy sector emissions increased between 2000 and 2009, then declined to 2014, after which total emissions were stable until 2019 (Figure 2.4). Emissions declined by 6.8% between 2019 and 2020. This decline was due to Commercial/institutional emissions declining by 19.7%, along with a 13.7% reduction in Road transport and a 54.3% reduction in Civil aviation emissions. These reductions can be attributed to the reduced travel and trading during the COVID-19 lockdown restrictions.

2.7.4.1.2. IPPU

The IPPU sector contributed 5.4% to the total GHG emissions (excl. FOLU) in 2020, which is an overall decline from 7.1% in 2000 (Figure 2.4). In 2020, the IPPU contribution was 25 486 Gg CO_2e. IPPU sector emissions increased between 2000 and 2006 by 18.0%, after which the emissions declined by 13.6% to 2009. Emissions increased between 2010 and 2016 due to an increase in production in the Mineral and Metal industries. There was an increase of 8.9% during this time within the Mineral industry and an increase of 2.4% within the Metal industry, which led an overall increase of 11.7% for the IPPU sector. Thereafter, emissions decreased by 19.6% between 2016 and 2017 as demand in the Chemical and Metal industries dropped.

Emissions within the sector decreased further from 2017 to 2020 by 21.0% due to lower production demands in the Mineral, Chemical and Metal industry. The economy in 2020 was further strained due to the COVID-19 pandemic and stringent lockdown regulations within South Africa. As a result, the

Mineral industry emissions decreased by 23.7% (1 483 Gg CO_2e) since 2017 and the Metal industry showed an overall decrease of 40.0% (8 150 Gg CO_2e).

The largest source category is the Metal industry, which contributes 48% to the total IPPU sector emissions. Iron and steel production and ferroalloys production are the biggest contributors to the Metal industry subsector, producing 3 853 Gg CO_2e (31.5%) and 7 069 Gg CO_2e (57.8%) respectively to the total Metal industry emissions.

2.7.4.1.3. AFOLU

The AFOLU sector (excl. FOLU) contributed an average of 8.5% to the total emissions (excl. FOLU) between 2000 and 2020 (Figure 2.4). The contribution has declined by 3.9% since 2000. The main driver of change in the AFOLU emissions (excl. FOLU) is change in livestock population. Livestock have input into the Enteric fermentation, Manure management, as well as Direct and Indirect N_2O emissions from managed soils. Enteric fermentation emissions show a declining trend due to a decline in livestock population. Dairy cattle, pigs and poultry are the largest contributors to Manure management emissions and with increasing poultry numbers, these emissions have increased over the 20- year period.

The AFOLU sector produced 40 775 Gg CO_2e (excl. FOLU) in 2020, while the emissions including FOLU were 14 088 Gg CO_2e. The largest contributor to the sink is the Forest land, followed by Grasslands, while Other land is the main contributor to the source in the Land sector. Emissions from Forests land increase between 2003 and 2008 due to a combination of factors. During this time there was an increase in losses due to fire, both in plantations and natural vegetation classes and an increase in wood harvest. Emissions and removals from Grasslands remained fairly constant, with Grasslands remaining grasslands and Other land converted to grasslands contributing to the sink.

Aggregated and non-CO_2 emissions on land contributed 23.1% to the AFOLU (excl. FOLU) emissions in 2020 and the largest contributor to this category is Direct N_2O from managed soils (56.1%). Within the Direct N_2O from managed soils category, nitrogen inputs from crop residues contribute 57.5%, followed by 19.0% from inorganic fertilisers and 14.9% from urine and dung deposits.

2.7.4.1.4. Waste

The Waste sector emissions have increased from 18 241 Gg CO_2e in 2000 to 23 046 Gg CO_2e in 2020. The Waste sector contribution to overall emissions (excl. FOLU) has slowly increased from 3.9% in 2000 to 4.9% in 2020 (Figure 2.4). Solid waste disposal is the main contributor to this sector and these emissions are driven mainly by population growth.

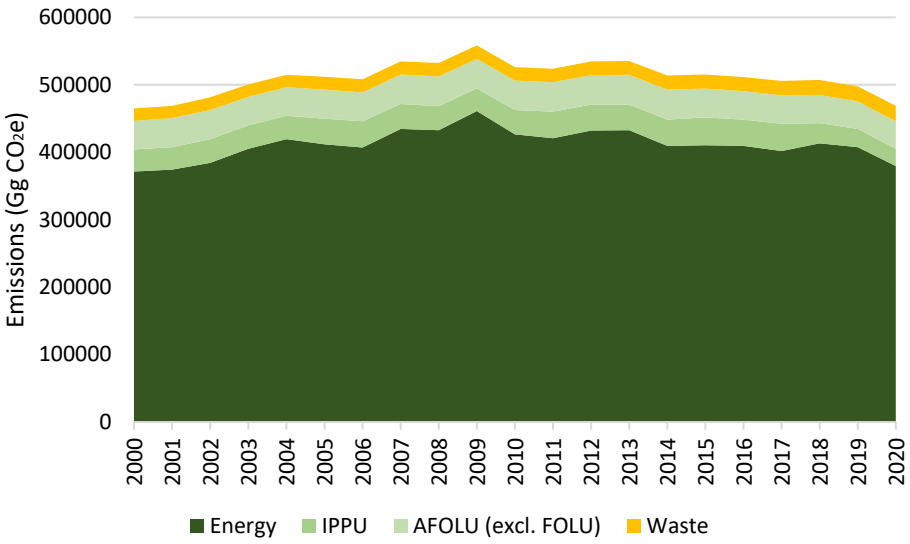
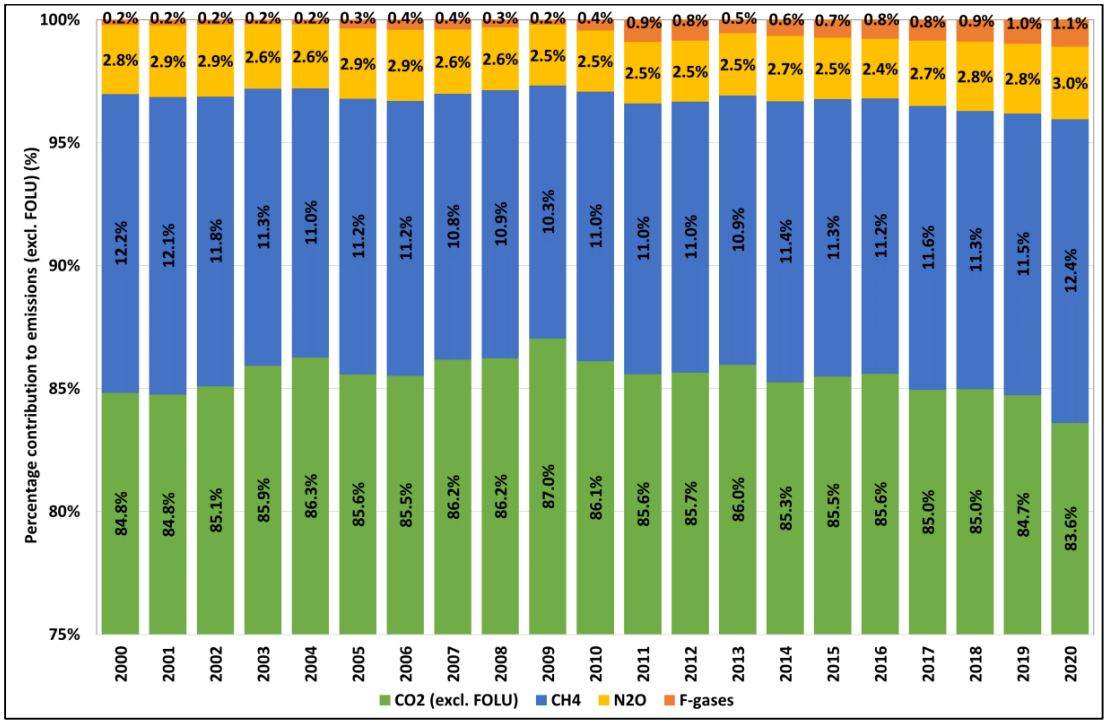


Figure 2.4: Trend in emissions by sector for 2000 to 2020

2.7.5. Emission Trends by Gas

The contributors by gas to South Africa's emissions is shown in Figure 2.5. CO_2 gas is the largest contributor (Figure 2.6), this is followed by CH_4 and N_2O.



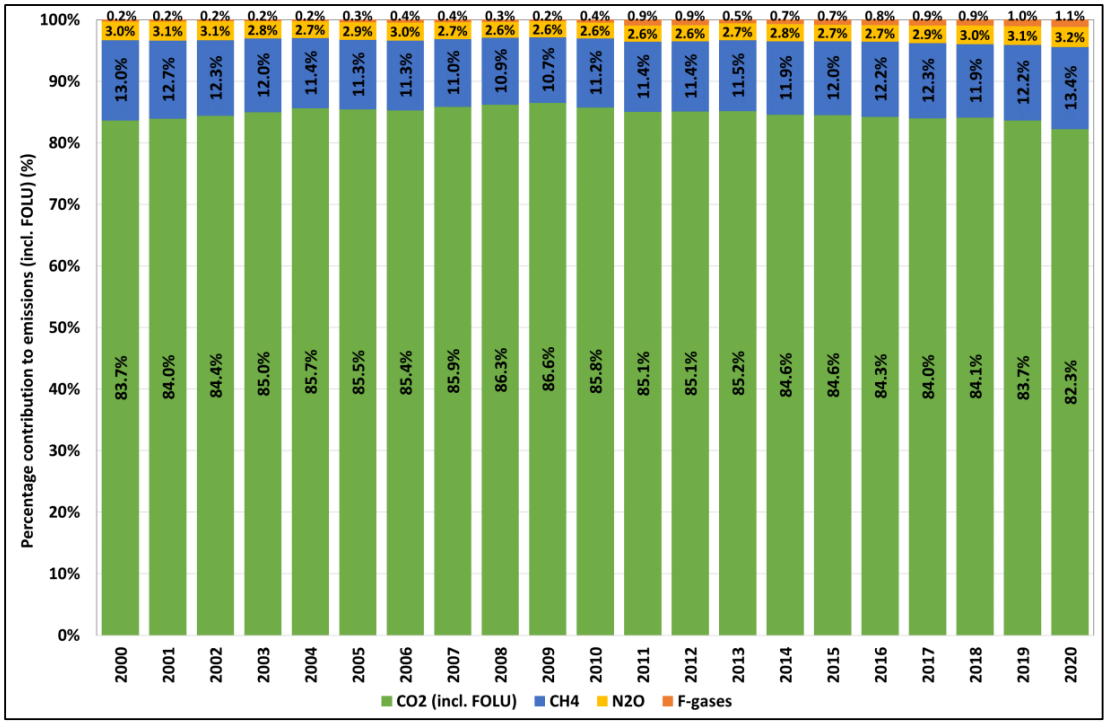


Figure 2.5: Percentage contributions from each of the gases to South Africa's emissions (excl. FOLU (top) and incl. FOLU (bottom)) between 2000 and 2020

Carbon Dioxide (CO_2)

The CO_2 emissions totalled 391 993 Gg CO_2 (excl. FOLU) and 363 677 Gg CO_2 (incl. FOLU) in 2020. As CO_2 is the largest contributor to national emissions, the CO_2 emission trend follows that of the overall emission trend. The Energy sector is by far the largest contributor to CO_2 emissions in South Africa, contributing an average of 80.7% between 2000 and 2020 (Figure 2.6). The categories 1A1 energy

industries (60.1%) and 1A3 Transport (12.0%) were the major contributors to the CO_2 emissions in 2020. The IPPU sector contribution an average of 6.2% between 2000 and 2020, while the AFOLU sector (excl. FOLU) contributed an average of 0.2%.

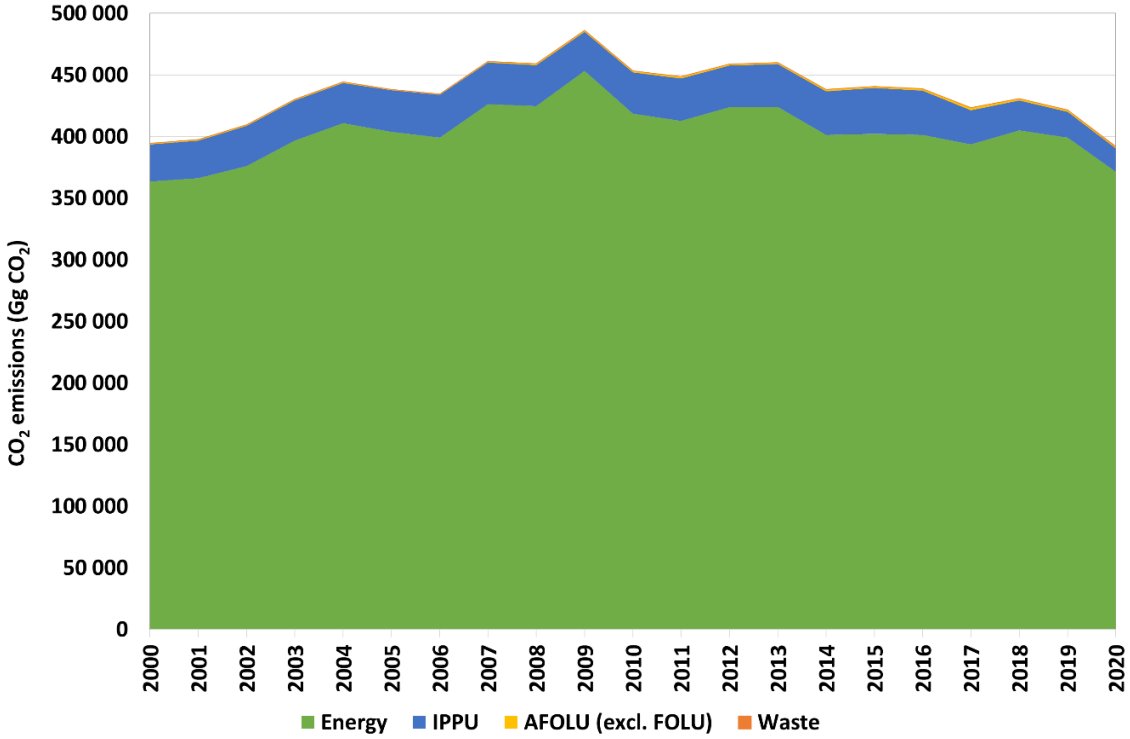


Figure 2.6: Trend and sectoral contribution to CO_2 emissions (excl. FOLU), 2000 – 2020

Methane (CH_4)

The sector contributions to the total CH_4 emissions in South Africa are shown in Figure 2.7. National CH_4 emissions (excl. FOLU) increased from 56 522 Gg CO_2e (2 692 Gg CH_4) in 2000 to 57 935 Gg CO_2e (2 759 Gg CH_4) in 2020. In the Land sector wetlands contributed 1 193 Gg CO_2e (57 Gg CH_4) to the total CH_4, pushing the total CH_4 (incl. FOLU) to 59 128 Gg CO_2e. The AFOLU Livestock category and Waste sectors were the major contributors, providing 48.7% and 37.5%, respectively, to the total CH_4 emissions in 2020.

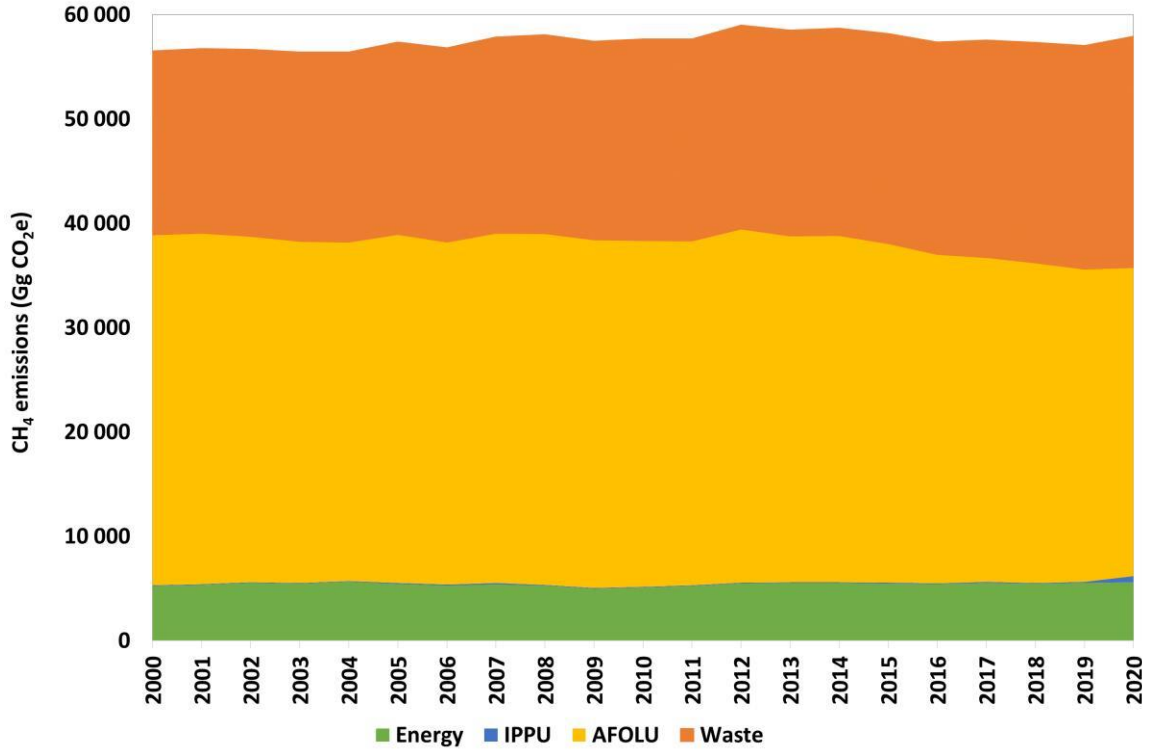


Figure 2.7: Trend and sectoral contribution to the CH_4 emissions (excl. FOLU), 2000 – 2020

Nitrous Oxide (N_2O)

Inputs to managed soils provided the largest N_2O contribution in the AFOLU sector, therefore the trend follows a similar pattern to the livestock population. N_2O emissions from IPPU declined by 82.2% between 2000 and 2017, but then increased again in 2018 (Figure 2.8). The increase between 2018 and 2020 is due to improved data through the GHG Reporting Regulations.

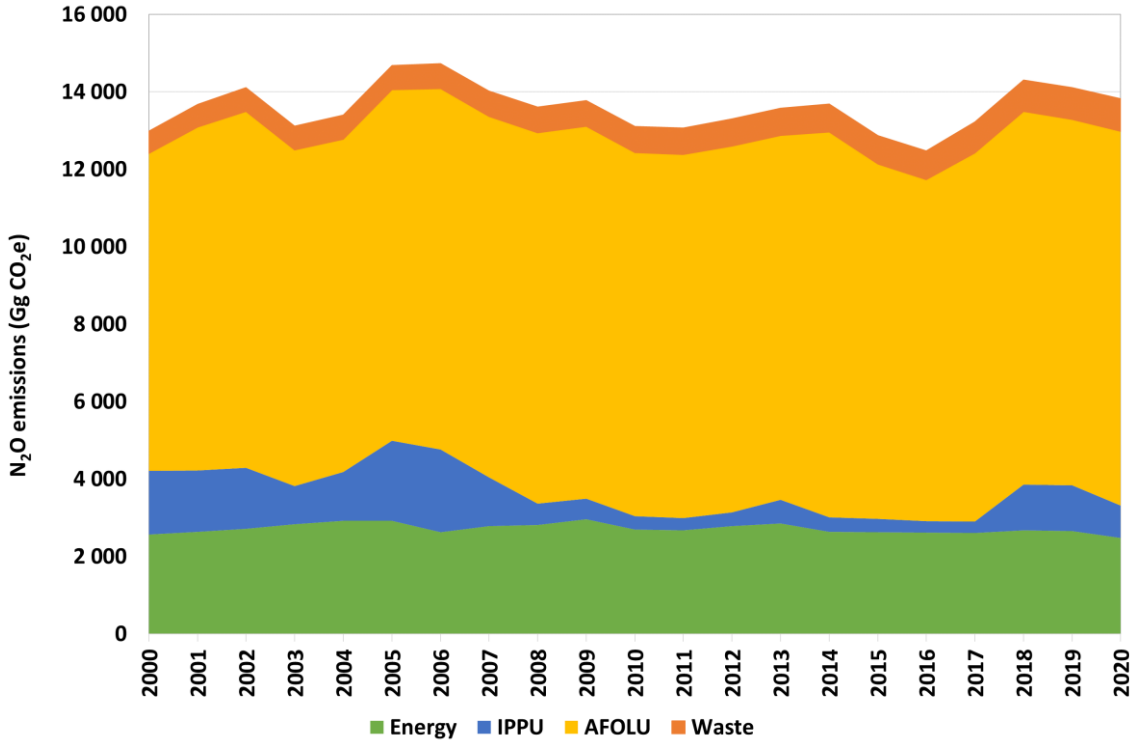


Figure 2.8: Trend and sectoral contribution to N_2O emissions (excl. FOLU) in South Africa, 2000 – 2020

F-Gases

Estimates of HFC and PFC emissions were only estimated for the IPPU sector in South Africa. F-gas emission estimates varied annually (Figure 2.9) and contributed 1.1% to overall emissions (excl. FOLU) in 2020. Emissions increase from 2011 due to the addition of HFC emissions from air conditioning, foam blowing agents, fire protection and aerosols. There is no data prior to 2005, so this time-series is inconsistent. The elevated F-gas emissions are therefore not necessarily due to an increase in emissions, but rather due to the incorporation of new categories.

PFC emissions were estimated at 983 Gg CO_2e in 2000. This increased to 1 979 Gg CO_2e in 2012, then declined to 120 Gg CO_2e in 2020. PFCs are produced during the production of aluminium. The Aluminium production data was updated for the years 2014 onwards and the updated data was an order of magnitude lower than the previous years. This is causing the decline in the PFC emissions. There is a sharp decline in emissions from the Metal industry between 2007 and 2009 and this is attributed to reduced production caused by electricity supply challenges and decreased demand following the economic crisis that occurred during 2008/2009. Increases in 2011 and 2012 were due to increased emissions from aluminium plants due to inefficient operations. The industry was used to assist with the rotational electricity load shedding in the country at the time and which necessitated switching on and off at short notice leading to large emissions of Tetrafluoroethylene (C2F4) and Carbon tetrafluoromethane (CF4). CF4 emissions contribute the most to the PFC emissions.

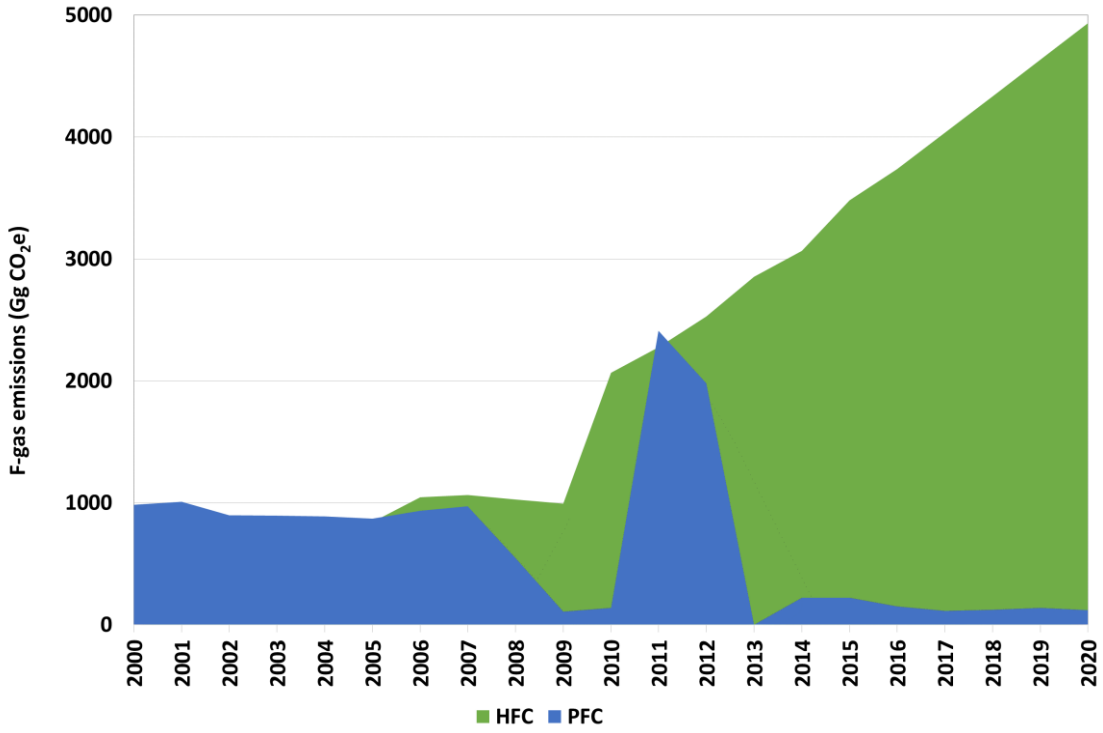


Figure 2.9: Trend in F-gas emissions in South Africa, 2000 – 2020

HFCs increased from 842 Gg CO_2e in 2005 to 4 933 Gg CO_2e in 2020 and the largest contributor is HFC-134a.

2.7.6. Trends in Indirect GHG Emissions

The trend in emissions of CO, NOx and NMVOCs is shown in Table 2.. These emissions were estimated for biomass burning only. There is annual variability because the emissions include wildfires as well as controlled fires.

Table 2.4: Trends in indirect GHG emissions between 2000 and 2020

	NOx	CO	NMVOC
	(Gg)		
2000	59.9	1 313.4	56.8
2001	67.8	1 438.6	68.0
2002	71.4	1 503.3	76.0
2003	54.1	1 203.9	62.4
2004	50.5	1 120.9	53.0
2005	77.4	1 672.6	82.5
2006	75.0	1 592.1	75.5
2007	73.3	1 680.1	84.9
2008	69.0	1 476.7	76.1
2009	65.9	1 409.0	69.3
2010	67.3	1 441.3	68.0
2011	64.3	1 344.8	67.3
2012	58.3	1 246.1	63.6
2013	58.8	1 262.1	61.2
2014	60.5	1 344.0	69.5
2015	43.4	952.1	49.8
2016	24.6	545.0	30.0
2017	47.6	1 062.4	54.4
2018	49.2	1 091.8	58.4
2019	45.4	1 018.5	55.4
2020	48.7	1 093.9	53.4

2.7.7. Key Categories

The identification of key categories allows for resources to be allocated to the appropriate activities to improve those specific subcategory emissions in future submissions. In this inventory, a ranking system was added to allow the key categories to be ranked in order of prioritisation based on the findings from both the level and trend assessment. The ranking system works by allocating a score based on how high categories rank in the current year level assessment and the trend assessment. The top-ranking category gets a score of 1 and the second gets a score of 2, etc. The ranking score from both approaches are then added together to get the overall score for each category. The categories are then ranked from lowest score to highest, with draws in score resolved by the most recent year level assessment. This ranking approach was only applied to the assessments including FOLU.

The key categories identified in 2020, along with their ranking, are summarised in Table 2.4.

Table 2.5: Key categories for South Africa for 2020 (including FOLU) and their ranking

Rank	IPCC Category code	IPCC Category	GHG[#]
1	1A1a	Electricity and Heat Production (solid)	CO_2
2	1A3b	Road Transport (liquid)	CO_2
3	3B1a	Forest land remaining forest land	CO_2
4	4A	Solid Waste Disposal	CH_4
5	1A5a	Stationary (solid)	CO_2
6	1B3	Other Emissions from Energy Production	CO_2
7	3A1a	Enteric fermentation - cattle	CH_4
8	1A1c	Manufacture of Solid Fuels and Other Energy Industries (liquid)	CO_2
9	1A2	Manufacturing Industries and Construction (solid)	CO_2
10	1A4c	Agriculture/Forestry/Fishing/Fish Farms (liquid)	CO_2
11	2C1	Iron and Steel Production	CO_2
12	2F1	Refrigeration and Air Conditioning	HFCs
13	1A2	Manufacturing Industries and Construction (liquid)	CO_2
14	1A1a	Electricity and Heat Production (liquid)	CO_2
15	2C2	Ferroalloys Production	CO_2
16	3C4	Direct N_2O emissions from managed soils	N_2O
17	3A1c	Enteric fermentation - sheep	CH_4
18	3B1b	Land converted to forest land	CO_2
19	1A3d	Water-Borne Navigation (liquid)	CO_2
20	1A4a	Commercial/Institutional (solid)	CO_2
21	1A2	Manufacturing Industries and Construction (gas)	CO_2
22	1A4b	Residential (solid)	CO_2
23	4D1	Domestic Wastewater Treatment and Discharge	CH_4
24	1A4b	Residential (liquid)	CO_2
25	1B1a	Coal mining and handling	CH_4
26	3B3b	Land converted to grassland	CO_2
27	1A1b	Petroleum Refining (gas)	CO_2
28	3B5a	Settlements remaining settlements	CO_2
29	3B2b	Land converted to cropland	CO_2
30	3D1	Harvested wood products	CO_2
31	3B4	Wetland	CH_4
32	1A3a	Civil Aviation (liquid)	CO_2
33	3C2	Liming	CO_2
34	2B	Chemical industry	C
35	3A1d	Enteric fermentation - goats	CH_4
36	1A5a	Stationary (liquid)	CO_2
37	3A2i	Manure management - poultry	N_2O
38	1A1b	Petroleum Refining (liquid)	CO_2
39	1A4a	Commercial/Institutional (liquid)	CO_2
40	1A4a	Commercial/Institutional (gas)	CO_2
41	3B2a	Cropland remaining cropland	CO_2
42	3A2a	Manure management - cattle	N_2O
43	3B6b	Land converted to other lands	CO_2
44	2D2	Paraffin Wax Use	CO_2
45	2D1	Lubricant Use	CO_2
46	1B3	Other Emissions from Energy Production	CH_4
47	2B	Chemical industry	C
48	2A2	Lime Production	CO_2
49	1A1a	Electricity and Heat Production (solid)	N_2O
50	2C2	Ferroalloys Production	CH_4
51	4D1	Domestic Wastewater Treatment and Discharge	N_2O
52	2A1	Cement Production	CO_2
53	3C3	Urea application	CO_2
54	1A3b	Road Transport (liquid)	N_2O
55	2C3	Aluminium Production	CO_2
56	2C3	Aluminium Production	PFCs
57	3B3a	Grassland remaining grassland	CO_2
58	1B2a	Oil	CO_2

[#]*C=Confidential*

Changes in category analysis since BUR-4

In the level assessment of emissions (incl. FOLU) there were several additional key Land categories, namely Land converted to forest land (CO_2), Forest land remaining forest land (CO_2), Land converted to grassland (CO_2), Land converted to other lands (CO_2), Land converted to cropland (CO_2), Settlements remaining settlements (CO_2), Cropland remaining cropland (CO_2), Wetland (CH_4) and Grassland remaining grassland (CO_2) (Figure 2.10). The Wetland category CH_4 and Cropland remaining cropland (CO_2) emissions were added to the key categories list in this inventory. The Forest land remaining forest land and Grassland remaining grassland contributions declined; however, these changes are due to updates as opposed to be actual changes.

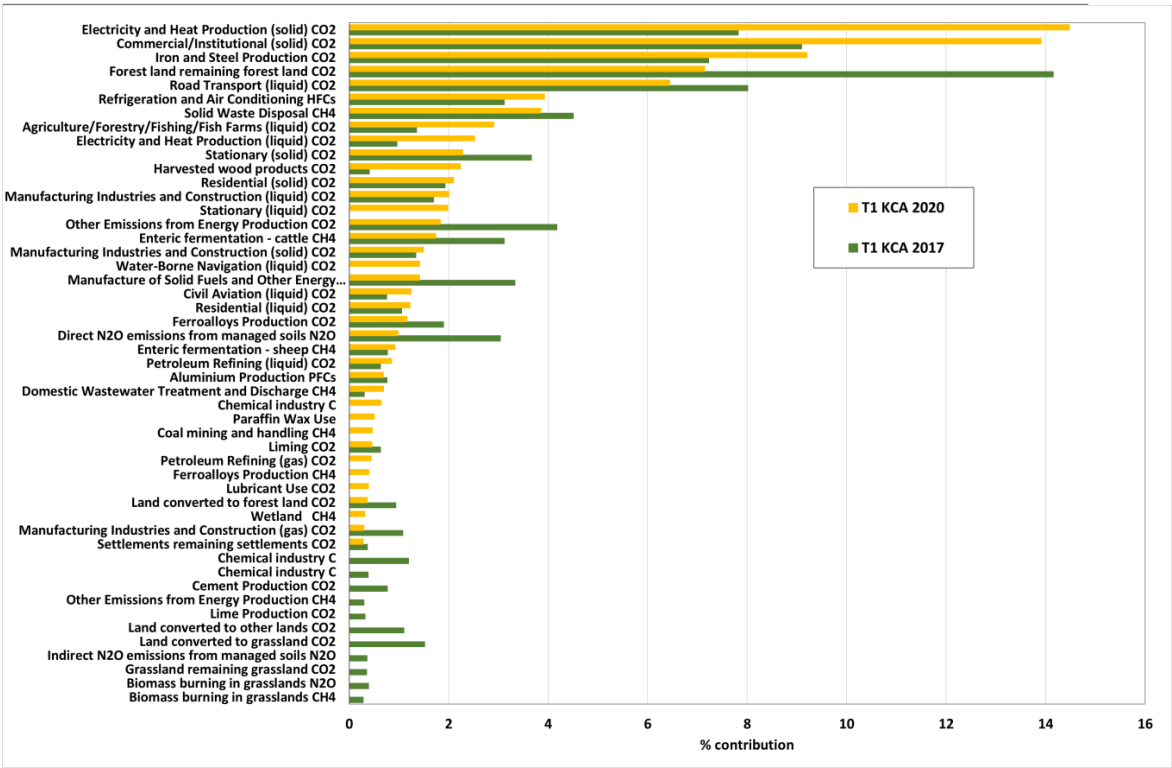


Figure 2.10: Comparison of trend assessment key categories and their contribution to emissions (incl. FOLU) in the current and previous 2017 submission

2.7.8. Uncertainty Analysis

2.7.8.1.1. Approach

Uncertainty estimates are an essential element of a complete and transparent emissions inventory. Uncertainty information is not intended to challenge the validity of inventory estimates, but to help prioritise efforts to improve the accuracy of future inventories and guide future decisions on methodological choice. Uncertainty is inherent within any kind of estimation and arises from the limitations of the measuring instruments, sampling processes and model complexities and assumptions. Managing these uncertainties and reducing them over time, is recognised by IPCC 2006 Guidelines as

an important element of inventory preparation and development. Chapter 3 of the 2006 IPCC Guidelines describes the methodology for estimating and reporting uncertainties associated with annual estimates of emissions and removals. There are two methods for determining uncertainty:

- Tier 1 methodology which combines the uncertainties in activity rates and emission factors for each source category and GHG in a simple way; and
- Tier 2 methodology which is generally the same as Tier 1; however, it is taken a step further by considering the distribution function for each uncertainty and then carries out an aggregation using the Monte Carlo simulation.

The reporting of uncertainties requires a complete understanding of the processes of compiling the inventory, so that potential sources of inaccuracy can be qualified and possibly quantified. South Africa still lacks data in terms of country specific uncertainty for all sectors. As data becomes available, it is incorporated but there is a general need to build capacity and develop projects to assess the uncertainty in each sector.

The identified uncertainties are associated with activity data, emission factors and emissions. The individual uncertainties are combined to provide uncertainty estimates. Hence a Tier 1 methodology was applied for the 2020 inventory uncertainty.

2.7.8.1.2. Results

Emission estimate uncertainties are typically low for CO_2 from energy consumption, as well as from some industrial process emissions. Uncertainty surrounding estimates of emissions are higher for AFOLU and synthetic gases. Uncertainty ranges for the various sectors are largely consistent with typical uncertainty ranges expected for each sector (IPCC, 2014).

The IPCC good practice Tier 1 method was used to determine the overall aggregated uncertainty on South Africa's inventory estimate for 2020. A trend uncertainty between the base year and 2020, as well as a combined uncertainty of activity data and emission factor uncertainty was determined using an Approach 1. The total uncertainty for the inventory was determined to be between 8.13% and 8.77%, with a trend uncertainty of 6.71%. Excluding FOLU reduces the overall uncertainty to be between 6.64% and 7.32%, with the trend uncertainty dropping to 6.21%.

2.7.9. Recalculations and their Impact

Recalculations due to improvements led to higher emissions than previous estimates in the period 2000 to 2013, after which the estimates were lower than previous estimates.

For 2017, improvements led to a 2.8% and a 0.5% decrease in emission estimates excluding and including FOLU, respectively. The highest change in the emissions, for 2017, was a 32.8% increase for

the LULUCF sector and a 12.7% decrease in emissions for the Agriculture sector. Recalculations resulted in a 2.1 % decrease in emissions for the Energy sector, a 2.1% increase for the Waste sector and a 0.5 % increase in IPPU emissions for 2017 (Figure 2.11).

Figure 2.11: Changes in overall emission estimates due to recalculations

2.7.10. Time-Series Consistency

Time-series inconsistencies were noted the IPPU sector. The mandatory GHG Reporting Programme, which is driven by the NGERs, will provide enhanced data for this sector. This data has been included in the recent years of the inventory but does pose some issues in terms of time-series consistency due to the data not being available prior to 2018 in most cases. These are issues which will be improved in future as more data becomes available.

In particular, lime production data showed an inconsistency in the time series with the data prior to 2008. Only pyrometallurgical quicklime and hydrated lime (only included lime for water purification) were included. The Other Process Uses of Carbonates is a new category introduced to the inventory in 2018. This has resulted in an inconsistent time series as historical data is currently unavailable. The time series consistency will be updated as industry continues to report in future via the SAGERS Portal. Most plants provided a split between ferromanganese 1% and 7%, however, where the split was not made, the split from 2013 was applied. The inconsistency will be overcome in future inventories as the SAGERS requires the split to be made. For Zinc production, the time series is inconsistent as activity data has not been available since 2017 and an extrapolation was undertaken to obtain data values. For

Lubricant use (2.D.1) the time series is inconsistent as activity data has not been available for 2020 and an extrapolation was undertaken to obtain data values.

For Paraffin wax use (2.D2), the time series is inconsistent as activity data has not been available for 2020 and an extrapolation was undertaken to obtain data values.

2.7.11. Completeness

The South African GHG emission inventory for the period 2000 – 2020 is not complete, mainly due to the lack of sufficient data. Table 2.2 identifies the sources in the 2006 Guidelines which were not estimated or included elsewhere in this inventory and the reason for their omission is discussed further in the appropriate chapters. The table also indicates which activities do not occur in South Africa.

Table 2.2: Activities in the 2020 inventory which are not estimated (NE), included elsewhere (IE) or not occurring (NO)

NE, IE or NO	IPCC Category	Activity	Comments
NE	1B2	CO_2 and CH_4 fugitive emissions from oil and natural gas operations	CO_2 emissions from Oil are included, but CH_4 emissions need to be included along with natural gas emissions. To be included in the next inventory submission.
	1B1b	CO_2, CH_4 and N_2O from spontaneous combustion of coal seams.	New research work on sources of emissions from this category will be used to report emissions in future inventories.
	1B1ai3	CH_4 emissions from *abandoned mines*.	New research work on sources of emissions from this category will be evaluated and emissions will be included in future inventories.
	1B3	N_2O from Other Emissions from Energy Production	Insufficient data to include.
	1C1	CO_2 transport	Insufficient data to include.
	1C2	Injection and storage	Insufficient data to include.
	2A	CH_4 emissions from cement production, lime production, glass production and OPUC	Insufficient data to include.

NE, IE or NO	IPCC Category	Activity	Comments
	2B1	N_2O from Ammonia production.	Insufficient data to include.
	2B2	CO_2 & CH_4 from nitric acid production	Insufficient data to include.
	2B5	N_2O from carbide production	Insufficient data to include.
	2B7	CH_4 & N_2O from Soda Ash production	Insufficient data to include.
	2B8	N_2O from petrochemical & carbon black production	Insufficient data to include.
	2C1	N_2O emissions from iron and steel production	Insufficient data to include.
	2C2	N_2O emissions from ferroalloy production	Insufficient data to include.
	2C3	CH_4 from Aluminium production	Insufficient data to include.
	2D2	CH_4 and N_2O emissions from paraffin wax use.	Insufficient data to include.
	2E	*Electronics industry*	A study needs to be undertaken to understand emissions from this source category.
	2F1	CO_2 & PFCs from refrigeration & air condiitioning	Insufficient data to include.
	2F2	CO_2 & PFCs from foam blowing agents	Insufficient data to include.
	2F3	CO_2 & PFCs from Fire protection	Insufficient data to include.
	2F4	PFCs from aerosols	Insufficient data to include.
	2F5	PFCs and HFCs from solvents	Insufficient data to include.
	2G1	PFCs from electrical equipment	Insufficient data to include.
	2G1	SF_6 emissions in the IPPU sector	Insufficient data. It is planned to include these in the next inventory.
	2G2	PFCs from other product uses	Insufficient data to include.
	2G3	N_2O from product uses	Insufficient data to include.
	2H1	CO_2 & CH_4 from Pulp & Paper industry	Insufficient data to include.
	2H2	CO_2 & CH_4 from Food & beverage industry	Insufficient data to include.
	3B	CO_2 from organic soils	This will be included in future inventories.
	3C4	N_2O from organic soils	Insufficient data to include.
	4C1	CO_2, CH_4 and N_2O from waste incineration	Insufficient data to include.

NE, IE or NO	IPCC Category	Activity	Comments
	All sectors	NOx, CO, NMVOC emissions	These have only been included for biomass burning due to a lack of data in other sectors.
	All sectors	SO_2 emissions.	Insufficient data. It is planned to include these in future inventories.
IE	1A1aii	CO_2, CH_4 and N_2O emissions from Combined Heat and Power (CHP) combustion systems	Not separated out but is included within 1A1ai.
	1A3eii	CO_2, CH_4 and N_2O emissions from off-road vehicles and other machinery	Included under Road transportation.
	1A5b	CO_2, CH_4 and N_2O emissions from other mobile machinery	Included under Road transportation.
	1B1c	Solid fuel transformation	Included under sector specific categories
	3B	Precursor emissions from controlled burning	Emissions from controlled burning are not separated from biomass burning and so are included under *Biomass burning* (3C1).
	3C1	CO_2 emissions from biomass burning.	These are not included under biomass burning, but rather under disturbance losses in the Land sector (3B).
NO	2B3	CO_2, CH_4 and N_2O emissions from *Adipic acid production*	
	2B4	CO_2, CH_4 and N_2O *Caprolactam, Glyoxal and Glyoxylic acid production*	
	2B8a	Methanol production	
	2B8b	Ethylene production	
	2B8c	Ethylene dichloride & vinyl chloride monomer	
	2B8d	Ethylene oxide	
	2B8e	Acrylonitrile	
	2B9	HFCs, PFCs and SF_6 from *Fluorochemical production*	
	2C4	CO_2, HFCs, PFCs and SF_6 from *Magnesium production*	
	3A1	CH_4 emissions from buffalo and camels.	
	3A2	CH_4 and N_2O emissions from buffalo and camels.	
	3C1f	All emissions from *Other lands*	
	3C7	Rice cultivation	

2.7.12. Planned Improvements

2.7.12.1.1. GHG Improvement Programme

The main challenge in the compilation of South Africa's GHG inventory remains the availability of accurate activity data. The DFFE is in the process of implementing a project that will ensure easy accessibility of activity data. It has initiated a programme called the National Greenhouse Gas Improvement Programme (GHGIP), which comprises a series of sector-specific projects that are targeting improvements in activity data, country- specific methodologies and emission factors used in the most significant sectors. Table 2.7 summarises some of the projects that are under implementation as part of the GHGIP.

Table 2.7: List of planned improvements for South Africa's GHG inventory

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
Completed tasks						
Cross-cutting	Incorporate data from SAGERS into inventory (data reported due to NGERs)	High	Accuracy	Completed	5th BUR (2020 inventory)	Data will continue to be incorporated into the future
	Set up MOUs with key data providers, e.g., DMRE, SAPIA	High	Transparency	Resolved	NA	This has proved to be difficult and is not working, therefore regulatory processes (NGERs) and the GHGIP are being used for data gathering instead.
	Improve understanding of difference between reference and sectoral approach	Medium	Key category; Transparency	Resolved	5th BUR (2020 inventory)	Updates were made to the Energy balance data and the actual methodology and calculation file for the reference approach was reassessed. Data was incorporated into the energy sector calculation file.
Energy	Develop EFs, carbon content of fuels and NCVs of liquid fuels	High	Key category; accuracy	Completed	1st BTR (next inventory)	Study was completed in 2022 for most used liquid fuels. Developed parameters to be used in the next inventory.
IPPU	Calculate CH_4 emissions from Iron and steel production	High	Key category; completeness	Completed	5th BUR (2020 inventory)	Completed.
	Estimate emissions from OPUC category using currently available data	Medium	Completeness	Completed	5th BUR (2020 inventory)	Completed for ceramics, soda ash usage and dolomite usage.
AFOLU	Update HWP with country specific data	Low	Accuracy	Completed	5th BUR (2020 inventory)	Completed
	Incorporate all background data and equations for the Tier 2 calculations of enteric fermentation	High	Key category; Accuracy; Transparency	Completed	5th BUR (2020 inventory)	Completed

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
Waste	Include information on population distribution in rural and urban areas as a function of income	Medium	Key category; Accuracy;	Completed	5th BUR (2020 inventory)	Study was completed in March 2020 and data is included in the 2020 inventory.
Tasks in progress						
Cross cutting	Improve transparency in reporting by including more detailed description of methodologies and activity data, particularly in energy and IPPU sectors.			In progress	5th BUR (2020 inventory)	Transparency in the Energy and IPPU sectors were enhanced, however this is an ongoing activity and further updates will be made in the next inventory.
	Improve the improvement plan by incorporating all review activities not addressed in current inventory.	High	Transparency	In progress	5th BUR (2020 inventory)	Partly resolved. Challenges around inclusion of further improvements into the improvement plan are limited resources and process management. The DFFE inventory team has increased in size, but it is still taking time to completely address all the issues. The review outputs are included in this report as a reminder of what still needs to be completed.
	Incorporate NOx, CO, NMVOC and SO_x emissions	High	Completeness	In progress	5th BUR (2020 inventory)	Partly resolved. NOx, CO and NMVOCs emissions from Biomass Burning were estimated.
Energy	CO_2 and CH_4 fugitive emissions from oil and natural gas operations	Medium	Completeness	In progress	5th BUR (2020 inventory)	Partly resolved. CO_2 emissions from Oil are included. Further gases from this source category will be added in the next inventory as information will be obtained through NGERs.
	Improve explanation of large changes in trends	High	Transparency	In progress	5th BUR (2020 inventory	Partly resolved. Additional explanations have been provided, but there are still areas where this can be improved further. Ongoing process.
AFOLU	Incorporate updated National Terrestrial Carbon Sinks Assessment (NTCSA) data to improve	High	Key category; Accuracy	In progress	5th BUR (2020 inventory)	Partly resolved. The NTCSA above- ground woody, above round herbaceous and DOM were included or used as validation data, but not as a Tier 3 approach due to there only being 1 year of data for woody biomass. A QGIS plugin was developed with the last update and this is currently being explored to determine whether the sinks data can be updated for the additional years to allow for the use of

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
	estimates, particularly for soils					the stock difference approach. A study needs to be undertaken to fully incorporate the carbon sinks data and to conduct an uncertainty assessment on the data. This could be a project for the GHGIP.
	Include deadwood in the DOM pool for all land categories	Low	Completeness	In progress	1st BTR (next inventory)	Partly resolved. Deadwood was included for forest land categories.
	Include CO_2 estimates for wetlands	Low	Completeness	In progress	Future inventories	Partly resolved. Wetlands were assumed to be mineral inland wetlands and CO_2 estimates were incorporated on this basis. The data from the Blue Carbon study should however be used to update this in future inventories and include other wetlands and mangroves.
	Include 2018 and 2020 SANLC maps	High	Key category; Completeness; Accuracy	In progress	1st BTR (Next Inventory)	Partly resolved. The 2018 and 2020 SANLC maps were developed using Sentinel 2 data as opposed to the Landsat data that was used for 1990 and 2014. This posed some challenges as there was some reclassification of the land types which led to large area changes. The 2018 map was degraded to compare with the 1990 and 2014 maps and an assessment of the natural land change classes was completed. In this inventory the 1990-2018 matrix was applied with some assumptions based on the land change data assessment. At this stage the 2020 data has not been included as it needs to be assessed in terms of the reclassifications, particularly for the natural land classes, but it will be included in the next inventory. DFFE is currently trying to obtain annual maps of the 8 natural land classes to be able to assist in separating out actual change from natural seasonal change. This is a high priority.
Waste	Data collection on quantities of waste disposed of into managed and unmanaged landfills		Key category; Accuracy	In progress	1st BTR (next inventory)	Project is completed some of the results will be incorporated in the next inventory.
Tasks outstanding						
Cross cutting	Improve uncertainty data for all sectors but incorporating more country specific uncertainty values	Medium	Accuracy	Proposed	Incorporated as data becomes available	Lack of uncertainty data constrains this activity. As data becomes available it will be incorporated, but there are no specific planned projects for this activity at this stage.
	Extend time-series back to 1990 for energy, IPPU and waste sectors.	Medium	Completeness	Proposed	Future inventories	Lack of data for years prior to 2000, particularly for categories where data is highly variable (such as HFCs and PFCs), have constrained

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
						the completion of this task. A study is planned to extend/extrapolate the data back to 1990 for the three IPCC sectors.
	Investigate inconsistencies in lime activity data (for lime production in IPPU and lime application emission in AFOLU), explore alternative data sources or improve consistency.	Low	Consistency	Planned	Future inventories	Not resolved. Various methods were compared but give varying results. Alternative data sources have not yet been found, but it may be possible to collect further data through the SAGERS system in future.
	Improve QA/QC process by addressing all issues in external review	High	Transparency	In progress	1st BTR (Next Inventory)	Challenges in addressing external review comments have been limited by resources and process management. The DFFE inventory team has increased in size which should assist in addressing this issue. There are still many issues not resolved but the inventory team is working through them. It is an ongoing process.
	CO_2, CH_4 and N_2O from spontaneous combustion of coal seams.	Low	Completeness	Proposed	1st BTR (next Inventory	New research work on sources of emissions from this category are evaluated and used to report emissions in future inventories.
	CH_4 emissions from abandoned mines	Low	Completeness	Proposed	Future inventories	New research work on sources of emissions from this category are evaluated and used to report emissions in future inventories.
Energy	Fugitive emissions from coke production to be reported separately from 2C process emissions	Low	Transparency	Proposed	Future inventories	Progress on this has been slow but reporting through the NGER will allow this activity to be incorporated in the next inventory.
	Incorporate emissions from biogas	Low	Completeness	Proposed	Future inventories	This would require a study and so should be recommended as a project under the GHGIP.
	CO_2 transport and storage	Low	Completeness	Proposed	Future inventories	Proposed but nothing planned.

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
	CO_2, CH_4 and N_2O emissions from combined heat and power (CHP) combustion systems	Medium	Completeness	Proposed	Future inventories	Proposed but nothing planned.
IPPU	Development of country specific EF for ferroalloy industry	Medium	Key category; Accuracy	Proposed	Future inventories	Resources and funding are required to complete this study so it will be incorporated into the GHGIP.
	Include emissions from electronics industry	Medium	Completeness	Planned	Future inventories	A study needs to be undertaken to understand emissions from this source so it should be highlighted as a project for the GHGIP.
	Incorporate SF_6 emissions	Medium	Completeness	In progress	1st BTR (next inventory)	Lack of data is still a challenge.
	Investigate historical data for the imports and exports of clinker		Completeness	Proposed	Future inventories	TBC
	Undertake a completeness assessment to determine if non-marketed lime is reported	Medium	Completeness	Proposed	Future inventories	TBC
	Disaggregate the cullet ratio by facility.	Medium	Completeness	Proposed	Future inventories	TBC
	Investigate the availability of the historical data (2B6)	Medium	Completeness	Proposed	Future inventories	TBC
	Investigate the air quality database for those data providers that trigger reporting under Lead Battery processing	Medium	Completeness	Proposed	Future inventories	TBC

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
	Investigate if secondary zinc production occurs in South Africa Investigate the air quality database regarding pyrometallurgical process involving the use of an imperial smelting furnace is used for combined zinc and lead production.	Medium	Completeness	Proposed	Future inventories	TBC
	South Africa to undertake a desktop study regarding two-stroke engines and the use of blended lubricant.	Medium	Completeness	Proposed	Future inventories	TBC
AFOLU	Incorporate organic soils study to include emissions from organic soils	Medium	Completeness	Planned	Future inventories	Not resolved. Due to the other more pressing issues relating to land this was not a priority and will be incorporated once the land mapping system is running.
	Complete an assessment of crop types and areas and investigate discrepancies between crop statistics and NLC data	Medium	Consistency; Comparability	Planned	Future inventories	Variability in crop classifications from the various data sources have made this challenging. Funding will be required to complete a proper assessment of croplands so this project can be included in the GHGIP.
	Improve HWP model by incorporating further country specific data and by comparing the production method to the atmospheric model.	Medium	Key category; Accuracy	Planned	Future inventories	Proposed project that could be considered under the GHGIP.
	Complete a full uncertainty analysis for the Land sector, including area bias corrections	High	Key category; Accuracy	Proposed	Future inventories	Proposed to conduct a study to complete an uncertainty analysis for the Land sector, include all spatial data. This could be a project for the NGHGIP.

Sector	Improvement	Priority	Reason	Status	Completion timeframe	Barriers and constraints
Waste	Improve MCF and rate constants		Key category; Accuracy	Proposed	To be considered as a long-term project	This would require a study s will be recommended as a project under the GHGIP.
	Include economic data for different population groups		Key category; Accuracy	In progress	Future inventories	TBC
	Include HWP in solid waste	Medium	Key category; Completeness	Proposed	To be considered in long-term	Insufficient data.
	Obtain data on waste streams and the bucket system		Accuracy	In progress	Future inventories	TBC
	CO_2, CH_4 and N_2O from waste incineration	High	Completeness	Proposed	Future inventories	TBC

2.8. SECTORAL ANALYSIS

2.8.1. Energy

South Africa's GDP is the 30th highest in the world, but in primary energy consumption South Africa is ranked 17th in the world. South Africa's energy intensity is high mainly due to the economy being dominated by large-scale, energy-intensive primary minerals beneficiation industries and mining industries. Furthermore, there is a heavy reliance on fossil fuels for the generation of electricity and to produce a significant proportion of the liquid fuels consumed in the country. The Energy sector is critical to the South African economy because it accounts for 15% of the GDP.

In 2019, the Department of Mineral Resources and the Department of Energy (DOE) were combined to form the DMRE. The Energy division is responsible for the management, processing, exploration, utilisation, and development of South Africa's energy resources.

The Energy sector in South Africa is highly dependent on coal as the primary energy resource. The largest source of energy sector emissions in South Africa is the combustion of fossil fuels. Emissions from combustion include CO_2, N_2O, CH_4 and H_2O. A large quantity of liquid fuels is imported in the form of crude oil. Renewable energy sources include biomass and natural processes that can be used as energy sources. Biomass is used commercially in industry to produce heat, and in households for cooking and heating.

In terms of energy demand, South Africa is divided into six sectors: Industry, Agriculture, Commerce, Residential, Transport and Other. The Industrial sector (which includes mining, iron and steel, chemicals, non-ferrous metals, non-metallic minerals, pulp and paper, food and tobacco, and other) is the largest user of energy in South Africa. The primary energy supply in South Africa dominated by coal (65%), followed by crude oil (18%), renewable and waste resources (11%), gas (3%) and nuclear (2%) (DMRE, 2021).

The energy sector includes:

(i) Exploration and exploitation of primary energy sources.
(ii) Conversion of primary energy sources into more useable energy forms in refineries and power plants.
(iii) Distribution of fuels.
(iv) Final use of fuels in stationary and mobile applications.

The categories included in the Energy sector for South Africa are Fuel combustion activities (1A), including international bunkers, Fugitive emissions from fuels (1B) and Carbon dioxide transport and storage (1C).

The Energy sector is the largest contributor to South Africa's total emissions (excl. FOLU), contributing 81.1% towards these emissions in 2020 which is an increase from an 80.1% contribution in 2017. Energy sector emissions increased from 349 100 Gg CO_2e in 2000 to 410 685 Gg CO_2e in 2017 and then reduced to 379 505 Gg CO_2e in 2020.

2.8.1.1.1. Trends

Total emissions from the Energy sector for 2020 were estimated to be 379 505 Gg CO_2e (Table 2.). Within the Energy sector, Energy industries was the main contributor, accounting for 62.4% of emissions. This was followed by Transport (12.7%) and Manufacturing industries and construction (8.8%). The Residential and Commercial sectors are both heavily reliant on electricity for meeting energy needs.

Table 2.8: Emissions from the Energy Sector in 2020 by gas and sub-category

Greenhouse gas source and sink categories	CO_2	CH_4		N_2O		Total
	Gg CO_2e	Gg	Gg CO_2e	Gg	Gg CO_2e	Gg CO_2e
1. ENERGY	**371 409.3**	**267.3**	**5613.4**	**8**	**2482.4**	**379 505.2**
1A Fuel combustion activities	345 085.0	23.9	502.5	7.7	2 482.4	348 069.9
1B Fugitive emissions from fuels	26 324.3	243.4	5 110.9			31 435.2
1C Carbon dioxide transport and storage	NE					NE

Energy sector emissions increased by 2.2% between 2000 and 2020 (Figure 2.12). Emissions peaked in 2009 and thereafter the emissions have plateaued. The plateauing might be a result of increasing penetration of electricity generated from renewable energy resources (e.g., wind, solar photovoltaics (PV) and concentrated solar power (CSP)). In 2013, a penetration level of 0.03% (0.01 TWh) of wind and solar energy resources was introduced into the national electricity system. By 2016 and 2017, the penetration levels of these renewable resources had increased to 3% (6.9 TWh) and 4% (10.8 TWh), respectively.

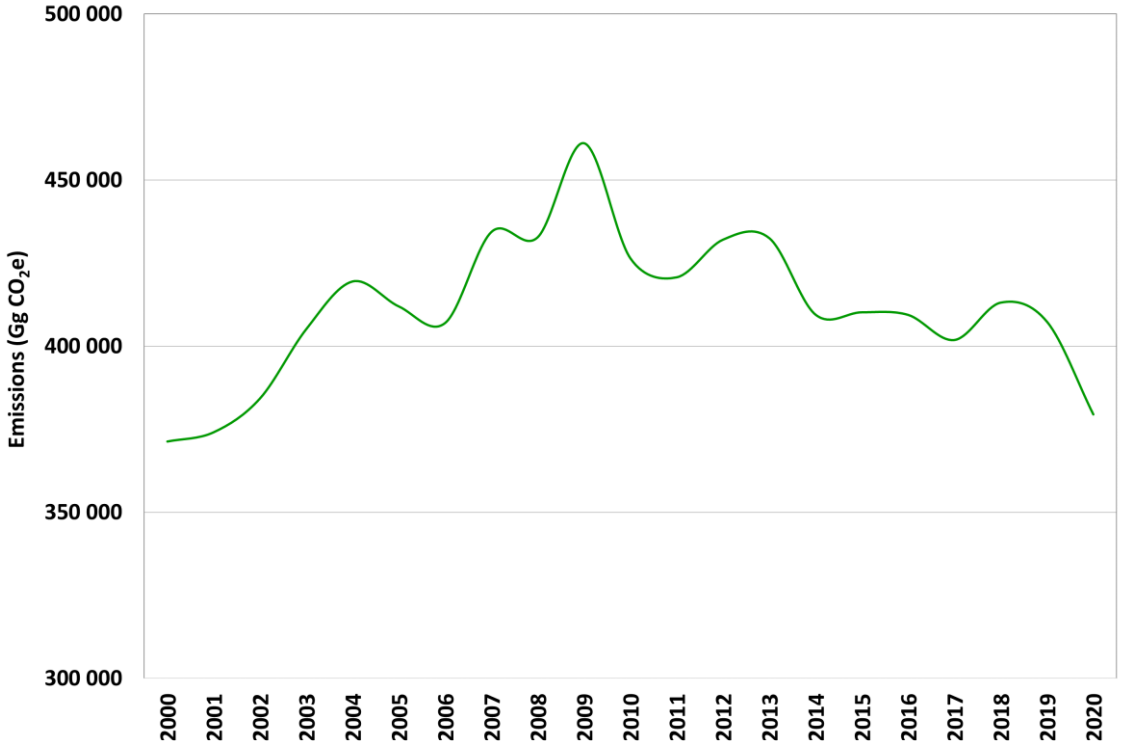


Figure 2.12: Trends in South Africa's energy sector emissions, 2000 – 2020

The emissions from Fuel combustion activities grew by an average of 0.2% per annum from 2000 to 2020. While the economy was growing, there was a steady increase in emissions until 2008, followed by a decline in emissions due to the global economic crisis of 2008. There is a slight decline from 2014 to 2016 due to a decline in the energy industries emissions as seen in Figure 3.4 of the 2020 NIR (DFFE, 2022), as Eskom coal power stations had lower energy availability factors, low economic growth and an increasing share of renewables into the electricity grid. There was a slight increase in 2017 and emissions then stabilised in 2018 due to very slow economic growth.

The sectoral summary sheet for Energy, provided in Appendix C of the 2020 NIR (DFFE, 2022), can be referred to for further details.

2.8.1.1.2. Methods and data

All activity and emission factor data sources for the Energy sector are provided in Table 2.9. GHG emissions from the Energy sector were estimated using a detailed sectoral or bottom-up approach. Most of the emission estimates in the sectoral approach for the Energy sector are calculated using IPCC Tier 1 and 2 methods (Table 2.7).

Table 2.9: Summary of Methods and Emission Factors for the Energy Sector

GHG Source and sink category		CO_2		CH_4		N_2O		NOx	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
1A	**Fuel combustion activities**										
1A1	***Energy industries***										
	a. Main activity electricity and heat production	T1, T2, T3	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
	b. Petroleum refining	T1	DF	T1	DF	T1	DF	NE	NE	NE	NE
	c. Manufacture of solid fuels and other energy industries	T3	CS	T3	CS	T3	CS	NE	NE	NE	NE
1A2	***Manufacturing industries and construction***	T1, T2	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
1A3	***Transport***										
	a. Civil aviation	T1	DF	T1	DF	T1	DF	NE	NE	NE	NE
	b. Road transportation	T1	DF	T1	DF	T1	DF	NE	NE	NE	NE
	c. Railways	T1	DF	T1, T2	DF, CS	T1	DF	NE	NE	NE	NE
	d. Water-borne navigation	T1	DF	T1	DF	T1	DF	NE	NE	NE	NE
	e. Other transportation	NA		NA		NA		NA	NA	NA	NA
1A4	***Other sectors***										
	a. Commercial/ Institutional	T1, T2	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
	b. Residential	T1, T3	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
	c. Agriculture/ Forestry/ Fishing/ Fish farms	T1, T3	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
1A5	***Non-specified***										
	a. Stationary	T1, T2	DF, CS	T1	DF	T1	DF	NE	NE	NE	NE
	b. Mobile	IE		IE		IE		NE	NE	NE	NE
1B	**Fugitive emissions from fuels**										
1B1	***Solid fuels***										
	a. Coal mining and handling	T2	CS	T2	CS	NA		NE	NE	NE	NE

GHG Source and sink category		CO_2		CH_4		N_2O		NOx	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
	b. Uncontrolled combustion and burning coal dumps	NE		NE		NA		NE	NE	NE	NE
	c. Solid fuel transformation	IE		IE		NA		NE	NE	NE	NE
1B2	***Oil and natural gas***										
	a. Oil	T3	CS	NE		NA		NE	NE	NE	NE
	b. Natural gas	NE		NE		NE		NE	NE	NE	NE
1B3	***Other emissions from energy production***	T3	CS	T1, T3	DF, CS	NE		NE	NE	NE	NE
1C	**Carbon dioxide transport and storage**										
1C1	***Transport of CO_2***										
	a. Pipelines	NE									
	b. Ships	NE									
	c. Other	NE									
1C2	***Injection and storage***										
	a. Injection	NE									
	b. Storage	NE									
1C3	***Other***	NE		NE		NE		NE	NE	NE	NE

Data were collected through two instruments. The first process involved receiving data through direct interaction between the DFFE and stakeholders that supplied the department with the data. These key department and stakeholders are government departments such as the DMRE, public entities such as Eskom (electricity production), Transnet and associations such as South African Petroleum Industry Association (SAPIA). The second process involved collecting data that was publicly available. The datasets from all these data collection processes are run through a data completeness checking system to check whether all the sectors within the economy are covered (Figure 2.13). Incomplete categories are then identified and highlighted for future data collection.

The main sources of data for the Energy sector are the energy balance data compiled by the DMRE, data supplied by the main electricity provider, Eskom and petroleum companies, i.e., PetroSA and Sasol. Annual reports from South African Petroleum Industry Association (SAPIA) and Transnet are also considered. There are currently no formal processes in place for requesting or obtaining data from DMRE. Data from major companies are gathered via SAGERS, through the GHG Reporting Programme. The data collection process for the Energy sector is shown in Figure 2.13.

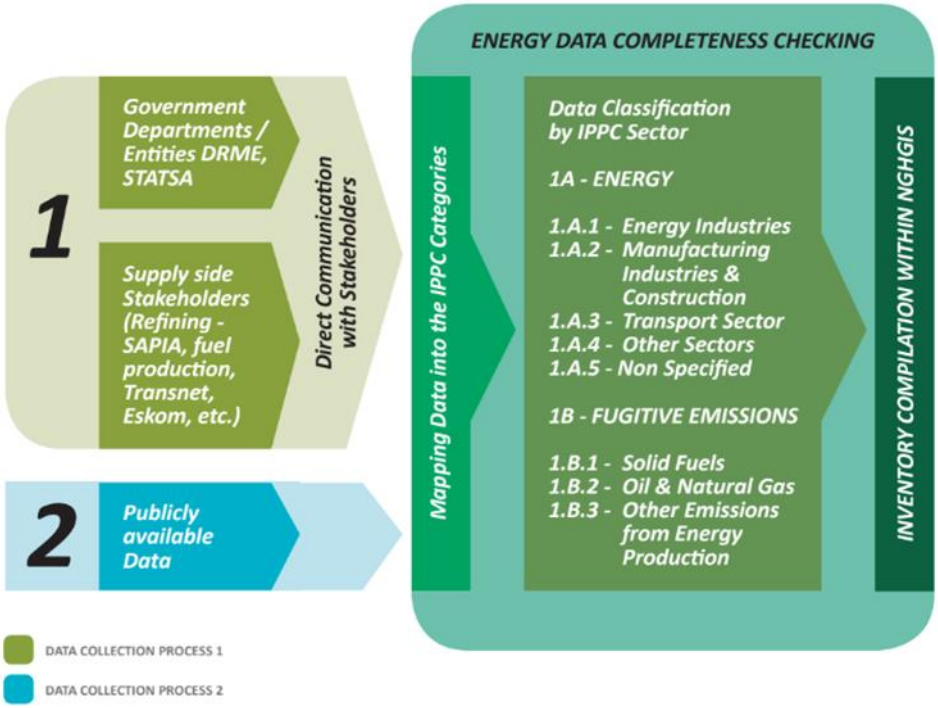


Figure 2.13: Data Collection Process for the 2020 Energy Sector Inventory

2.8.1.1.3. Reference and sectoral approach comparison

It is good practice to apply both a Sectoral Approach and the Reference Approach to estimate a country's emissions from fuel combustion and to compare the results of these two independent estimates. Significant differences may indicate possible problems with the activity data, net calorific values, carbon content, excluded carbon calculation etc.

The Reference Approach is a top-down approach, using a country's energy supply data to calculate the emissions from combustion of mainly fossil fuels. The Reference Approach was applied on the basis of relatively easily available energy supply statistics.

The Reference Approach and the Sectoral Approach often have different results because the Reference Approach is a top-down approach using a country's energy supply data and has no detailed information on how the individual fuels are used in each sector.

The Reference Approach outputs were compared to the sectoral emissions for the period 2000 to 2017 (energy balance data for 2019 to 2020 was not available at the time of publication) and the CO_2 emissions were always higher using the Reference Approach. The difference in CO_2 emissions using the reference and sectoral approach was 19% and 14% for the years 2017 and 2018, respectively. The largest differences were seen in the solid fuels, where consumption is consistently higher with the Reference Approach (Appendix D of NIR, 2020). Allocation of solid fuels between energy use, non-energy use, as well as use for synthetic fuels production remains one of the key drivers of the differences observed between the two datasets. The opposite is true for liquid fuels, with the Sectoral Approach showing higher values (Appendix D of NIR, 2020), whereas for gaseous fuels the consumption data is higher with the Reference Approach (Appendix D of NIR, 2020). Reasons for the differences between the emissions and fuel consumption data of the Reference and Sectoral Approach are similar to those reported in the BUR-4 and are briefly described here:

I. Missing information on stock changes that may occur at the final consumer level. The relevance of consumer stocks depends on the method used for the Sectoral Approach.
II. High distribution losses for gas will cause the Reference Approach to be higher than the Sectoral Approach.
III. Unrecorded consumption of gas or other fuels may lead to an underestimation of the Sectoral Approach.
IV. The treatment of transfers and reclassifications of energy products may cause a difference in the Sectoral Approach estimation since different net calorific values and emission factors may be used depending on how the fuel is classified.
V. Net Calorific Values (NCV) used in the sectoral approach differs from those used in the reference approach. In power generation, NCV values in the sectoral approach vary over the 2000-2016 time series based on the information provided by industry.
VI. Activity data on Liquid fuels in the sectoral approach particularly for energy industries is sourced directly from the companies involved and has been reconciled with other publicly available datasets.
VII. Inconsistencies on the sources of activity data within the time series and in some cases the application of extrapolation.
VIII. The misallocation of the quantities of fuels used for conversion into derived products (other than power or heat) or quantities combusted in the energy sector.
IX. Simplifications in the Reference Approach. There are small quantities of carbon which should be included in the Reference Approach because their emissions fall under fuel combustion. These quantities have been excluded where the flows are small or not represented by a major statistic available within energy data.

2.8.1.1.4. Recalculations

Recalculated emission estimates for the Energy sector were between 4.4%–8.5% higher than previous estimates between 2000 and 2009, while in 2014 and 2015 estimates were 1.8% and 0.9% lower than previous estimates for the Energy sector (see Figure 3.9 of NIR, 2020). Estimates were 2.2% higher in the current inventory for the year 2017. These recalculations were necessary due to an update of consumption data in the Road transport, Manufacturing industries and construction, Other sectors and Non-specified emissions from energy production.

The main fuels that necessitated recalculation are coal, diesel, natural gas and gasworks gas in those sectors. There are three reasons why recalculations had to occur:

1. The energy balance from DMRE has updated fuel allocation in these sectors hence there was a need to recalculate the emissions.
2. The fuel consumption study done by DFFE under the GHG improvement programme was finalised.
3. The DMRE had updated coal statistics in its SAMI report series.

A significant amount of diesel was allocated to 1A5a in the energy balance, which was not there before. Given that in the previous inventories, this category did not have any diesel allocated to it, this led to an increase in diesel consumption in the energy industries.

A recent parc model, as part of the Fuel Consumption Study (DEFF, 2020), was completed for the Transport sector, which provided consumption data based on VKT. In this inventory the petrol, diesel and natural gas consumption data for Road transport was updated and this led to a 3.7% increase in the Road transport emission estimates between 2017 and 2019. In 2020, the emissions decreased by 13%. It is assumed that most of this reduction occurred due to the restricted travel from Road transport, especially passenger travel where people converted to working from home. In the Other emissions from energy production category, the charcoal consumption data was corrected producing a 1% decline in emission estimates for 2008 to 2012 and a 12% reduction in the 2013 estimates. The re-allocation of diesel significantly reduced diesel allocation in the manufacturing industries and construction sector.

2.8.1.1.5. Planned improvements

Improvements planned for the next Inventory are outlined below:

(i) Two studies, that were conducted to improve the emission factors for fuels used in industry, were completed in 2022. This is to move from Tier 1 to Tier 2 in those applicable industries. The emission factors will be used in the next inventory. These studies are:

1) Development of CO_2 emission factors for alternative fuels (mainly waste fuels such as tyres) used within the cement production industry.

2) The second study is planned to look at country specific CO_2 emission factors for gaseous and liquid fuels used in stationary application.

(ii) There is a study that is being conducted to improve the emission factors for solid fuels used in industry. This is to move from Tier 1 to Tier 2 in those applicable industries. The resulting emission factors will be incorporated in future inventories.

(iii) There is currently another study under the GHG improvement programme that is trying to improve the activity data for fuel wood consumption in different subsectors.

(iv) Fugitive emissions from coke production are currently accounted for under category 2C as part of process emissions, however, it is planned that by the next inventory these will be separated from process emissions and reported separately.

(v) Time-series will be extended back to 1990 over the next few years, but this will likely only be available in the 1st BTR.

2.8.2. IPPU

The IPPU sector includes non-energy related emissions from industrial processing plants. The main emission sources are releases from industrial processes that chemically or physically transform raw material, e.g., ammonia products manufactured from fossil fuels. GHG emissions released during these processes are CO_2, CH_4, N_2O, HFCs and PFCs. Also included in the IPPU sector are emissions used in products such as refrigerators, foams and aerosol cans.

HFCs and perfluorocarbons PFCs are used in many products, such as refrigeration and air conditioning equipment. PFCs are also emitted because of anode effects in aluminium smelting. Therefore, the IPPU sector includes estimates of PFCs from aluminium production and HFCs from refrigeration and air conditioning.

The estimation of GHG emissions from non-energy sources is often difficult because they are widespread and diverse. The difficulties in the allocation of GHG emissions between fuel combustion and industrial processes arise when by-product fuels or waste gases are transferred from the manufacturing site and combusted elsewhere in different activities. The largest source of emissions in the IPPU sector in South Africa is the production of ferroalloys.

The performance of the economy is the key driver for trends in the IPPU sector. South Africa is a relatively small, open economy, therefore, economic activity, typically correlates with global economic trends. South Africa officially entered an economic recession in May 2009, which was the first in 17 years. Until the global economic recession affected South Africa in late 2008, economic growth had been stable and consistent. As a result of the recession, GHG emissions during that period decreased enormously across almost all categories in the IPPU sector. The Covid 19 pandemic caused economic growth to decline during 2020, especially during the second half of the year when lockdown measures where stricter.

2.8.2.1.1. Trends

In 2020, the IPPU sector produced 25 486 Gg CO_2e, which is 5.4% of South Africa's emissions (excl. FOLU). The largest source category within this sector is the metal industry (Table 2.8), which contributes 48% to the total IPPU sector emissions. Iron and steel production and ferroalloys production are the biggest CO_2 contributors to the metal industry subsector, producing 3 853 Gg CO_2 (31.5%) and 7 069 Gg CO_2 (57.8%), respectively. The mineral industry and the Product used as substitutes for ozone depleting substances subsectors contribute 18.7% and 19.4%, respectively, to the IPPU sector emissions. Carbide production, carbon black production, iron and steel production, ferroalloy production and ammonia production produce 576 Gg CO_2e of CH_4, while chemical industries are estimated to produce 836 Gg CO_2e of N_2O.

Table 2.10: Emissions from the IPPU sector in 2020 by gas and sub-category

GHG source categories	CO_2	CH_4	N_2O	HFCs	PFCs	Total
	Gg CO_2e					
2.IPPU	**19 021**	**576**	**836**	**4 933**	**120**	**25 486**
2.A Mineral industry	4 774	NA	NA	NA	NA	4 774
2.B Chemical industry	1 348	80	836	NA	NA	2 264
2.C Metal industry	11 604	496	NA	NA	120	12 220
2.D Non-energy products from fuels and solvents	1 295	NA	NA	NA	NA	1 295
2.E Electronic industry	NE	NE	NE	NE	NE	NE
2.F Product uses as substitute ODS	NA	NA	NA	4 933	NE	4 933
2.H Other	NE	NE	NE	NE	NE	NE

Numbers may not sum exactly due to rounding off.

IPPU emissions increased by 18.0% between 2000 and 2006, after which there was a 13.6% decline to 2009. This decrease was mainly due to the global economic recession and the electricity crisis that occurred in South Africa during this period. In 2010, emissions increased by 6.9% due to an increase in the metal industry and products used as substitutes for ozone depleting substances subsectors. Emissions increased between 2010 and 2016 due to an increase in production in the mineral and metal industries. Emissions then decreased by 19.6% between 2016 and 2017, as demand in the chemical and metal industries dropped. In recent years, companies have been reporting data through the SAGERS system due to the NGER and this data is starting to be included in the inventory. Emissions within the sector decreased further from 2017 to 2020 by 21.0% due to lower production demands in the mineral, chemical and metal industries. The economy in 2020 was further strained due to the COVID-19 pandemic and stringent lockdown regulations within South Africa. The emission factor for sinter is much lower than for pig iron and direct reduced iron and hence the reduction in emissions in 2017. The mineral industry emissions decreased by 23.7% (1 483 Gg CO_2e) since 2017 and the metal industry showed an overall decrease of 40.0% (8 150 Gg CO_2e).

The metal industry was estimated to produce 12 220 Gg CO_2e in 2020, which is 48% of the IPPU sector emissions. The largest contribution comes from ferroalloy production (7 069 Gg CO_2e or 57.8%), followed by iron and steel production (3 853 Gg CO_2e or 31.5%). IPPU emissions decreased by 19.6% between 2016 and 2017 as demand in the chemical and metal industries dropped (Figure 2.14). In 2020 the mineral industries produced 4 774 Gg CO_2, which is 18.7% of the IPPU sector emissions. The IPPU sectoral summary sheet in Appendix C of the 2020 NIR (DFFE, 2022) provides further detail.

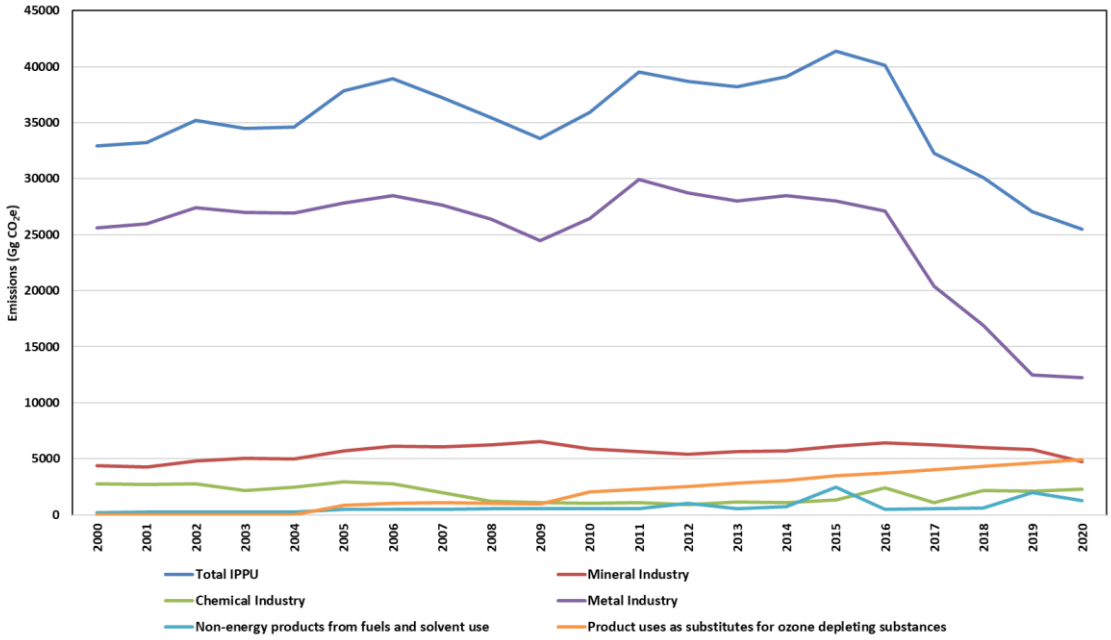


Figure 2.14: Trends in the IPPU sub-categories between 2000 and 2020

2.8.2.1.2. Methods and data

A summary of the methods and emission factors applied to each subsector of IPPU is shown in Table 2.11 below.

Table 2.11: Summary of methods and emission factors for the IPPU sector and an assessment of completeness of the IPPU sector emissions

GHG Source and sink category		CO_2		CH_4		N_2O		HFCs		PFCs		SF6		NOx	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method Applied	Emission Factor				
A	**Mineral industry**																
1	*Cement production*	T1	DF	NE										NE	NE	NE	NE
2	*Lime production*	T1, T2	DF	NE										NE	NE	NE	NE
3	*Glass production*	T3	CS	NE										NE	NE	NE	NE
4	*Other process uses of carbonates*	T1, T3	DF, CS	NE										NE	NE	NE	NE
B	**Chemical industry**																
1	*Ammonia production*	T3	CS	T3	CS	NE								NE	NE	NE	NE
2	*Nitric acid production*	NE		NE		T3	CS							NE	NE	NE	NE
3	*Adipic acid production*	NO		NO		NO								NO	NO	NO	NO
4	*Caprolactam, glyoxal and glyoxylic acid production*	NO		NO		NO								NO	NO	NO	NO
5	*Carbide production*	T1	DF	T1	DF	NE								NE	NE	NE	NE
6	*Titanium dioxide production*	T3	CS	NE		NE								NE	NE	NE	NE
7	*Soda Ash production*	T3	CS	NE		NE								NE	NE	NE	NE
8a	*Methanol*	NO		NO		NO								NO	NO	NO	NO
8b	*Ethylene*	NO		NO		NO								NO	NO	NO	NO
8c	*Ethylene Dichloride and Vinyl Chloride Monomer*	NO		NO		NO								NO	NO	NO	NO
8d	*Ethylene Oxide*	NO		NO		NO								NO	NO	NO	NO
8e	*Acrylontrile*	NO		NO		NO								NO	NO	NO	NO

GHG Source and sink category		CO_2		CH_4		N_2O		HFCs		PFCs		SF6		NOx	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method Applied	Emission Factor				
8f	*Petrochemical and carbon black production*	T1	DF	T1	DF	NE								NE	NE	NE	NE
8g	*Hydrogen Production*	T3	CS	NE		NE								NE	NE	NE	NE
9	*Fluorochemical production*							NO		NO		NO		NO	NO	NO	NO
11	*Other*	T2	CS	T2	CS	NE		NE		NE		NE		NE	NE	NE	NE
C	**Metal industry**																
1	*Iron and steel production*	T1, T3	DF, CS	T1	DF	NE								NE	NE	NE	NE
2	*Ferroalloy production*	T1, T3	DF, CS	T1, T3	DF, CS	NE								NE	NE	NE	NE
3	*Aluminium production*	T3	CS	NE						T3	CS			NE	NE	NE	NE
4	*Magnesium production*	NO						NO		NO		NO		NO	NO	NO	NO
5	*Lead production*	T1	DF											NE	NE	NE	NE
6	*Zinc production*	T1	DF											NE	NE	NE	NE
D	**Non-energy products from fuels and solvents**																
1	*Lubricant use*	T1	DF											NE	NE	NE	NE
2	*Paraffin wax use*	T1	DF	NE		NE								NE	NE	NE	NE
3	*Solvent use*													NE	NE	NE	NE
E	**Electronics industry**																
1	*Integrated circuit or semiconductor*	NE				NE		NE		NE		NE		NE	NE	NE	NE
2	*TFT flat panel display*							NE		NE		NE		NE	NE	NE	NE
3	*Photovoltaics*							NE		NE		NE		NE	NE	NE	NE
4	*Heat transfer fluid*													NE	NE	NE	NE

GHG Source and sink category		CO_2		CH_4		N_2O		HFCs		PFCs		SF6		NOx	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method Applied	Emission Factor				
F	**Product uses as substitute ODS**																
1	*Refrigeration and air conditioning*	NE						T2a, T2b	DF	NE				NE	NE	NE	NE
2	*Foam blowing agents*	NE						T1	DF	NE				NE	NE	NE	NE
3	*Fire protection*	NE						T1	DF	NE				NE	NE	NE	NE
4	*Aerosols*							T1a, T2a	DF	NE				NE	NE	NE	NE
5	*Solvents*							NE		NE				NE	NE	NE	NE
G	**Other product manufacture and use**																
1	*Electrical equipment*									NE		NE		NE	NE	NE	NE
2	*SF6 and PFCs from other product uses*									NE		NE		NE	NE	NE	NE
3	*N_2O from product uses*					NE								NE	NE	NE	NE
H	**Other**																
1	*Pulp and paper industry*	NE		NE										NE	NE	NE	NE
2	*Food and beverage industry*	NE		NE										NE	NE	NE	NE

2.8.2.1.3. Recalculations

Through the introduction of the National Greenhouse Gas Emissions Reporting Regulations in 2017 (DEA, 2016), amendments to these regulation in 2020 (DEFF, 2020) as well as the introduction of the SAGERS, the GHG reporting tool, there have been various additions to the inventory as well as recalculations. The following are improvements and recalculations made to the inventory since 2017:

Mineral Industry:

- The addition of the OPUC(2A4) category from 2018.
- Activity data for 2018 and 2019 were extrapolated for quicklime due to lack of activity data.
- The addition of dolomitic lime from 2019.

Chemical Industry:

- Addition of silicon carbide production in 2019.
- Titanium dioxide production saw an error in activity data corrected from 2014 onwards resulting in higher but accurate emissions.
- Addition of Soda ash production (2B7) category from 2019.
- Addition of hydrogen production (2B8g) from 2018.
- Addition of the Other (2B10) from 2020.

Metal Industry:

- The addition of treatment of secondary raw material under Lead production, which has led toa change throughout the time series where the emission factor was changed from 0.52 to 0.2 from 2000 – 2020.

The specific details of the recalculations for the various sub-categories are provided in section 4.1.3 of the 2020 NIR (DFFE, 2022).

2.8.2.1.4. Planned improvements

General improvements are planned around having sector specific engagements on moving to higher Tier methods. There is also a need to address time series consistency issues as data becomes available for specific categories that have been included in the inventory.

Category specific improvements and recommendations include:

- 2A1: Investigate historical data for imports and exports of clinker.
- 2A2: Undertake a completeness assessment to determine if non-marketed lime is reported.
- 2A3: Disaggregate the cullet ratio by facility.
- 2B6: Investigate the availability of the historical data.

- 2C5: Investigate the air quality database for those data providers that trigger reporting under Lead Battery processing.
- 2C6: Investigate if secondary zinc production occurs in South Africa.
- Investigate the air quality database regarding pyrometallurgical process involving the use of an imperial.
- smelting furnace is used for combined zinc and lead production.
- 2D1: South Africa to undertake a desktop study regarding two-stroke engines and the use of blended lubricant.

2.8.3. AFOLU

The AFOLU sector includes GHG emissions and removals from agriculture as well as land, forestry and other land use. Based on the IPCC 2006 Guidelines, the main categories that were included in the emission estimates for the AFOLU sector are shown in Table 2..

Table 2.12: List of IPCC categories included in AFOLU sector emissions inventory

IPCC Category	Category name	Included
3A1	Enteric fermentation	√
3A2	Manure management	√
3B1	Forest lands	√
3B2	Croplands	√
3B3	Grasslands	√
3B4	Wetlands	√
3B5	Settlements	√
3B6	Other lands	√
3C1	Biomass burning	√
3C2	Liming	√
3C3	Urea application	√
3C4	Direct N_2O emissions from managed soils	√
3C5	Indirect N_2O from managed soils	√
3C6	Indirect N_2O from manure management	√
3C7	Rice cultivation	NO
3C8	Other	NO
3D1	Harvested wood products	√
3D2	Other	NO

Rice cultivation is not included. Food and Agriculture Organization (FAO) statistics indicate that there is a small area of rice cultivation in South Africa, therefore, in the UNFCCC review it was indicated that this should be investigated and included if necessary. Discussions with various experts at the ARC suggests that there have been some small experimental plots for rice cultivation, however, the precise area was not known but it is thought to be less than 50 ha. For this reason, rice cultivation is considered

insignificant. Emissions from fuel combustion in this sector are not included here as these falls under the agriculture/forestry/fisheries subsector in the energy sector.

The land use component includes Forest lands, Croplands, Grasslands, Wetlands, Settlements and Other lands. In addition, for each of these classes both land remaining in the same land use as well as land converted to another land use are considered. The land component includes biomass, DOM and SOC. A Tier 1 (Formulation B) approach to the mineral soil carbon pool. Organic carbon is considered insignificant in this inventory.

Emissions from ruminants in privately owned game parks were excluded due to comments made during the UNFCCC review. Livestock included are dairy cattle, other cattle, sheep, goats, horses, mules and asses, swine and poultry. Further details are provided in the relevant sections below.

2.8.3.1.1. Trends

The AFOLU sector (including FOLU) in South Africa was a source of 14 088 Gg CO_2e in 2020 (Table 2.).

Table 2.13: Emissions from the AFOLU sector in 2020 by gas and sub-category

Greenhouse Gas Source Categories	Net CO_2 emissions/removals	CH_4	N_2O	NO_x	CO	NMVOCs	Total
	Gg	Gg	Gg	Gg	Gg	Gg	Gg CO_2e
3. AFOLU (incl. FOLU)	**-26 788,8**	**1465,80**	**32,57**	**1093,91**	**47.70**	**53,40**	**14087,98**
3. AFOLU (excl. FOLU)	**1526,92**	**1409,00**	**31,16**	**1093.91**	**47.70**	**53,40**	**40774,60**
3A Livestock	n/a	1369,78	8,41				31 371,68
3B Land	-28 950.96	56,78	1,41				-27 321,86
3C Aggregated and non-CO_2	1526.92	39,22	22,75	1093.91	47.70	53,40	9402,92
3D Other	635,24						635,24

The AFOLU (excl. FOLU) emissions declined by 4% between 2000 and 2020, while net emissions from AFOLU (incl. FOLU) declined by 40% over the same period (Figure 2.15).

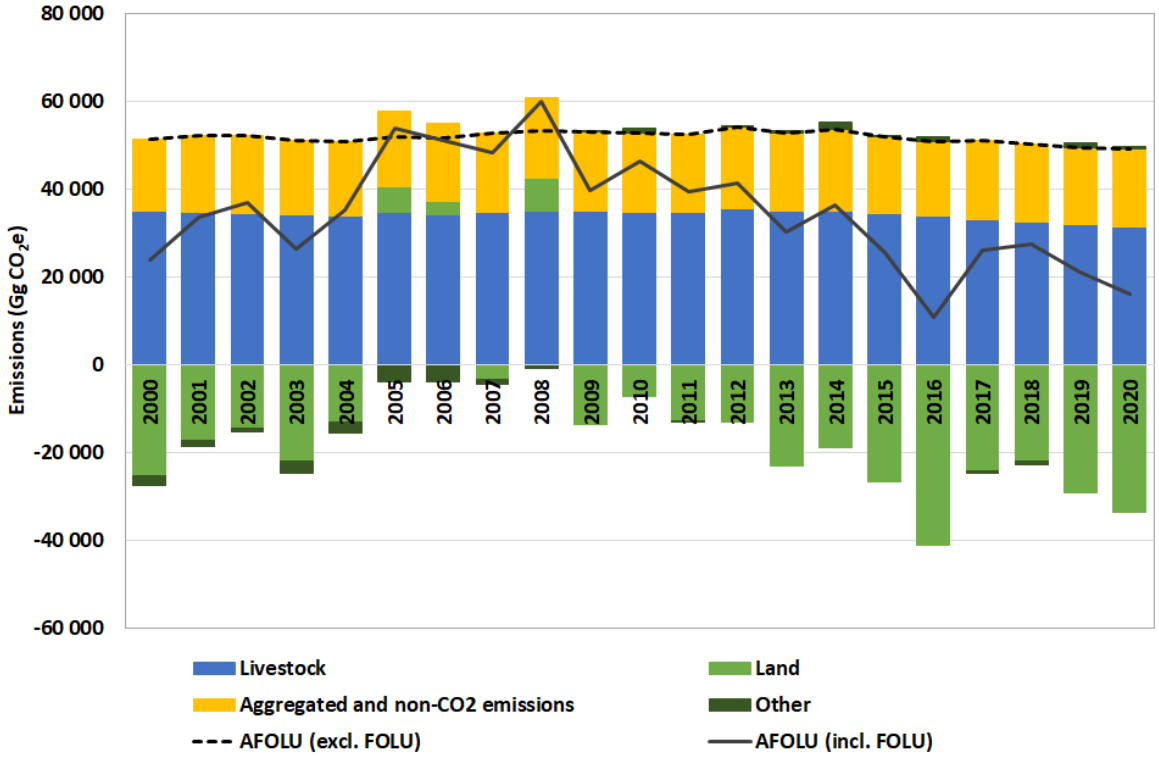


Figure 2.15: The overall AFOLU emissions for South Africa between 2000 – 2020

Forest land was a sink between 2000 and 2004 after which it became a source. In 2011 Forest land became a sink again and this sink increased to 2020 (see Figure 5.7 of the 2020 NIR; DFFE, 2022). Forest land remaining forest land was the main contributor to the source between 2005 and 2008 due to increased biomass losses due to fires. This initial decline contributes to the increasing sink. The increasing sink is due to increasing forest land area and a decline in wood removals. There was a peak in burnt area in 2008 and then a fairly steep decline between 2014 and 2017, leading to reduction in disturbance losses and then increased again in 2017 between 2019. Furthermore, there was a decline in wood removals by households for lighting and cooking purposes, probably due to increased electrification, which also contributed to the reduced removals.

The Grasslands sink remained fairly constant over the 20-year period. Land converted to grasslands contributed the largest portion to the Grassland category.

Other lands provide a constant source of emissions as carbon is lost when land is converted to Other lands. Since it is assumed that there is no vegetation on Other lands and no changes in soil carbon, there are no emissions or removals from the Other lands remaining other land category. In Land converted to Other land only changes due to initial biomass loss and soil carbon losses are relevant.

The AFOLU and LULUCF sectoral summary sheets are provided in Appendix A of the 2020 NIR (DFFE, 2022).

2.8.3.1.2. Land representation

The land cover maps for South Africa cover the national territory; however, it does not include overseas territories at this point. South Africa possesses two subantarctic islands, namely Marion Island (46° 54´ S, 37° 45´ E; 29 300 ha) and Prince Edward Island (46° 38´ S, 37° 57´ E; 4 500 ha) and together they are known as The Prince Edward Islands (Nel et al., 2001; Smith and Mucina, 2006). These overseas territories are not included in the inventory currently due to their small size and difficulties with accessibility. Marion Island has been occupied permanently by South African research and logistic personnel since February 1948, while there is no occupation of Prince Edward Island. The vegetation on these islands is indicated to be subantarctic tundra, polar desert, and marine microalga vegetation (Smith and Mucina, 2006). With the cold climate it is not expected that these islands will produce any significant emissions relative to the rest of South Africa.

2.8.3.1.3. Methods and data

The 1990–2018 National Land Cover Datasets had 73 land classes. For the 2020 inventory these were aggregated into 20 classes and the 20 class maps were used to produce the land change matrix (Table 2.14). The reason for this is to reduce analysis time as the more categories that are included the more complex and time consuming the land change mapping and calculations become. The processing needs to be completed within the timeframes of the inventory cycle. It is, however, recommended that in future an attempt is made to incorporate the more detailed land use classes, particularly in the forest land category, as this would improve the accuracy of the land.

Table 2.14: Relationship between SANLC, land change and IPCC categories in the 2020 inventory

SANLC Class	1990 and 2013/14	Category in 2020 class change map		IPPC category	SANLC 2018 Class	
No.	**Class**	**No.**	**Category**	**Category**	**No.**	**Class**
4	Indigenous forest	1	Indigenous forest	Forest land	1	Contiguous forest
5	Thicket/ dense bush	2	Thicket/dense bush	Forest land	2	Contiguous low forest & thicket
6	Woodland/open bush	3	Natural woodland	Forest land	3 4 42 43	Dense forest and woodland Open woodland Fallow lands (trees) Fallow lands (bushes)
32 33 34	Plantations and woodlots	4	Planted forest	Forest land	5 6 7	Contiguous and dense plantation forest Open and sparse plantation forest Temporary unplanted plantation
8 9	Shrublands fynbos Low shrubland	5	Shrubland	Grassland	8 9 10 11 46	Low shrubland (other, fynbos, succulent karoo, nama karoo) Fallow lands and old fields (low shrub)
7	Grassland	6	Grassland	Grassland	12 13 44	Sparsely wooded grassland Natural grassland Fallow land (grass)
1 **2 37**	Water seasonal/permanent	7	Waterbodies	Wetland	14 15 16	Rivers Estuaries and lagoons
38	Mine water seasonal/permanent				17 18 19 20 21	Ocean and coastal Lakes Pans Artificial dams Artificial sewage ponds Artificial flooded mine pits
3	Wetlands	8	Wetlands	Wetlands	22 23 24 73	Herbaceous wetlands Mangrove wetlands Fallow land (wetlands)

SANLC Class	1990 and 2013/14	Category in 2020 class change map		IPPC category	SANLC 2018 Class	
No.	**Class**	**No.**	**Category**	**Category**	**No.**	**Class**
41	Bare non vegetated	9	Barren land	Other land	25 26 28 29 30 31 45	Rock surfaces Dry pans Sand dunes Coastal sand dunes Bare riverbed Other bare Fallow land bare
40	Erosion (donga)	10	Eroded land	Grassland	27	Eroded land
16 17 18 22	Cultivated orchards Cultivated pineapples	11	Permanent orchards	Cropland	32 35	Permanent orchards Permanent pineapples
19 20 21	Cultivated vines	12	Permanent vines	Cropland	33	Permanent vines
13 14 15 26 27	Commercial pivot crops Cane pivots Cane pivot - fallow	13	Annual pivot irrigated	Cropland	34 38	Sugarcane pivot irrigated Annual crops pivot irrigated
10 **11** **12** **28** **29** **30** **31**	Commercial non- pivot crops Cane crop Cane fallow Cane emerging crop Cane emerging fallow	14	Annual non-pivot crops	Cropland	36 37 39 40	Sugarcane non-pivot Sugarcane emerging non-pivot Non-pivot irrigated Rainfed dryland
23 24 25	Cultivated subsistence	15	Cultivated subsistence	Cropland	41	Subsistence annual crops
44-52, 57-72	Various types of urban classes (informal, residential, sport, township, village, built-up)	16	Built-up residential	Settlements	47–56, 61-64	Various types of residential (formal, informal, village, recreational, urban)

SANLC Class	1990 and 2013/14	Category in 2020 class change map		IPPC category	SANLC 2018 Class	
No.	**Class**	**No.**	**Category**	**Category**	**No.**	**Class**
53 54 55 56	Various urban small holdings	17	Built-up smallholdings	Settlements	57 58 59 60	Various smallholdings
42	Urban commercial	18	Built-up commercial	Settlements	65	Commercial
43	Urban industrial	19	Built-up industrial	Settlements	66	Industrial
35 36 39	Mine bare Mine semi-bare Mine buildings	20	Mines	 Settlements	 68 69 70 71 72	Mines Landfills

The AFOLU sector uses a mix of T1 and T2 methods as indicated in Table 2.15. The IPCC 2006 methodology is applied in this sector, with a few updated methodologies being taken from the IPCC 2019 Refinement and the 2013 Wetlands Supplement. Details of sources of activity data are provided in Table 5.15 of the 2020 NIR (DFFE, 2022).

Table 2.15: Summary of methods and emission factors for the AFOLU sector and assessment of the completeness of the AFOLU sector emissions

GHG Source and sink category		CO_2		CH_4		N_2O		NO_x	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
3A LIVESTOCK	***1 Enteric fermentation***										
	a.i. Dairy cattle			T2	CS			NA	NA	NA	NA
	a.ii. Other cattle			T2	CS			NA	NA	NA	NA
	b. Buffalo			NO	NO			NA	NA	NA	NA
	c. Sheep			T2	CS			NA	NA	NA	NA
	d. Goats			T2	CS			NA	NA	NA	NA
	e. Camels			NO	NO			NA	NA	NA	NA
	f. Horses			T1	DF			NA	NA	NA	NA
	g. Mules and asses			T1	DF			NA	NA	NA	NA
	h. Swine			T2	CS			NA	NA	NA	NA
	j. Other			NO	NO			NA	NA	NA	NA
	2 Manure management										
	a.i. Dairy cattle			T2	CS	T2	DF	NE	NA	NA	NE
	a.ii. Other cattle			T2	CS	T2	DF	NE	NA	NA	NE
	b. Buffalo			NO	NO	NO	NO	NE	NA	NA	NE
	c. Sheep			T2	CS	NO	NO	NE	NA	NA	NE
	d. Goats			T2	CS	NO	NO	NE	NA	NA	NE
	e. Camels			NO	NO	NO	NO	NE	NA	NA	NE
	f. Horses			T2	CS	NO	NO	NE	NA	NA	NE
	g. Mules and asses			T2	CS	NO	NO	NE	NA	NA	NE
	h. Swine			T2	CS	T2	DF	NE	NA	NA	NE
	i. Poultry			T2	CS	T2	DF	NE	NA	NA	NE
	j. Other			NO	NO	NO	NO	NE	NA	NA	NE
3B LAND	***1 Forest land***										
	a. Forest land remaining forest land	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: CS					NA	NA	NA	NA

GHG Source and sink category		CO_2		CH_4		N_2O		NO_x	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
	b. Land converted to forest land	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: TE	Soil: T2					NA	NA	NA	NA
	2 Cropland										
	a. Cropland remaining cropland	Biomass: T1	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: CS					NA	NA	NA	NA
	b. Land converted to cropland	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: T2					NA	NA	NA	NA
	3 Grassland										
	a. Grassland remaining grassland	Biomass: T1	Biomass: DF	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: CS					NA	NA	NA	NA
	b. Land converted to grassland	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: T2					NA	NA	NA	NA
	4 Wetland										
	a. Wetland remaining wetland	Biomass: T1 Litter: T1 Soils: T2	Biomass: CS Litter: CS Soil: CS	T1	CS	T1	CS	NA	NA	NA	NA
	b. Land converted to wetland	Biomass: T2 Litter: T1 Soil: T2	Biomass: CS Litter: CS Soil: T2	NE		NE		NA	NA	NA	NA
	5 Settlements										

GHG Source and sink category		CO_2		CH_4		N_2O		NO_x	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
	a. Settlements remaining settlements	Biomass: T1	Biomass: CS	NE		NE		NA	NA	NA	NA
		Litter: T1	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: CS					NA	NA	NA	NA
	b. Land converted to settlements	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NA
		DOM: T2	Litter: CS					NA	NA	NA	NA
		Soil: T2	Soil: T2					NA	NA	NA	NA
	6 Other land										
	a. Other land remaining other land	Biomass: T1	Biomass: CS	NE		NE		NA	NA	NA	NA
		Soil: T2	Soil: CS					NA	NA	NA	NO
	b. Land converted to other land	Biomass: T2	Biomass: CS	NE		NE		NA	NA	NA	NO
		Soil: T2	Soil: T2					NA	NA	NA	NO
3C AGGREGATED SOURCES AND NON-CO_2 EMISSIONS ON LAND	***1 Biomass burning***										
	Biomass burning in all lands	T2	DF, CS	T2	DF, CS	T2	DF, CS	T2	T2	T2	T2
	2 Liming										
	Liming	T1	DF					NA	NA	NA	NA
	3 Urea application										
	Urea application	T1	DF					NA	NA	NA	NA
	4 Direct emissions from managed soils										
	Synthetic fertilizers					T1	DF	NA	NA	NA	NA
	Animal waste added to soils					T1	DF	NA	NA	NA	NA
	Other organic fertilizers					T1	DF	NA	NA	NA	NA
	Urine and dung deposited by grazing livestock					T1	DF	NA	NA	NA	NA
	Crop residues					T1	DF	NA	NA	NA	NA
	5 Indirect emissions from managed soils										
	Atmospheric deposition					T1	DF	NA	NA	NA	NA

GHG Source and sink category		CO_2		CH_4		N_2O		NO_x	CO	NMVOC	SO_2
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor				
	Nitrogen leaching and runoff					T1	DF	NA	NA	NA	NA
	6 Indirect emissions from manure management										
	Volatilization					T1	DF	NA	NA	NA	NA
	Nitrogen leaching and runoff					T1	DF	NA	NA	NA	NA
	7 Rice cultivation										
	Rice cultivation	NO		NO		NO		NO	NO	NO	NO
3D OTHER	***1 Harvested wood products***										
	Harvested wood products	T2	DF					NA	NA	NA	NA
	2 Other										
	Other	NO		NO		NO		NO	NO	NO	NO

2.8.3.1.4. Recalculations

The AFOLU sector is under continual improvement which leads to recalculations. As in the previous 2017 Inventory, significant changes have been made to this sector. The improvements and their contribution to total change in the 2017 estimates are provided below (Figure 2.16).

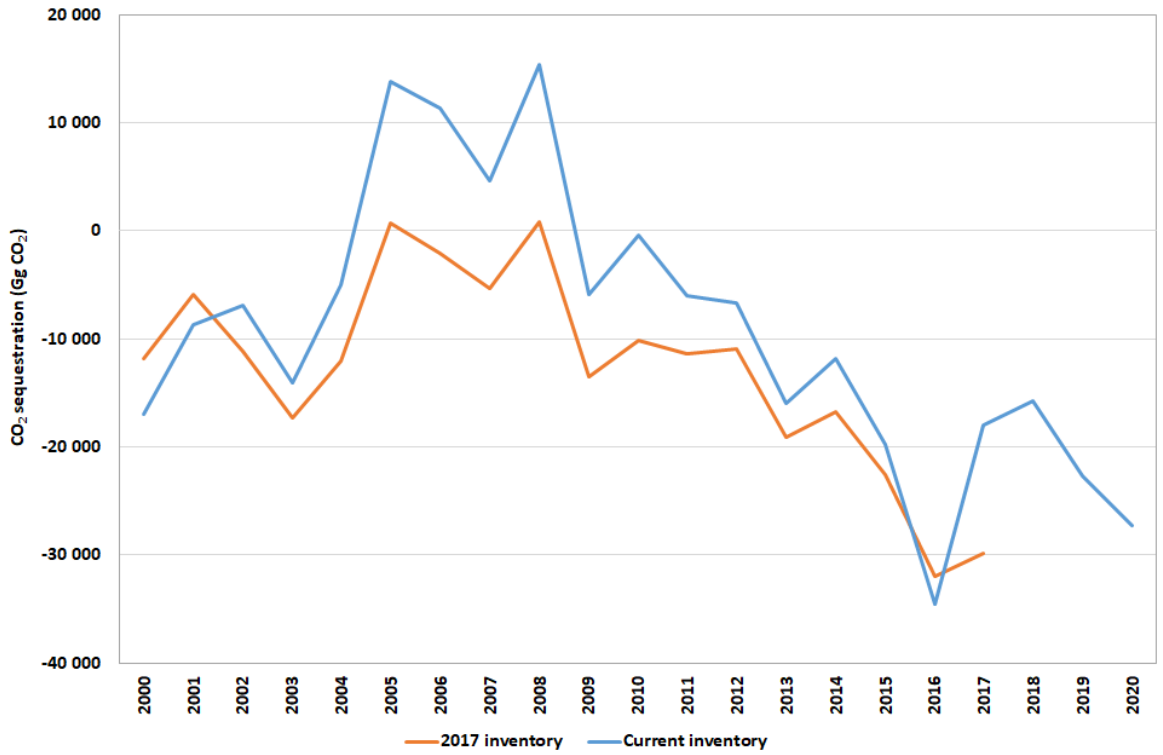


Figure 2.16: Recalculated Land category emissions in 2020 compared to 2017 submission data.

2.8.3.1.5. Planned improvements

There are several needs and improvements which are required to improve the estimates in the AFOLU sector. In terms of livestock there are six recommendations for improving estimates in the future:

a) Improve livestock population data: There have been several studies on the emission factors and now the population data is the most uncertain component. Setting up a Livestock Estimates Committee could assist with this, although this has been mentioned before and not much progress has been made in terms of the committee. Further engagement is required between DFFE and the Department of Agriculture. It could also be an activity to discuss with the Agricultural Research Council which has a livestock division.

b) National data set on manure management systems: This data seems to be highly variable depending on where the information comes from. In addition, data on the amount of manure being diverted to biogas needs to be included as this is a mitigation option and has been highlighted in previous inventory reviews. It is recommended to find a mechanism to track manure management practices or systems used in South Africa, as this could allow for incorporation of dynamics driven by changes in management regimes and thus improve the accuracy of manure related emissions.

c) A detailed study on the herd composition of the various livestock and the number of days each livestock sub-category is alive in a year would contribute to a reduction in uncertainty.

d) Collect and include in NIR background information of the livestock population original data sources (e.g., surveys, questionnaires etc.).

e) Use appropriate MCFs depending on the average temperature for each year of the time series. Stratify the estimates depending on the average temperature in different regions in South Africa.

f) Investigate if there are studies available about the burning of manure in South Africa.

In terms of the Land Use, Land-Use Change and Forestry (LULUCF) sector there are three very critical issues (a – c) and three important issues (d – g) which need attention, and which are a much higher priority than the agriculture improvement requirements. These are:

a) Obtain the 8-class annual land cover maps and use them to determine how much variability is likely due to natural seasonal changes. This can then be utilised to identify the actual areas of change more accurately.

b) Conduct further assessments of the land cover classifications and the impact of the Landsat versus the Sentinel data on the area changes to improve assumptions and incorporate the various land cover maps (2014, 2018, 2020).

c) Explore the QGIS Plugin which was developed as part of the NTCSA to determine what the data requirements are and the feasibility of updating the carbon density maps on a more frequent basis. If the carbon density maps can be updated more regularly, then the possibility of moving to the stock-difference method can be explored. Investigate the overlap between burnt area data and land use change data to determine if there are areas that are just burnt as opposed to being an actual landcover change (i.e., to ensure no double counting of losses).

d) Further investigate the soils maps and incorporate organic soils.

e) Explore a more dynamic model, to aid in producing the LULUCF inventory.

f) Conduct a detailed uncertainty analysis on all LULUCF data, particularly the spatial data. This was due to happen in this inventory but there was insufficient capacity and data to complete the uncertainty analysis.

2.8.4. Waste

Among the sectors that contribute to the increasing quantities of GHGs into the atmosphere is the Waste sector. This section highlights the GHG emissions into the atmosphere from managed landfills, open burning of waste and wastewater treatment systems in South Africa, estimated using the IPCC 2006 Guidelines and 2019 refinements for National Greenhouse Gas Inventories.

The waste sector in the national Inventory of South Africa comprises three sources:

(i) 4A Solid waste disposal.
(ii) 4C Open burning of waste.
(iii) 4D Wastewater treatment and discharge.
(iv) 4B Biological Treatment of Solid Waste, CH_4 and N_2O emission.

For completeness in this sector, emissions from incineration still need to be addressed. Emissions from use of solid waste as fuel for combustion in Energy Industries and Manufacturing Industries are reported in the Energy Sector.

2.8.4.1.1. Trends

In 2020 the Waste sector produced 23 046 Gg CO_2e of total net national emissions. The largest source category was Solid waste disposal which contributed 79.2% towards the total sector emissions (Table 2.16). This was followed by Wastewater treatment and discharge which contributed 19.3% while open burning of waste contributed 1.5%. Waste sector emissions have increased by 26.3% from the 18 241 Gg CO_2e in 2000. Emissions increased steadily between 2000 and 2120 (Figure 2.16).

Solid waste disposal increased its contribution to the total Waste sector emissions by 4.5% (from 74.6% to 79.2%) since 2000. Incineration and open burning of waste increased its contribution since 2000 by 0.5% (1.0% to 1.5%), while the contribution from Wastewater treatment and discharge declined from 24.4% to 19.3% by 2020.

Waste sector emissions have increased by 26.3% from the 18 241 Gg CO_2e in 2000. Emissions increased steadily between 2000 and 2020 (Figure 2.17; Table 2.). The Waste sectoral summary sheet in Appendix C of the NIR, 2020 (DFFE, 2022) provides further details.

Table 2.16: Summary of the estimated emissions from the Waste Sector in 2020

Categories	Emissions [Gg]							Total emissions
	CO_2	CH_4	N_2O	NOx	CO	NM VOCs	SO_2	(Gg CO_2e)
4. WASTE	**35.4**	**1 055.1**	**2.8**	**NE**	**NE**	**NE**	**NE**	**23 045.8**
4A Solid Waste Disposal		869.2		0.0	0.0	0.0	0.0	18 252.8
4A1 Managed Waste Disposal Sites				*NE*	*NE*	*NE*	*NE*	*NE*
4A2 Unmanaged Waste Disposal Sites				*NE*	*NE*	*NE*	*NE*	*NE*
4A3 Uncategorised Waste Disposal Sites				*NE*	*NE*	*NE*	*NE*	*NE*
4B Biological Treatment of Solid Waste		0.0	0.0	NE	NE	NE	NE	0.0
4C Incineration and Open Burning of Waste	35.4	10.6	0.2	0.0	0.0	0.0	0.0	334.9
4C1 Waste Incineration	*NE*	*NE*	*NE*	*NE*	*NE*	*NE*	*NE*	*NE*
4C2 Open Burning of Waste	*35.4*	*10.6*	*0.2*	*NE*	*NE*	*NE*	*NE*	*334.9*
4D Wastewater Treatment and Discharge	0.00	175.3	2.5	0.0	0.0	0.0	0.0	4 458.1
4D1 Domestic Wastewater Treatment and Discharge		*132.5*	*2.5*	*NE*	*NE*	*NE*	*NE*	*3 560.8*
4D2 Industrial Wastewater Treatment and Discharge		*42.7*		*NE*	*NE*	*NE*	*NE*	*897.3*
4E Other (please specify)				0.0	0.0	0.0	0.0	0.0

Numbers may not sum exactly due to rounding off.

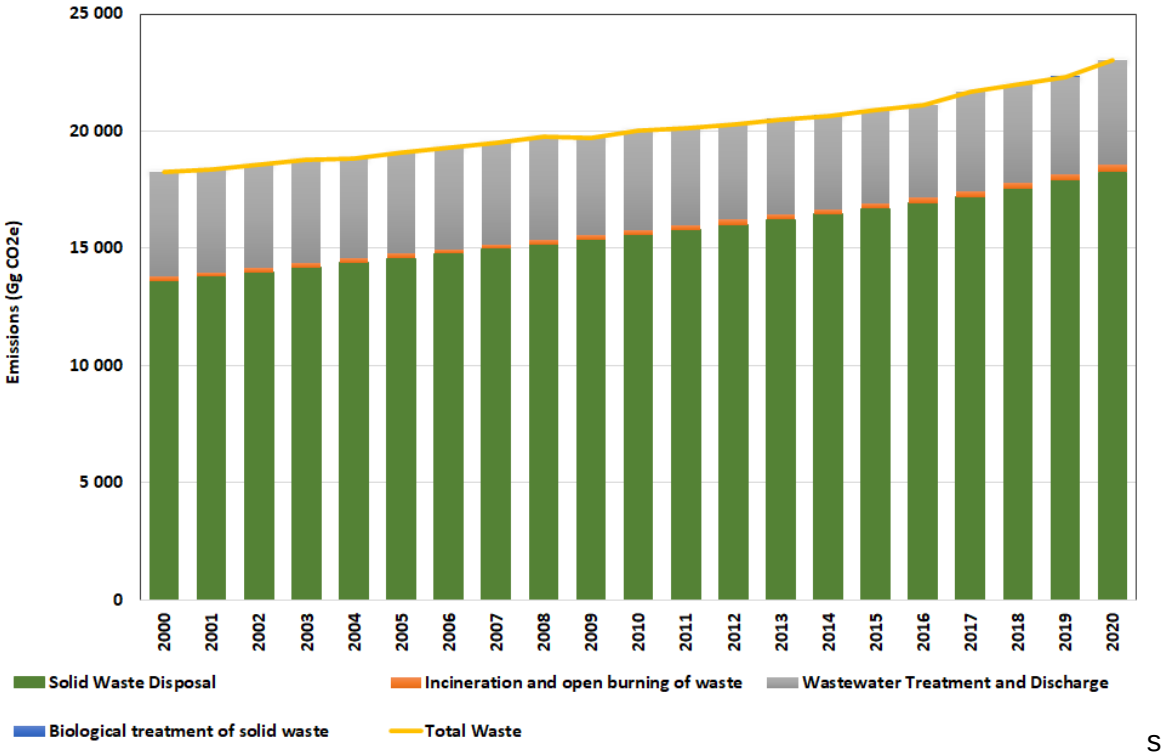


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Figure 2.17: Trend in emissions from Waste sector, 2000 – 2020

2.8.4.1.2. Methods and data

The emissions for the Waste sector were derived by either using available data or estimates based on accessible surrogate data sourced from the scientific literature.

Table 2.13 shows the methods and emission factors applied in this sector. For the waste sector, among the chief limitations of quantifying the GHG emissions from different waste streams was the lack of a periodically updated national inventory data on the quantities of organic waste deposited in well managed landfills, the annual recovery of methane from landfills, quantities generated from anaerobically decomposed organic matter from wastewater treated and per capita annual protein consumption in South Africa.

Table 2.17: Summary of methods and emission factors for the Waste sector and an assessment of the completeness of the Waste sector emissions

GHG Source and sink category		CO_2		CH_4		N_2O		Details
		Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	
A	Solid waste disposal			T1	DF			Tier 1 FOD model was used.
B	Biological treatment of solid waste			T1	DF	T1	DF	2006 IPCC GL
C	Incineration and open burning of waste	T1	DF	T1	DF	T1	DF	2006 IPCC GL
D	Waste water treatment and discharge			T1	DF, CS	T1	DF	2006 IPCC GL

2.8.4.1.3. Recalculations

Recalculations were performed for the category Solid waste disposal for all years between 2000 to the latest inventory year (2020) due to the following changes:

- Waste generation rate per person was adjusted from 578 kg/cap/yr in previous submissions to 398 kg/cap/yr in the current submission and this is consistent with the waste generation rates per capita provided in the 2019 refinement to the 2006 IPCC guidelines. This is used from the base year of 2000 until 2020.
- Waste generation rate per GDP value, for purposes of estimating the amount of industrial waste generated was adjusted from 8Gg waste/GDP/yr in previous submissions to 0.4 waste/GDP/yr in the current submission (calculated based on data contained in the 2018 state of waste report). This is used from the base year of 2000 until 2020.

- Amount sent to SWDS adjusted to 76% for MSW and 85% for Industrial waste to reflect changes in penetration of recycling and the evolution of other forms of waste management and/or treatment.

2.8.4.1.4. Planned improvements

The most challenging task in estimating GHG emissions in South Africa is the lack of specific activity and emissions factor data. As a result, estimations of GHG emissions from both solid waste and wastewater sources were largely computed using default values suggested in IPCC 2006 Guidelines and, consequently, margins of error were large.

No specific improvements are planned; however South Africa has identified the following areas to be considered in the improvement plan:

(i) Obtain data on the quantities of waste disposed of into managed and unmanaged landfills including its composition.
(ii) Improve the classification of landfill sites.
(iii) Improve the reporting of economic data (e.g., annual growth) to include different population groups. The assumption that GDP growth is evenly distributed (using a computed mean) across all the population groups is highly misleading and leads to exacerbated margins of error.
(iv) Obtain information on population distribution trends between rural and urban settlements as a function of income.
(v) Conduct a study to trace waste streams and obtain more information on the bucket system which is still widely used in South Africa.
(vi) Collect data on CH_4 recovery at SWDS based on metering data.

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3. Mitigation Actions and Their Effects

3.1. Introduction

South Africa submitted an updated first Nationally Determined Contribution (NDC) to the United Framework Convention on Climate Change (UNFCCC) in 2021 (RSA, 2021). The finalised NDC update target range could not be reported in the BUR-4 which had been submitted earlier. The mitigation targets consider the country's national circumstances, capabilities, and development priorities. The coverage and scope of the near- and medium-term mitigation targets in the updated NDC are on the same basis as the previous National Inventory Report from 2000 to 2017 (DFFE, 2021a). The Low Emissions Development Strategy (DEA, 2018a) provides a long-term perspective to reaching net zero CO_2 emissions by 2050.

3.2. Mitigation Policy Context and Implementation Framework

Following an extensive public consultation process conducted by DFFE and the Presidential Climate Commission (PCC), South Africa's NDC commitments for the period between 2020 and 2030 were approved by parliament in 2021. This approval solidified South Africa's commitment to achieving net zero emissions by 2050 in the long term. The NDC outlines the country's medium-term objectives, stating that South Africa's emissions from 2021 to 2030 will be within the range of 398 to 420 Million tonnes of carbon dioxide equivalent emissions (Mt CO_2e), as specified in the national policy. These targets are divided into two implementation periods: 2021-2025 and 2026-2030. During the 2021-2025 period, South Africa's annual GHG emissions will range from 398 to 510 Mt CO_2e, while for the 2026-2030 period, the annual emissions will range from 350 to 420 Mt CO_2e (RSA, 2021).

3.2.1. Driving Policies for Climate Change

3.2.1.1. National Development Plan, 2030

The overall objective of the NDP Vision 2030 is to eliminate poverty and reduce inequality by 2030 (NCP, 2011). Chapter 5 of the NDP aims to ensure that by 2030 South Africa is an environmentally sustainable society, with an expanded low-carbon economy and reduced emissions while at the same time reducing poverty, unemployment and social inequities. This chapter provides various mitigation objectives and outlines actions for achieving these goals by 2030, such as:

- Achieving the peak, plateau and decline GHG emission trajectory.

- Entrenching an economy-wide carbon price.
- Developing zero-emission building standards.
- Reducing the total volume of waste disposal to landfill each year.

To reflect on past development progress and lessons learnt while also looking forwards to a net zero carbon future by 2050, therein which socio-economic inequities are addressed, the National Planning Commission (NPC) completed a review of the NDP in 2022 (NPC, 2022). This has led to the development of a framework to translating the NDP's top goals into short to medium-term (3-5 years) actions and in this way, the framework can inform short to medium-term strategic plans such as medium-term strategic frameworks (MTSF) and Annual Performance Plans (APPs).

3.2.1.2. National Climate Change Response Policy

The National Climate Change Response Policy (NCCRP) was approved by Cabinet in October 2011 (DEA, 2011a). This set out an overall climate change policy framework for South Africa. The objectives and goals of the NCCRP were informed by other national and international commitments, including the South African Constitution (Act No. 108 of 1996), the Bill of Rights, the National Environmental Management Act (Act No. 107 of 1998), the Millennium Declaration (UN Millennium Summit, 2000) and commitments made under the UNFCCC. The NCCRP presents the government's vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society. The objectives of the policy are to (a) effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity and (b) make a fair contribution to the global effort to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner (DEA, 2011a).

3.2.1.3. Climate Change Bill

In June 2018, South Africa released a draft National Climate Change Bill (DEA, 2018b) for public consultation. The bill was tabled in Parliament in February 2022 (DFFE, 2022a). The Bill is going through legislative processes to become the Climate Change Act. This Bill, once approved by Cabinet, will provide a regulatory framework for managing climate change impacts by enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change. In doing so, it also aims to make a fair contribution to the global effort to stabilise GHG concentrations in the atmosphere. The Climate Change Bill addresses issues related to institutional and coordination arrangements across the three spheres of government, namely national, provincial, and local. In terms of the mitigation system, the Bill makes provision for the development and review of the national GHG emission trajectory, the setting of sectoral emission targets (SET) to sectors and sub-sectors and allocating carbon budgets to companies. SETs are qualitative or quantitative goals informed by sectoral policies and measures that may lead to greenhouse gas emission reductions for the sector or sub-sector over a defined period.

Carbon budgets will be developed to specifically cover industry and the threshold will be published by DFFE.

The Minister of DFFE is required to publish a list of GHG emitting activities specified in the Climate Change Bill 2022 regulations. This list applies to both existing and new GHG emitting activities. The notice must establish specific emission thresholds in CO_2e for identifying individuals that are subject to a carbon budget under the Climate Change Bill 2022 regulations. Those individuals are required to submit GHG mitigation plans to the Minister.

Additionally, the notice excludes activities that emit GHGs below the established emission thresholds. Furthermore, the Minister also determines the effective date of this notice. The emission thresholds are expressed in CO_2e, applicable at the company level based on operational control, and are influenced by the feasibility of mitigation technology and the practicality of policy implementation.

3.2.2. Tracking Mitigation Impacts

3.2.2.1. National emissions trajectory

The national GHG emissions trajectory as described in Section 21 of the Climate Change Bill of 2022 (DFFE, 2022a) represents the “total amount of greenhouse gas emissions projected to be emitted during a specified period” in the country. To implement the trajectory, the minister of DFFE must consult with the cabinet and then publish a notice in the government gazette. Until this is done, an interim trajectory is specified in Schedule 3 of the Climate Change Bill. Regulation and communication of the national GHG emissions trajectory is important since the SETs must be aligned with it.

3.2.2.2. Low-carbon and climate-resilient economy and society

The country aims for a just transition to a low-carbon and climate-resilient economy and society, as stipulated in the Climate Change Bill of 2022 but first referenced in the NCCRP. Under article 4.19 of the Paris Agreement, South Africa developed a Low Emissions Development Strategy which aims moving towards a goal of net zero carbon emissions by 2050. It is mentioned in the updated NDC and is the country’s most ambitious long-term desire for the just transition. The PCC was established in 2020 to oversee progress in research, technology and development towards this just transition (PCC, 2022). The establishment of the PCC serves to advise on the country’s climate change response including the reduction of emissions of greenhouse gases and adapting to the effects of climate change as provided for in the Climate Change Bill. Robust stakeholder engagement is at the core of the PCC structure as it is composed of a multi-stakeholder body drawn from the public and private sectors. The PCC published the Just Transition Framework in 2022 which provides recommendations about the principles to guide the transition and policies and governance arrangements to give effect to the transition.

3.3. Overarching Mitigation Policies To Support Implementation

3.3.1. National GHG Emission Reporting Regulations and Pollution Prevention Plans

Many companies in South Africa had been reporting their GHG emissions voluntarily for a number of years, primarily through the CDP (formerly the Carbon Disclosure Project), while at the same time national government has been reporting South Africa's emissions as part of its National Communications to the United Nations Framework Convention on Climate Change (UNFCCC). The South African Government, through the National Environmental Management: Air Quality Act (Act No. 39 of 2004): National GHG Emission Reporting Regulations (NGERs) (DEA, 2016), introduced mandatory reporting which implies that some emitters that are meeting set capacity, production or usage thresholds are required to report their emissions to the government. The purpose of the NGERs was to introduce a single national reporting system for the transparent reporting of GHG emissions, which will be used (a) to update and maintain an inventory; (b) for the Republic of South Africa to meet its reporting obligations under the UNFCCC and instrument treaties to which it is bound; and (c) to inform the formulation and implementation of legislation and policy. The NGERs were amended in 2020 (DEFF, 2020). Companies will submit emissions data to the South African GHG Emissions Reporting System (SAGERS) (discussed in chapter 6, section 6.3.3.1) which is a component of the National Atmospheric Emissions Inventory System (NAEIS). In accordance with regulation 7(1) of the NGERs the initial reporting cycle commenced on 31 March of 2018 requiring data providers to register and submit activity and GHG emissions data to the competent authority (DFFE). The SAGERS helps to facilitate the process of enabling Industry to meet its GHG reporting requirements in a web-based secure environment and facilitates the data collection process for energy-related activities and IPPU.

This inventory has started to incorporate information from the SAGERS system, however further data will be included in the next inventory. The inclusion of this data has led to some time-series inconsistencies, but these will be addressed as further data is collected.

3.3.1.1. Carbon Tax Act

The Carbon Tax Act No 15 of 2019 (RSA, 2019a) has been implemented since the 1 June 2019. In the Taxation Laws Amendment Act: 2022, the National Treasury extended the timeline for carbon tax to run from the 1 January 2023 to the 31 December 2025 (RSA, 2023). From the 1 January 2023, the carbon tax rate increased from R144 to R159 per ton CO_2e. The inclusion of the automatic rate adjustments in the Carbon Tax Act meant that the annual adjustments of the carbon tax rate have increased by inflation plus 2% until the end of 2022 and inflationary adjustments from the 2023 tax period onwards.

There have been further amendments to the carbon tax regulations since 2020 included in the Taxation Laws Amendment Act, 2021, Act No. 20 of 2021 (RSA, 2022) and the Taxation Laws Amendment Act, 2022, Act No. 20 of 2022.

Changes described in terms of the Taxation Laws Amendment Act, 2021, Act No. 20 of 2021 included:

- Entities that bear the responsibility for the carbon tax, engage in electricity generation activities, and procure additional primary renewable energy either through the Renewable Energy Independent Power Producer Procurement (REIPPPP) program or from private independent power producers (IPPs), can qualify for a tax deduction on their renewable energy acquisitions if they have an existing power purchase agreement (known as the renewable energy premium).
- The amendments to the carbon tax regulations tackle the issue of carbon sequestration accrual by explicitly stating that deductions for carbon sequestration will only apply to forestry plantations and harvested wood products used in forestry, pulp, paper and print processes. Additionally, deductions will be allowed for GHG sequestration in geological or carbon reservoirs related to fuel combustion activities, as well as sequestration in forestry plantations and harvested wood products specifically for forestry, pulp, paper and print operations.
- Schedule 2 of the Carbon Tax Act has been amended to reflect the changes set out in the amended National Greenhouse Gas Emission Reporting Regulations. This includes changes to the thresholds for certain activities and the inclusion of a new activity (manufacture of ceramic products by firing in particular, roofing tiles, tiles, stoneware or porcelain) which has been added to the emissions reporting regulations.

Changes described in terms of the Taxation Laws Amendment Act, 2022, Act No. 20 of 2022 included:

- Setting out changes to the carbon tax rate as R159 for tax periods from 1 January 2023 until 31 December 2023; R190 for tax periods from 1 January 2024 until 31 December 2024 and R236 for tax periods from 1 January 2025 until 31 December 2025.
- Taking into account the impact of exchange rate movements on carbon tax pricing.
- A three-year extension of the section 12L energy efficiency savings tax incentive and renewable energy premium so that it is aligned to the revised carbon tax period of 1 January 2023 to 31 December 2025.

3.3.1.2. Carbon Offset Regulations

Carbon offsetting is a regulated activity under section 19(c) of the Carbon Tax Act, 2019 (Act No.15 of 2019) that allows registered tax paying organisations to compensate for their GHG emissions by supporting projects that reduce emissions elsewhere in the country. The regulations explain who can participate in these projects and what they need to do to be eligible. The regulations also outline how taxpayers can claim the carbon offset allowance, which is a benefit or credit they can receive for their participation in offset projects. Additionally, the regulations cover the management and organisation of

the carbon offset system to ensure it runs smoothly and fairly. The carbon offset tax-free allowance assists tax paying organisations to cost-effectively reduce their emissions and carbon tax liability by up to 10 % of their total GHG emissions by investing in GHG emissions mitigation projects.

The National Treasury gazetted amendments to the Carbon Offsets Regulations in terms of Section 19 (c) of the Carbon Tax Act on 8 July 2021 (National Treasury, 2021a). The gazetting of the Amendments to the Carbon Offsets Regulations followed publication of the draft amendments to the Carbon Offsets Regulations on 31 March 2021 for public comments.

The Department of Mineral Resources and Energy (DMRE) is currently working on releasing a preliminary plan for local standards that can be used to determine whether a project qualifies as a carbon offset project. This plan was developed with the support of the World Bank's Partnership for Market Readiness project and will be made available for public input and feedback (DMRE, 2022). The department will also explore the possibility of including offset projects from other African countries as part of the second phase of the carbon tax review and design process.

The National Treasury has proposed that the utilisation period in the Carbon Offsets Regulations should be changed to align with the first phase of the carbon tax from 1 January 2023 to 31 December 2025, which will take effect from 1 January 2023 (National Treasury, 2023a). Furthermore, the National Treasury plans to evaluate stakeholder feedback in 2023 regarding the feasibility of establishing a domestic marketplace for trading tax credits generated by the carbon tax. The consultation will specifically address various essential components needed for smooth trading, such as determining the financial asset status of carbon credits, establishing trading and post-trade market structures, issuing licenses for private carbon credit funds and implementing carbon credit certification.

3.3.1.3. Carbon Sequestration in the Carbon Tax Act

In terms of the Carbon Tax Act, Section 4(1) and 4(2)(a) defines the carbon tax base that is, fuel combustion, fugitive and industrial process emissions that are determined using the Tier 3 company-based emissions methodologies or the Tier 1 and 2 emission factors as per Schedule 1 of the Carbon Tax Act, respectively.

The Carbon Tax Act allows taxpayers to deduct sequestered emissions as verified and certified by DFFE from their energy combustion related greenhouse gas emissions for a tax period as determined in Section 4 of the Act. DFFE gazetted the regulations which set out methodological guidelines for quantifying carbon sequestration in the forestry sector on 28 January 2022.

Sequestrated emissions cover carbon capture and storage in geological reservoirs and biological sequestration including forests. Government has clarified that for fuel combustion activities where carbon capture and storage (CCS) technologies are used, the net GHG emissions (already excluding captured and stored emissions) should be reported to the DFFE. However, for forestry plantations and

wood products, the DFFE provides for emissions sequestered directly by forests and harvested wood products to be subtracted from gross fuel combustion emissions subject to approval by the DFFE. As such, for fuel combustion emissions in the forestry, paper and pulp sectors, the total emissions declared to the SARS would not include reporting the upfront deduction for sequestration. It would be possible for companies in these sectors to accrue double benefits for the same sequestered emissions. The changes made to the carbon tax regulations address the problem of accrual by specifying that only sequestration of GHGs in forestry plantations and harvested wood products for pulp, paper and print would be deductible; and sequestration of GHGs in geological or carbon reservoirs for fuel combustion activities; and sequestration in forestry plantations and harvested wood products for the pulp, paper and print activity would be deductible (National Treasury, 2023).

3.3.1.4. Trade Exposure Allowance Regulations

The maximum trade exposure allowance available to entities that are trade exposed and sensitive to international competitiveness has been increased from 30% to 50% from 1 January 2023.

3.3.1.5. GHG Emission Intensity Benchmark Regulations

The Regulations for the Greenhouse Gas Emissions Intensity Benchmarks were gazetted in 2020 under section19 (a) of the Carbon Tax Act, 2019 (Act No.15 of 2019) for purposes of section 11 for the Performance Allowance (National Treasury, 2020). The performance allowance aims to incentivise companies to decrease the carbon intensity of their production processes compared to their industry counterparts. It also aims to enhance the competitiveness of local products. The gazetted Regulations for the GHG Emissions intensity benchmarks sets out the emissions intensity benchmarks for sectors and subsectors that submitted benchmark proposals during the period 2016 to 2020. The date of commencement of the regulation is 1 June 2019.

3.3.1.6. Renewable Energy Premium

Section 6(2)(c) of the Carbon Tax Act outlines a provision allowing electricity generators who are subject to carbon tax to reduce their carbon tax liability by accounting for the expenses associated with acquiring additional renewable energy. Initially, this deduction was limited to Eskom and its renewable energy purchases within the REIPPPP framework. However, it has now been broadened to encompass other electricity generators, making renewable energy purchases through either the REIPPPP or private transactions.

To address this expansion, a proposal is being made to restrict eligibility for the tax deduction. Eligibility would be limited to entities that meet the following criteria: they are liable for carbon tax, they engage in electricity generation activities, and they directly procure primary renewable energy, either through the REIPPPP or from private independent power producers (IPPs). This proposed tax deduction for renewable energy purchases would only apply to those made within the REIPPPP or through private transactions that involve a power purchase agreement (PPA). (National Treasury, 2022a).

For purposes of Section 6(2)(c) of the Carbon Tax Act, a power purchase agreement (PPA) is a long-term electricity supply agreement between a renewable power producer and electricity consumer (buyer or off taker). PPAs can exist for onsite renewable electricity purchases where there is direct supply of electricity to the buyer and offsite electricity purchases where the producer supplies electricity to the buyer through the national grid (National Treasury, 2022a).

3.3.1.7. Green Finance Taxonomy

The Taxonomy Working Group, under the leadership of the National Treasury, has spearheaded the country's Sustainable Finance Initiative. The Sustainable Finance Initiative emphasises the critical need to facilitate the flow of sustainable finance, directing it towards the construction of a South African economy that is both more resilient to climate change and characterised by lower carbon emissions. The aims of this initiative and implementation actions are described in a technical paper published in 2021 (National Treasury, 2021b). This technical paper presents the findings and recommendations derived from a research process aimed at defining minimum practices and standards concerning climate change as well as emerging environmental and social risks.

To facilitate the execution of the recommendations outlined in the technical paper, a Steering Committee and Working Groups were established. These groups encompass a Taxonomy Working Group led by the National Treasury, which includes representatives from various organisations such as South Africa's Department of Forestry, Fisheries and the Environment (DFFE), Department of Monitoring and Evaluation (DPME), the Financial Sector Conduct Authority (FSCA), the Prudential Authority (PA), the Johannesburg Stock Exchange (JSE), Banking Association South Africa (BASA), Batseta (Council of Retirement Funds for South Africa), the Association for Savings and Investment South Africa (ASISA), as well as representatives from banks and retirement funds.

An integral component of the Sustainable Finance Initiative is the development of South Africa's Green Finance Taxonomy project. One of the recommendations of the technical paper is to “develop or adopt a taxonomy for green, social and sustainable finance initiatives, consistent with international developments, to build credibility, foster investment and enable effective monitoring and disclosure of performance” (National Treasury, 2021b). A green finance taxonomy (GFT) refers to a categorisation framework or inventory that establishes a baseline of assets, projects, activities, and sectors meeting the criteria for being labelled as "green" in accordance with global best practices and domestic preferences. It serves as a tool for investors, issuers, and other participants in the financial sector to effectively track, monitor and showcase the sustainability credentials of their green initiatives with greater assurance and efficiency.

The Taxonomy Working Group's initial phase of work receives support from the International Finance Corporation (IFC), a member of the World Bank Group. The IFC's Green Bond Market Development program, in collaboration with SECO (Swiss State Secretariat for Economic Affairs) and Sida (Swedish

International Development Cooperation Agency), provides assistance for this phase. Additionally, the IFC-facilitated Sustainable Banking Network (SBN) extends global support to the initiative.

For the first phase of establishing a national sustainable finance taxonomy, the Taxonomy Working Group has enlisted the services of the National Business Initiative and the Carbon Trust. These organisations are responsible for conducting research, stakeholder consultations and drafting. Their objectives include establishing governance principles and a structure for the taxonomy's development and maintenance, as well as creating an initial draft taxonomy for green and climate finance activities, leveraging existing international frameworks. The document at hand presents the South African Green Finance Taxonomy's first edition (GFT 1st Edition) and is supplemented with additional information on the ongoing development of the governance structure.

The Taxonomy aims to deliver several advantages. These include:

- Assisting the financial sector in making informed decisions by providing clarity and certainty when selecting green investments aligned with international best practices, as well as South Africa's national policies and priorities.
- Mitigating financial sector risks through improved management of environmental and social performance.
- Reducing the expenses associated with labelling and issuing green financial instruments.
- Unlocking substantial investment prospects for South Africa across various green and climate-friendly assets.
- Supporting regulatory and supervisory oversight of the financial sector.
- Providing a foundation for regulators to align with or reference green financial products.

South Africa and its trade partners and organisations around the world are working together to create a system that categorises sustainable investments. This system will be used both domestically and internationally. It considers things like how ambitious the goals are, how achievable they are and how rigorous the standards should be. It also looks at the scope, speed and methods of aligning and harmonising these standards. While there are issues, stakeholders are gaining a better understanding of the challenges. This understanding is leading to a stronger commitment and support for building an economy that is fair, can withstand challenges and is environmentally friendly, with reduced carbon emissions (National Treasury, 2022b).

3.4. Sectoral Mitigation Policies and Measures

3.4.1. Energy

The list of domestic actions in the energy sector are presented in Table 3.1 (Tables 3.1a to Table 3.1k). The 1998 White Paper on Energy Policy, alongside the 2003 White Paper on Renewable Energy, sets

out government's overarching position on the supply and consumption of energy. Other applicable policies include the National Development Plan, the Integrated Energy Plan, Integrated Resource Plans (IRP), the Electricity Pricing Policy, the National Environmental Management: Air Quality Act (2004) and the National Energy Act (2008).

Recent developments in the sector include:

- The IRP 2019 is under review by DMRE which aims to update the IRP in 2023/24.
- The Renewable Energy Sector Master Plan Report is under review and consideration by the Energy Steering Committee.
- The Exploration Strategy for the Mining Industry of South Africa and its Implementation Plan was published in April 2022. These policy documents seek to attract investment through a reinvigorated mining exploration strategy encouraging mineral exploration, clean technology, processing and mining supply and services sectors.

The IRP 2019 remains under implementation until a new plan is published by the DMRE. In 2023/24 ESKOM will procure an additional 10 000MW of renewable energy electricity capacity through the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

Table 3.1: List of domestic actions in the energy sector

Table 3.1a: *12L Tax Incentive Program*

NAME OF ACTION	12L TAX INCENTIVE PROGRAM									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ from 2010 TILL 2020)[1]**	**CO-BENEFITS**
To incentivise companies to implement energy-saving measures and technologies, thereby contributing to a more sustainable and environmentally friendly economy.	Through the 12L tax incentive program, qualifying businesses can claim a tax deduction based on their verified energy savings achieved through energy efficiency improvements. The program is administered by the South African National Energy Development Institute (SANEDI) and aims to stimulate investment in energy efficiency projects across various sectors.	Public tax incentive	South African National Energy Development Institute (SANEDI)	CO_2 Energy sector	The 12L tax incentive does not set any quantitative goals, however it is hoped that the number of applicants can be doubled during the extension period from 2020 to 2022. The 12L tax incentive program can contribute to the targets set out in the Post-2015 National Energy Efficiency Strategy (NEES) industry and mining targets: (a) 16% reduction in the weighted mean specific consumption of manufacturing by 2030 compared to 2015 baseline; (b) 40 PJ cumulative	Ongoing - 2013- 2022 The incentive was effected from 1st of November 2013 and was claimable until the 1st of January 2020. In 2015, amendments were made, and the minister announced an increase to the incentive from 45c/kWh to 95c/ kWh. Further to this change, initially only waste heat recovery was claimable as savings in co-generation, but now co-generation in terms of combined heat and power are also claimable.	kWh savings; Reduction of CO_2 through the efficient use of energy	No calculations were conducted on the primary data received from SANEDI. The $kgCO_2e$ saved by each project was provided directly by SANEDI. These values consider the various energy carriers present in the projects. The SANEDI emission data sets are based on information provided by claimants which is assured by an accredited entity. The process is initiated by the compilation and submission of a baseline benchmarking model and report to SANEDI for approval, which outlines the business-as-usual scenario in which the energy saving measure would not have been implemented.	2014: 5.78 2015: 1.04 2016: 4.18 2017: 4.61 2018: 2.23 2019:6.97 2020: 1.41 Total savings: 26.22 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

[1] Corrections made to the quantified GHG emission reductions as mentioned in section 6.3.2 of this report

NAME OF ACTION	12L TAX INCENTIVE PROGRAM									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ from 2010 TILL 2020)[1]	CO-BENEFITS
					annual savings from energy efficient interventions in mining. (DMRE, 2016).	The tax incentive was extended until 31 December 2022.		Once the baseline is approved, the energy performance assessment report must be compiled which demonstrates the energy savings for the assessment year. The baseline and performance assessment must be conducted by a monitoring and verification professional certified by the South African National Accreditation System. The energy savings must then be certified by SANEDI through issuing of a savings certificate. Assumption: An average project lifetime of 5 years is assumed for the savings.		

Table 3.1a: Energy Efficiency Standards and Appliance Labelling project

NAME OF ACTION	ENERGY EFFICIENCY STANDARDS AND APPLIANCE LABELLING PROJECT									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
To ensure that consumers are informed about the relative energy efficiency of an appliance before purchasing.	The information provided on the label informs users of the energy efficiency rating of each appliance, the manufacturer and product model. For some appliances, the label will also have non-energy data such as water consumption per cycle and appliance noise level. (DoE, 2017). Mandatory labelling of household appliances is in place (DTI, 2014) and minimum energy performance standards (MEPS) have been introduced or are proposed for most of the major categories of appliances.	Public sector procurement programme; Policy & Standards	South African National Energy Development Institute (SANEDI)	CO_2 Energy sector	This will contribute to the targets set out in the post- 2015 NEES, particularly the residential target of a 33% reduction in the average specific energy consumption of new household appliances bought by 2030 compared to the 2015 baseline. (2016, DMRE)	Ongoing - 2015 - 2030 The Program has been in place for large residential appliances since 2015. Minimum Energy Performance Standards (MEPS); appliance standards and labelling regulations and energy efficiency labelling requirements for appliances have been implemented. The study on residential energy consumption (SANEDI; 2021) indicates that the program likely achieved an overall reduction of electricity use of around 3.5% in 2020. The savings occurred in fridges, which have a high ownership share in all household groups and are a relatively large energy consumer. Electricity reduction savings of 10% could be achieved by 2030.	kWh savings; Reduction of CO_2 through the efficient use of energy	No calculations were undertaken as part of this report, as only high-level, secondary data values (in $MtCO_2e$) were supplied for the period 2011- 2030. The data relates to the cumulative energy savings from technological advancements related to electrical appliances. The emission savings are calculated based on a time-dependent grid emission factor. This is published by Eskom in their annual reports.	Between 7.6 $MtCO_2e$ (low autonomous energy efficiency improvement scenario) and 22.7 $MtCO_2e$ (high autonomous energy efficiency scenario). Note that 'autonomous energy efficiency refers to the improvement of efficiency regardless of a price change of energy.	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1b: Eskom Integrated Demand Management (IDM) Programme

NAME OF ACTION	Eskom Integrated Demand Management (IDM) Programme									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
Provides for the efficient use of energy resources and related incentives / rebates.	Promotes energy efficiency and load management. The programme has promoted the implementation of energy efficiency technologies by providing various rebates for energy efficiency; management and conservation measures, as well as solar water heater installations.	Public sector subsidy programme	Eskom IDM team	CO_2 Energy sector	975 MW savings, with the residential lighting target set at 455MW (Eskom, 2016)	Ended - 2005 to 2018 The IDM programme was placed on hold in 2014 due to Eskom's prevailing financial constraints. The IDM programme was revived in February 2015 to pursue industrial energy efficiency and residential lighting projects. As part of the residential energy efficiency projects rolled out, a total of 70 million compact fluorescent lamps have been distributed (Eskom, 2018).	kWh savings; Reduction of CO_2 through the efficient use of energy	Emission savings ($MtCO_2e$) = activity data (GWh) x grid emission factor (tCO_2e/GWh). The emission savings were calculated by multiplying the activity data (primary data set provided by Eskom IDM Department) by the relevant grid emission factor. The grid emission factor is published by Eskom in its annual reports. Assumption: It was assumed that the measures implemented until 2018; still continue to be in use in 2020	2010: 0.53 2011: 1.33 2012:1.35 2013: 1.83 2014: 1.36 2015: 0.82 2016: 0.54 2017: 0.54 2018: 0.13 2019: 0.13 2020: 0.13 Total Cumulative Savings: 8.69 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1c: Municipal Energy Efficiency and Demand Side Management programme

NAME OF ACTION	Municipal Energy Efficiency and Demand side Management programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Provides for the efficient use of energy resources and related incentives / rebates.	Disbursement of grant funding to municipalities to implement energy efficient retrofits within the municipal infrastructure.	Public sector grant funding programme.	DMRE	CO_2 Energy sector	Energy Conservation Target: energy efficiency potential is between 20-30% across many segments. This action will contribute to the Post-2015 NEES targets (2016 DMRE) for municipalities: 20% reduction in the energy intensity in the provision of electricity-intensive municipal services.	Ongoing- Implementation period was 2011- 2018 but assumed that reductions continue for 5 years thereafter. Since its start significant funding (over R1 billion) has been dedicated towards this programme and 54 municipalities have participated.	kWh savings; Reduction of CO_2 through the efficient use of energy	Emission savings ($MtCO_2e$) = activity data (GWh) x grid emission factor (tCO_2e/GWh). The emission savings were calculated by multiplying the activity data (secondary data set provided by Department of Environment, Forestry and Fishers) by the relevant grid emission factor. The Department of Forestry, Fisheries and the Environment provided high-level data (in GWh) for the period 2011- 2015. Values were also provided for the period 2015- 2018, however these were classified as “expected savings”. Assumption: It was assumed that the measures are ongoing and that the annual emission savings were the equivalent to the amount recorded for 2018	2010: 0 2011: 0.39 2012: 0.43 2013: 0.49 2014: 0.61 2015: 0.85 2016: 1.33 2017: 2.26 2018: 4.10 2019: 4.10 2020: 4.10 Total cumulative Savings: 18.66 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of the green economy due to uptake of energy efficient technologies.

Table 3.1d: The National Cleaner Production Centre South Africa (NCPC) program

NAME OF ACTION	The National Cleaner Production Centre South Africa (NCPC) programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
The action aims to facilitate energy efficiency measures, particularly in the industrial and commercial sectors, to mitigate greenhouse gas emissions related to the energy sector and stimulate job creation in the green economy.	Implementation of projects in the private sector that achieve energy savings and improved economic competitiveness in South African businesses through resource and process efficiency.	Private sector energy efficiency funding program.	National Cleaner Production Centre	CO_2 Energy sector	No specific quantitative goals are provided but will contribute towards South Africa's energy efficiency targets.	Ongoing since 2011	kWh savings; Reduction of CO_2 through the efficient use of energy	The savings in this report are based on the emission calculations conducted by the NCPC. The NCPC calculates the emission savings for the projects based on the energy carrier relevant to each specific project. These emissions were aggregated and provided by the NCPC for each year the program has run for. Assumptions: assumed that project savings implemented during the program remain for a period of 5 years.	2010: 0 2011: 0.12 2012: 0.25 2013: 0.62 2014: 0.62 2015: 0.63 2016: 0.10 2017: 0.32 2018: 0.44 2019: 0.52 2020: 0.37 Total cumulative savings: 3.99 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1e: Private Sector Energy Efficiency (PSEE) Programme

NAME OF ACTION	Private Sector Energy Efficiency (PSEE) Programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
The action aims to facilitate energy efficiency measures, particularly in the industrial and commercial sectors, to mitigate greenhouse gas emissions related to the energy sector and stimulate job creation in the green economy.	Implement projects in the private sector that achieve energy savings and improved economic competitiveness in South African businesses through resource and process efficiency.	Private sector energy efficiency projects; economic incentive.	National Business Initiative (NBI)	CO_2 Energy sector	No specific targets provided but this action will contribute to the Post-2015 NEES industry and mining targets: (2016 DMRE) (a) 16% reduction in the weighted mean specific consumption of manufacturing by 2030 relative to the 2015 baseline; (b) 40 PJ cumulative annual savings from energy efficient interventions in mining.	Ended 2013 to 2015 however assumes that projects remain in place to date. Potential sources of funding, effective delivery mechanism and an appropriate hosting body will be identified to allow the development of a permanent successor scheme.	kWh savings	Emission savings ($MtCO_2e$) = activity data (GWh) x grid emission factor (tCO_2e/GWh) The calculations in this report are based on secondary data sets (energy savings in GWh), accessed from the National Business Initiative report on the outcomes of the program. The activity data sets are multiplied by the South African grid emission factor for that year (calculated using data in the related Eskom annual report) to derive the $MtCO_2e$ value. Assumptions: assumed that projects implemented during the program remain in place to date.	2014: 0.15 2015: 0.15 2016: 0.14 2017: 0.14 2018: 0.14 2019: 0.15 2020: 0.16 Total cumulative savings: 1.03 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1f: Private sector embedded solar generation

NAME OF ACTION	Private sector embedded solar generation									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
Solar photovoltaic (PV) generation, which can be quickly deployed, is expected to be the key technology behind small-scale embedded generation.	Installation of embedded solar PV for electricity generation.	Private sector energy efficiency projects; economic incentive.	South Africa Solar PV update published by the Association for Renewable Energy Practitioner (2019)	CO_2 Energy sector	This action will contribute to the solar PV targets set in the IRP (2019 IRP (DMRE, 2019). By 2030, South Africa aims for additional capacity of 6 GW solar power. It is expected that another 114 MW will come online in 2020, followed by 300 MW in 2021 and 400 MW in 2022, when an additional 1 GW will be added as well. By 2030 the cumulative total is expected to be 8,288 MW.	Ongoing - 2018 to present.	kWh generated and MW installed capacity; Reduction of CO_2 through the use of cleaner energy sources.	Emission savings ($MtCO_2e$) = activity data (GWh) x grid emission factor (tCO_2e/GWh). The calculations in this report are based on secondary activity data sets (new installed capacity additions in MW, converted to GWh), accessed from the South Africa Solar PV Update Report published by the Association for Renewable Energy Practitioners. Assumptions: Assumed a capacity factor of 15% for the solar PV panels and an operational time of 6hrs each day. These assumptions were used to calculate an estimate of the electricity generated by the installed solar PV in each year. This was then multiplied by the grid emission factor to obtain the carbon emission reductions. The grid emission factors were sourced from the Eskom annual reports.	2018: 0.21 2019: 0.31 2020: 0.31 Total cumulative savings: 0.83 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of renewable energy technologies. Strengthening of green economy due to uptake of renewable energy technologies.

Table 3.1g: Renewable Energy Independent Power Producer Procurement (REIPPP) programme

NAME OF ACTION	Renewable Energy Independent Power Producer Procurement (REIPPP) programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
The Integrated Resource Plan makes provision for the generation of 17.8 GW of renewable energy by 2030, to be commissioned under the Programme.	Competitive procurement programme, where prospective power producers submit bids to supply Eskom with renewable energy. The Department of Mineral Resources and Energy adjudicates the bids according to various criteria, price being the most critical.	Public sector renewable energy procurement programme.	Eskom	CO_2 Energy sector	17.8 GW of renewable energy by 2030. (DMRE, 2010).	Ongoing-2011 to present.	kWh renewable energy; Reduction of CO_2 through the use of cleaner energy sources.	Emission savings ($MtCO_2e$) = activity data (GWh) x grid emission factor (tCO_2e/GWh) The secondary activity data sets (electricity generated by renewable energy projects in each year sourced from Eskom Integrated Annual reports) are multiplied by the appropriate annual grid emission factor to yield the emissions that are avoided through the use of renewable energy generation. A conversion factor of 0.277778 was used to convert GJ to MWh in order to convert the coal emission factor to the correct unit. Assumption: Coal generation baseline was assumed.	2014: 5.21 2015: 7.01 2016: 8.91 2017: 11.81 2018: 12.81 2019: 13.31 2020: 14.31 Total cumulative savings:73.37 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of renewable energy technologies. Strengthening of green economy due to uptake of renewable energy technologies.

Table 3.1h: Natural Gas Fuel Switch Programmes

NAME OF ACTION	Natural gas fuel switch programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
To provide an economical and eco-friendly energy, by supplying natural gas to Compressed Natural Gas (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.	Switch to natural gas from emission intensive fuels.	Public and private sector programme.	Department of Mineral Resources and Energy.	CO_2 Energy sector	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 and 7,700,000 Litres equivalent of gas (295,000 GJ) per month dispensed.	Ongoing - 2000 to present. While an accurate number of converted taxis does not exist at this point, it is estimated that in the Cities of Johannesburg, Tshwane and Ekurhuleni combined there are approximately 1,000 CNG taxis.	Reduced emissions from fuel use.	The total primary natural gas supply in the country was taken from the Department of Mineral Resources and Energy's Energy Balance. These are located on the DMRE website. The emission savings from this was assumed to be the difference between the emissions from coal and the emissions from natural gas. In order to calculate the savings, the GJ of gas supplied was multiplied by the difference between the emission factors for coal and natural gas. An assumption for the years 2017 to 2019 was made to equal the 2016 energy balance number as these figures had not been updated by the Department of Mineral Resources and Energy.	2010: 7.66 2011: 7.35 2012: 7.37 2013: 6.95 2014: 7.74 2015: 7.78 2016: 7.08 2017: 7.08 2018: 7.08 2019: 7.91 2020: 7.91 Total cumulative savings: 81.91 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy generation purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1i: Bus Rapid Transport (BRT) System

NAME OF ACTION	Bus Rapid Transport (BRT) System									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
Promotes the efficient use of energy resources and the limitation of adverse environmental impacts in relation to land transport.	Provision of quick and safe public transport by bus. Implemented in Tshwane, Johannesburg, Durban and Cape Town. The reduction of GHG emissions is primarily achieved by modal shift from private passenger cars to public transport.	Public sector project.	Department of Transport and Local Governments	CO_2 Energy sector	Modal shift in Green Transport Strategy (DoT, 2017): 20% shift of passenger transport from private cars to public transport and non-motorised transport by 2022. DoT Annual Performance Plan 2019/20: (DoT, 2019) Strategic Goal 3: Improved rural access, infrastructure and mobility; Develop and monitor implementation of detailed Integrated Public Transport Network (IPTN) plans in 16 district municipalities by 2022/23; Strategic Goal 4: Improved public transport services; Fund and monitor implementation of Integrated Public Transport Networks (IPTNs) in thirteen (13) cities by 2022/23; Strategic Goal 4: Improved public transport services; Monitor implementation of the Transport Appeal	Ongoing-2007 to 2022 The National Land Transport Transition Act (DoT, 2000) was repealed by the gazetted National Land Transport Act (DoT, 2009) in April 2009. The Green Transport Strategy (DoT, 2017) replaced the Public Transport Strategy (DoT, 2007) from August 2017. The City of Cape Town's MyCiTi BRT system started operations in May 2010, just before the 2010 World Cup. Its first service was a shuttle from the Airport to the CBD. The initial Phase 1A trunk and feeder	GHG emission reductions from fuel savings	ASIF approach (Eichhorst et al. 2018) Weekday average BRT Passenger trips: MyCiti (2011-2019): 56023; GoGeorge (2016-2019): 12949; A Re Yeng (2016-2019): 6663; Libhongolethu (2017-2019): 9882; (Derived from (National Treasury, 2014; National Treasury, 2016; National Treasury, 2018; National Treasury, 2021)) Average trip length: 23 km (van Ryneveld, 2014) Modal Shift Car: 10%; Minibus-Taxi: 61%; Bus: 8% (DEA, 2016b) Occupancy: Car: 1.4; Minibus-Taxi:14 (Stone et al. 2018) BRT: 56 (derived from DEA, 2016b) Fuel split of road transport modes (Stone et al. 2018): Car Gasoline: 96%; Car Diesel: 4%; Car Hybrid Gasoline: 0.02%; Minibus-Taxi Gasoline: 92%; Minibus-Taxi Diesel: 8%; Bus Diesel: 100%	2012: 0.05 2013: 0.05 2014: 0.05 2015: 0.05 2016: 0.05 2017: 0.05 2018: 0.05 2019: 0.07 2020: 0.07 Total cumulative savings: 0.49 $MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of economy due to uptake of energy efficient technologies.

NAME OF ACTION	Bus Rapid Transport (BRT) System									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
					Tribunal (TAT) Amendment Act.	services started operating in May 2011. The Go George BRT system began operation in December 2014. The Tshwane A Re Yeng BRT services began operations in November 2014 with the launch of Phase 1A (DEA, 2016d)		Energy consumption factor (L/100km) of road transport (Stone et al. 2018): Car Gasoline: 7.8; Car Diesel: 7.4; Car Hybrid Gasoline: 6; Minibus-Taxi: Gasoline: 13.7; Minibus-Taxi Diesel: 12.7 Net calorific values per fuel type (MJ/l): Gasoline: 34.2; Diesel: 38.1 (DEA, 2018e) Emission Factors for CO_2 per fuel type (kg/TJ): Gasoline: 69300; Diesel: 74100 (IPCC, 2006) GWP (IPCC, 1996) Average trip distance information of GoGeorge; A Re Yeng and Libhongolethu were not available. Modal shift information for GoGeorge; A Re Yeng and Libhongolethu were not available. The modal shift information for Rea Vaya BRT was used instead.		

Table 3.1j: Transnet Road-to-Rail Programme

NAME OF ACTION	Transnet Road-to-Rail programme									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Promotes the efficient use of energy resources and the limitation of adverse environmental impacts in relation to land transport.	Encourages the shift of freight from road to rail.	Public sector project.	Transnet	CO_2 Energy sector	A 30% shift in freight from road to rail by 2050 (Green Transport Strategy), DoT, 2017)).	Ongoing - 2012 to present Accelerating modal shift from road to rail is included in the Minister of Public Enterprises' Statement of Strategic Intent (SSI). Government's National Climate Change Response White Paper, 2011, identifies a modal shift from road to rail as a flagship carbon mitigation programme for South Africa.	MJ savings; reduction of CO_2 through switching to a lower intensity mode of transport.	Data sets provided by Transnet.	2012: 0.24 2013: 0.23 2014: 0.50 2015: 0.38 2016: 0.21 2017: 0.61 2018: 0.76 2019: 0.13 2020: 0.35 Total cumulative savings: $3.41MtCO_2e$	Reduced air pollution due to the mitigation of fossil fuel combustion for energy purposes. Increase in jobs due to uptake of energy efficient technologies. Strengthening of green economy due to uptake of energy efficient technologies.

Table 3.1k: Electric Vehicles

NAME OF ACTION	Electric Vehicles									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Shift to electric vehicle use from internal combustion engine vehicles.	The support of EV local development (OEMs, Chargers and EV innovation), EV businesses including suppliers funding and banks buy-in on EVs by structuring vehicle finance for EVs.	Economic	The Department of Forestry, Fisheries and the Environment	CO_2, CH_4, N_2O Energy sector	No quantitative goals provided.	Ongoing- 2007 to 2025 The charging network in South Africa is growing, there are currently around 214 public chargers in South Africa. The Department of Science and Technology (DST) in partnership with the Technology Innovation Agency (TIA) is supporting the development of electric vehicle components (motors, battery management systems) and research on the use as well as localisation of renewable energy-based charging points (Parmar, 2020).	tCO_2e avoided	Average battery electric vehicle (BEV) population (2013-2020): 236 (derived from IEA, 2022) Average plugin hybrid electric vehicle (PHEV) population (2015-2020): 456 (derived from IEA, 2022) Distance travelled per vehicle: 21000 km (Stone et al. 2018) Substitution fuel ratio for PHEVs (petrol: electric): 60% / 40% Vehicle energy economy: BEV – 0.69 MJ/km; PHEV – 1.68 MJ/km fuel split of road transport modes (Caetano et al. 2017) Modal split in baseline scenario: Car Gasoline: 96%; Car Diesel: 4% (Stone et al. 2018) Energy consumption factor (L/100km) of road transport (Stone et al. 2018): Car Gasoline: 7.8; Car Diesel: 7.4 Net Calorific Values Per Fuel Type (MJ/l): Gasoline: 34.2; Diesel: 38.1 (DEA, 2018e) Emission Factors for CO2 Per Fuel Type (Kg/Tj): Gasoline: 69300; Diesel: 74100 (IPCC, 2006) Gwp (Ipcc, 1996)	2013: 0 2014: 0 2015: 0.0003 2016: 0.0013 2017: 0.0018 2018: 0.0008 2019: 0.0010 2020: 0.0012 Total cumulative savings 0.0062 $MtCO_2e$	Reduce energy consumption. Reduce air pollution.

3.4.2. IPPU

The mitigation actions implemented in the IPPU sector are shown in Table 3.2. There is one mitigation action reported, which is for nitrous oxide reduction projects. Regulation of GHG emissions from industrial processes and product use will come into effect once the Climate Change Bill has been enacted by Parliament.

Table 3.2: Nitrous Oxide Reduction Projects

NAME OF ACTION	Nitrous oxide reduction projects									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Reduced nitrous oxide emissions during the production of nitric acid.	Reduction of nitrous oxide emissions in nitric acid production. Five projects in three companies are registered with the UNFCCC CDM.	Private sector project	UNFCCC CDM	N_2O IPPU sector	No quantitative goals yet in existence.	Ongoing-2006 to present	Nitrous Oxide reductions	No calculations were conducted as the emission reductions were available from the data provided by the Chemical Allied Industries Association (CAIA).	2011: 1.46 2012: 1.71 2013: 1.69 2014: 1.69 2015: 1.69 2016: 1.69 2017: 1.63 2018: 1.20 2019: 1.05 2020: 1.05 Total cumulative savings 14.86 $MtCO_2e$	Not quantified

3.4.3. AFOLU

Domestic actions in the AFOLU sector are presented in Tables 3.3a to 3.3e. The AFOLU sector includes the GHG emissions from agriculture excluding fuel combustion and land use. In 2020, Livestock category emission sources accounted for 46% of total sectoral emissions. This is a decrease in the emissions share of livestock since 2010, when Livestock category emissions accounted for 76% of total sectoral emissions. This is attributed to declining cattle populations that have been negatively impacted by drought. Net farming income also has fallen in 2016, 2017, 2019 (DALRRD, 2023) due to the economic impacts of drought and in 2020 due to the covid pandemic.

Afforestation accounted for 80% of the total emission reductions from mitigation in AFOLU. Further details of AFOLU sector emission reductions are provided in Tables 3.3a to 3.3e. The emission shares of land emission sinks and sources to total sectoral emissions have grown from 1% in 2010 to 40% in 2020. This is attributed to increases of the plantation forestland sink and decreases of losses through fuelwood collection and biomass burning.

The Department of Trade, Industry and Competition (DTIC) published the Master Plan for the Commercial Forestry Sector in South Africa 2020-2025 in 2020 (DTIC, 2020). The overall objective of the plan is to implement actions in the medium term in commercial forestry that will stimulate economic growth. The process of developing the plan was a collaboration between DTIC, Department of Agriculture, Land Reform and Rural Development, DFFE and the corporate forestry industry. The corporate sector is mainly responsible for implementation of the plan since half of the sector is privately owned. DFFE has supported implementation in its capacity through the development of methodological guidelines for carbon sequestration for national GHG emissions reporting and the amendment of the National Forests Act, 1998 (for greater protection of natural forests) in 2022.

Table 3.3: Domestic actions in the AFOLU sector

Table 3.3a: Afforestation

NAME OF ACTION	Afforestation									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Encourages and supports sustainable land use practices, raising awareness and promoting resource conservation ethics.	Department of Forestry, Fisheries and the Environment afforestation programs, including the Working for Land and Working for Ecosystems afforestation programs.	Regulations and standards.	DFFE	CO_2 AFOLU sector (Land sub-sector)	To afforest 100,000 hectares of land in certain parts of the country. Potential emission savings has been estimated at 2.2 $MtCO_2$ if 100000 ha are afforested (DEFF, 2020).	Ongoing - 2006 to present The National Forestry Action Program (DWAF, 1997) was published in 1997 and had the expressed purpose of mobilising and organising national and international resources and catalysing action to implement programs and plans in a coordinated manner. A review of the National Forestry Action Programme in 2003, led to the development of the National Forest Policy (DWAF, 2005) a globally adopted framework for national forest policy development, planning and implementation. The process of developing a long-term strategy for the forestry sector was started in 2007, resulting in the Forestry 2030 Roadmap, which was finalised after a two-year period of consultation and deliberation between government and industry. Recently (2019) included plantations >100 ha in the National GHG Emission Reporting Regulations (DEFF, 2020b) to obtain more precise data on afforested and deforested areas.	tCO_2e sequestered; afforested area (ha)	Assumed that afforestation accounts for all land conversions to forestland that previously was not forestland. Total carbon stock change for land converted to forestland has been sourced from the 2020 AFOLU GHG inventory	2010: 12.72 2011: 12.90 2012: 13.16 2013: 13.12 2014: 12.84 2015: 13.33 2016: 13.78 2017: 13.26 2018: 13.13 2019: 13.27 2020: 13.41 Total cumulative savings 144.92 $MtCO_2e$	Sustainable, performing ecosystems and increased land productivity. Increased biodiversity and soil quality can improve subsistence farming which can positively impact human health. Improvements in subsistence farming can increase economic livelihoods and therefore, resilience to negative climate impacts.

Table 3.3b: Conservation Agriculture (CA)

NAME OF ACTION	CONSERVATION AGRICULTURE (CA)									
PRIMARY OBJECTIVE	DESCRIPTION	NATURE OF ACTION	ADMINISTERING GOVERNMENT / AGENCY / ACTOR	COVERAGE	QUANTITATIVE GOALS	STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)	PROGRESS INDICATORS	METHODOLOGY AND ASSUMPTIONS	ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)	CO-BENEFITS
Aims are to promote sustainability within the agriculture sector and to reduce the carbon footprint of Agriculture.	Advocates for implementation of minimum soil disturbance (no-tillage), permanent cover and crop association.	Programmes	Department of agriculture through Landcare program and South African National Biodiversity Institute (SANBI); Grain SA	CO_2 AFOLU sector (Land sub-sector)	The AFOLU Strategy (DEFF, 2020) indicates that there are 6 302 642 ha to be converted to CA over the next 20 years. Potential accumulated emission reductions are estimated to be 119 $MtCO_2$ by 2040.	Ongoing On February the 9th 2018 the Minister published the Draft Conservation Agriculture Policy (DAFF, 2018a) for public comment and in August 2018 the Draft Climate Smart Agriculture Strategic Framework (DAFF, 2018b) was published for public comment.	tCO_2e sequestered, area under conservation agriculture.	AFOLU strategy (DEFF, 2020) indicates that conservation area was 14% of the annual crop area in 2018, growing at a rate of 7.5% per year. Annual crop area in 2018: 11 126 022 ha (DEA, 2019). Area extrapolated for each year based on this. Mitigation potential factor: 0.2 tC/ha/yr. DEFF 2020 applied a value of 0.3 tC/ha/yr, but not all conservation activities are adopted (Findlater et al, 2019) therefore a value of 0.2 tC/ha/yr was applied. Assumptions: Soil carbon was assumed to accumulate for the IPCC default period of 20 years; Annual growth rate in conservation area remains constant at 7.5% per annum.	2010: 0.64 2011: 0.69 2012: 0.74 2013: 0.80 2014: 0.86 2015: 0.92 2016: 0.99 2017: 1.06 2018: 1.14 2019: 1.23 2020: 1.32 Total cumulative savings: 10.39 $MtCO_2e$	Sustainable, performing ecosystems and increased land productivity. Increased biodiversity, catchment management, water quality and soil quality can improve subsistence farming which can positively impact human health. Improvements in subsistence farming can increase economic livelihoods and, therefore, resilience to negative climate impacts.

Table 3.3c: Forest and Woodland Restoration and Rehabilitation

NAME OF ACTION	FOREST AND WOODLAND RESTORATION AND REHABILITATION									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
To restore and rehabilitate forests and woodlands to improve sustainability, ecosystem services and biodiversity.	Restoring state forests and woodlands stem from the Draft Climate Change Plan for South African Agriculture and Forestry Sectors (2010) and the DAFF Strategic Plan 2015/2016 to 2019/2020 (DAFF, 2015).	Regulations and standards.	Public sector programme; DFFE	CO_2 AFOLU sector (Land sub-sector)	To restore an additional 80 000 hectares of agricultural land and 2 500 hectares of state forests and woodlands. Furthermore, to replant 8 625 hectares of temporary unplanted (TUP) Category B and C State plantations per annum to address the approximately 30 000 hectares of TUP areas. The AFOLU strategy indicates the potential for 6 $MtCO_2$ savings by 2040 through the government's Expanded Public Works Programme (EPWP).	Ongoing	tCO_2e sequestered; forest area rehabilitated	Assumed that the restoration of forestland constitutes reforestation and that all land conversions within forestland subtypes occur on land that was previously forestland. Total carbon stock change for reforestation has been sourced from the 2020 AFOLU GHG inventory. This estimate includes clearing of invasive alien plant species or management of bush encroachment that is represented in woodland conversions to other plantation and indigenous forest. Land conversions to thicket have been excluded as this is reported separately as an action.	2010: 0.94 2011: 1.06 2012: 1.12 2013: 1.22 2014: 1.04 2015: 1.32 2016: 1.64 2017: 1.38 2018: 1.23 2019: 1.30 2020: 1.40 Total cumulative savings: 13.65 $MtCO_2e$	Improved ecosystem services, sustainability and biodiversity. Improved waster use. Creation of jobs Sustainable, performing ecosystems and increased land productivity. Increased biodiversity and soil quality can improve subsistence farming which can positively impact human health. Improvements in subsistence farming can increase economic livelihoods and, therefore, resilience to negative climate impacts.

Table 3.3d: Grassland Restoration

NAME OF ACTION	GRASSLAND RESTORATION									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
To restore and rehabilitate grasslands and grazing lands and to reduce soil erosion.	The purpose of grassland restoration is to improve the land productivity of grasslands by promoting sustainable grazing management that limits topsoil loss and disturbance, enhances forage production and cover and maintain key forage species diversity amongst others.	Regulations and standards.	Public sector programme.	CO_2 AFOLU sector (Land sub-sector)	The AFOLU Strategy (DEFF, 2020) indicates that there is another 935 000 ha grassland that can be rehabilitated. It is indicated that the EPWP government programs have the potential to reduce emissions by 0.76 Mt CO_2 over the next 20 years.	Ongoing Implementation of the action is driven by: Medium term (2030) UNCCD commitment to combat desertification to "rehabilitate and sustainably manage 2 436 170 ha of grassland" (DEA, 2018g). Natural land cover restoration goals within the The National Biodiversity Strategy and Action Plan (NBSAP). DFFE "Working for" Programs that focuses on the restoration of ecological infrastructure and DALRRD LandCare Programs which focuses on the sustainable land management of areas under agricultural management.	tCO_2e sequestered; grassland area rehabilitated	Assumed that grassland rehabilitation accounts for all land conversions (excluding natural land cover types) to grasslands. Total carbon stock change for land converted to grassland has been sourced from the 2020 AFOLU GHG inventory.	2010: 0.35 2011: 0.36 2012: 0.37 2013: 0.37 2014: 0.37 2015: 0.40 2016: 0.41 2017: 0.39 2018: 0.41 2019: 0.41 2020: 0.41 Total cumulative savings: 4.25 $MtCO_2e$	Sustainable, performing ecosystems and increased land productivity. Increased biodiversity and soil quality can improve subsistence farming which can positively impact human health. Improvements in subsistence farming can increase economic livelihoods and, therefore, resilience to negative climate impacts.

Table 3.3e: Thicket Restoration

NAME OF ACTION	THICKET RESTORATION									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
To restore and rehabilitate thickets to reduce land degradation and enhance carbon storage.	Thickets have been shown to have a large carbon storage capacity. Restoration projects involve replanting of thicket vegetation to increase carbon storage in the biomass and soil.	Regulations and standards.	Public sector programme.	CO_2 AFOLU sector (Land sub-sector)	The AFOLU strategy indicates the potential for 34 $MtCO_2$ savings by 2040 through thicket restoration, with the EPWP government programme estimated to potentially contribute 3.5 $MtCO_2$ savings in this time period.	Ongoing Implementation of the action is driven by: Medium term (2030) UNCCD commitment to combat desertification to "rehabilitate and sustainably manage 87 621 ha of thicket" (DEA, 2018g). Natural land cover restoration goals within the NBSAP. DFFE "Working for" Programs that focuses on the restoration of ecological infrastructure and DALRRD LandCare Programs which focuses on the sustainable land management of areas under agricultural management.	tCO_2e sequestered; thicket area rehabilitated	Assumed that thicket restoration accounts for all land conversions (excluding natural land cover types) to thicket. Total carbon stock change for land converted to thicket has been sourced from the 2020 AFOLU GHG inventory. In some years; biomass losses due to veld fire impacts	2010: 0.00 2011: 0.03 2012: 0.00 2013: 0.01 2014: 0.00 2015: 0.15 2016: 0.29 2017: 0.11 2018: 0.05 2019: 0.03 2020: 0.13 Total cumulative savings: 0.80 $MtCO_2e$	Sustainable, performing ecosystems and increased land productivity. Increased biodiversity and soil quality can improve subsistence farming which can positively impact human health. Improvements in subsistence farming can increase economic livelihoods and, therefore, resilience to negative climate impacts.

3.4.4. Waste

The main driving legislation in the waste sector is the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) that requires the periodical revision of the National Waste Management Strategy (NWMS) for the implementation of solid waste diversion, prevention and reduction measures. The 2020 update of the NWMS was published for public comments in December 2019. The strategy was then finalised in January 2021 (DFFE, 2021b). The new strategy differs to its predecessor as it indicates government's acknowledgement that implementation should be focussed on and grow resilient local waste economies to increase adoption rates of waste minimisation, diversion and prevention. DFFE is also working on the draft Waste Economic Master Plan (DFFE, 2023) which seeks "to purposefully provide access to the economic value inherent in waste".

It is shown in Table 3.4 that the annual GHG emission reductions for the NWMS have fallen by 97% from 2010 to 2020. Not many of the NWMS 2011 goals that would lead to substantial reduction of waste to landfill have been achieved either. For example, 21% of recyclables have been diverted from landfill sites for re-use, recycling or recovery against a goal of 25%. This is likely to be overestimated since only 50% of mainly urban municipalities have initiated source to separation programmes. By 2016, 95% of urban households were to have access to adequate levels of waste collection services. 65% of urban households had access to waste collection services.

Table 3.4: National Waste Management Strategy

NAME OF ACTION	NATIONAL WASTE MANAGEMENT STRATEGY									
PRIMARY OBJECTIVE	**DESCRIPTION**	**NATURE OF ACTION**	**ADMINISTERING GOVERNMENT / AGENCY / ACTOR**	**COVERAGE**	**QUANTITATIVE GOALS**	**STATUS AND PROGRESS (STEPS TAKEN OR ENVISAGED TO ACHIEVE THE ACTION)**	**PROGRESS INDICATORS**	**METHODOLOGY AND ASSUMPTIONS**	**ACTUAL EMISSION REDUCTIONS ($MtCO_2e$ TILL 2020)**	**CO-BENEFITS**
The NWMS provides a coherent framework and strategy for the implementation of the Waste Act and outlines government's policy and strategic approach to waste management within the South African government's context and agenda of socio-economic development that is "equitable, inclusive, sustainable and environmentally sound"	Provides the overall approach to national waste management during the lifecycle of waste, including waste avoidance and reduction, re-use and recycling, recovery and treatment and disposal.	Regulations and standards	Public sector programme.	CH_4 Waste sector	By 2016: 25% of recyclables diverted from landfill sites for re-use, recycling or recovery; All metropolitan municipalities, secondary cities and large towns have initiated separation at source programs; 95% of urban households and 75% of rural households have access to adequate levels of waste collection services; 80% of waste disposal sites have permits; 69 000 new jobs created in the waste sector; 80% of municipalities running local awareness campaigns (DEA, 2011c) (Selected list of goals).	Ongoing- 2011 to present The 2018 Revised and Updated NWMS (DFFE, 2021) is released for public comment together with a Status Quo Assessment of Waste Management in South Africa and a State of Waste Report that updates the National Waste Information Baseline Report of 2012 in December 2019. Since implementation of the 2011 NWMS, there are some improvements in waste collection and disposal services, including a successful programme to license landfills and the initiation of separation at source programmes in some metropolitan areas.	tCO_2e mitigation; percentage of waste recycled	No calculations were undertaken as part of this report. High-level, secondary data sets were provided (in $MtCO_2e$) by the Department of Environment, Forestry and Fisheries for the years 2011-2017. The provided data sets were aggregated per category (biogas, composting and material recovery facility projects) and per year. Assumptions: It was assumed that the waste diversion projects are ongoing and saving the equivalent amount of $MtCO_2e$ as in the last recorded year (2017).	2010: 0.61 2011: 0.81 2012: 0.97 2013: 1.05 2014: 1.09 2015: 1.11 2016: 1.12 2017: 0.92 2018: 0.69 2019: 0.06 2020: 0.02 Total cumulative savings: 8.45 $MtCO_2e$	Prevents pollution of water, soil and air. Reduces waste to landfill which has positive health impacts on society. Stimulate job creation in the green economy through waste reduction, reuse and recycling.

3.4.5. Challenges, constraints, and gaps to implementation

The overall decreasing trend of total GHG emissions from 2010 to 2020 (DFFE, 2022c) is due to the impact of declining electricity generation from coal fired power stations and constrained electricity supplied from coal fired power stations to economic sectors (Stats SA, 2022). The unintended consequence of the electricity crisis has been the increase of grid connected electricity generation from renewable energy sources as part of IPP Renewables. In 2020, IPP Renewables accounted for 49% of the total emission reductions of the energy sector. The COVID pandemic and lockdown restrictions in 2020 also reduced GHG emissions from road transport, civil aviation and commerce and institutions due to travel and trading restrictions that were implemented by government.

The electricity crisis has also impacted the economic productivity of manufacturing industries with a decline in net profits before tax from 2017 to 2020. The COVID restrictions compounded economic challenges in manufacturing during 2020 due to trading and travel restrictions with a reported net loss after tax in that year. These issues have been greater challenges and constraints for the corporate private sector that are largely responsible for economic development in manufacturing and emissions from the sector.

There is insufficient economic activity data to provide an indication whether electricity supply and COVID restrictions negatively impacted GHG emissions and mitigation in the AFOLU and Waste sectors. Commercial forestry, which accounts for most of AFOLU sector emission reductions, increased from 2010 to 2020 both in terms of land area and economy. Local governments are largely responsible for the management of solid waste and wastewater treatment with the total revenue collected for these services substantially increasing from 2010 to 2020. Solid waste management and reduction of waste disposed into landfill is the main contributor to Waste sector emission reductions. Implementation of integrated waste management policies by local governments as required under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) has been weak. Without government providing enough support to nurture an enabling environment to grow local green waste economies, recycling, reuse and reduction efforts dependent on government infrastructure, logistics and services have been constrained.

3.5. Analysis of Policy Impacts On Emission Reductions

DFFE and parliament regularly review the country's path for reducing greenhouse gas emissions. This review happens when there are specific reasons such as monitoring results, new technologies, the latest scientific knowledge, international commitments, or challenges and opportunities in implementing policies and actions. Tracking and reporting on the emission reductions of mitigation actions provides

some of the monitoring information needed. This is particularly important for the review of sectoral emission targets.

The sectoral emissions targets should be reviewed every five years and if the results of the review or national circumstances deem it necessary, the targets should be modified. This revision and amendment should be based on various factors, such as: (a) the findings of monitoring and evaluation; (b) advancements in technology; (c) the most reliable scientific knowledge, evidence, or information available; (d) the international commitments and obligations of the country; (e) the strategic significance of the sector or sub-sector in driving economic growth and job opportunities; or (f) the agreed approach to ensuring a fair transition.
Consistent and comprehensive tracking and reporting of mitigation action effects by DFFE will become mandatory once the Climate Change Bill is enacted by Parliament. This will be applicable for the monitoring, reporting and verification of mitigation action effects in the Energy; IPPU; AFOLU and Waste sectors.

To streamline the assessment of mitigation actions, a concise list of actions was provided in BUR-4. This limited the scope of the assessment to prioritise sector-specific developments that are influenced by the existing broader policies. This section is an update of the information provided about the annual emission reductions of these selected mitigation actions for the period 2010 to 2020.

3.5.1. Energy

Figure 3.1 shows the impact of annual emission reductions from energy sector mitigation actions on the total GHG emissions of the energy sector. The without mitigation timeseries are the total annual energy sector GHG emissions plus the annual emission reductions from energy sector mitigation actions. The with mitigation timeseries indicate the values as reported for energy sector GHG emissions in the 2020 GHG inventory. The gap between the with mitigation and without mitigation timeseries increases since the annual emission reductions have increased overall from 2010 to 2020 (20.94 Mt CO_2e). The sharp decline in the total GHG emissions in both timeseries is due to the decline of electricity generated in the country from coal fired power stations which have not been functioning at full capacity since 2007. The growth in energy sector mitigation is an unintended benefit of the electricity crisis as large energy users invest in renewable energy generation and municipalities implement energy efficiency and demand-side management initiatives within municipal infrastructure in order to adapt to conditions due to load shedding.

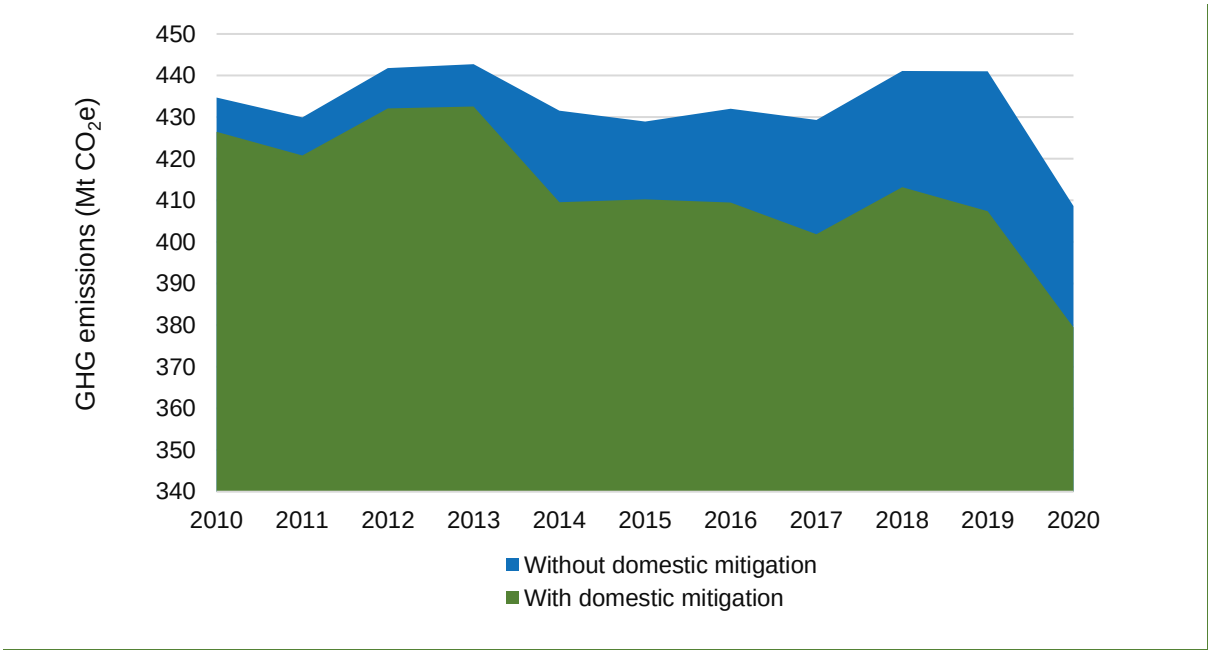


Figure 3.1: Impact of emission reductions from domestic mitigation actions on total Energy Sector GHG emissions

The increasing trend of emission reductions for individual mitigation actions is shown in Figure 3.2. The Renewable Energy Independent Power Producer Procurement (REIPPP) programme (IPP Renewable) and the Natural Gas Fuel Switch Programme (Fuel switch - Natural Gas) accounts for 71% of the accumulated emission reductions for the 2010 to 2020 period. Emission reductions for IPP Renewable and Fuel switch – Natural Gas have increased by 50% from 2015 to 2020; from 14.79 Mt CO_2e in 2015 to 22.22 Mt CO_2e in 2020. The 12L Tax Incentive Programme and the Municipal Energy Efficiency and Demand side Management programme (Municipal EE programme), both of which remain active, account for 21% of the accumulated emission reductions from 2010 to 2020 in the energy sector. The emission reductions of the Municipal EE programme have grown by 3.25 Mt CO_2e from 2015 to 2020. The emission reductions of the 12L Tax Incentive program increased slightly by 0.37 Mt CO_2e from 2015 to 2020.

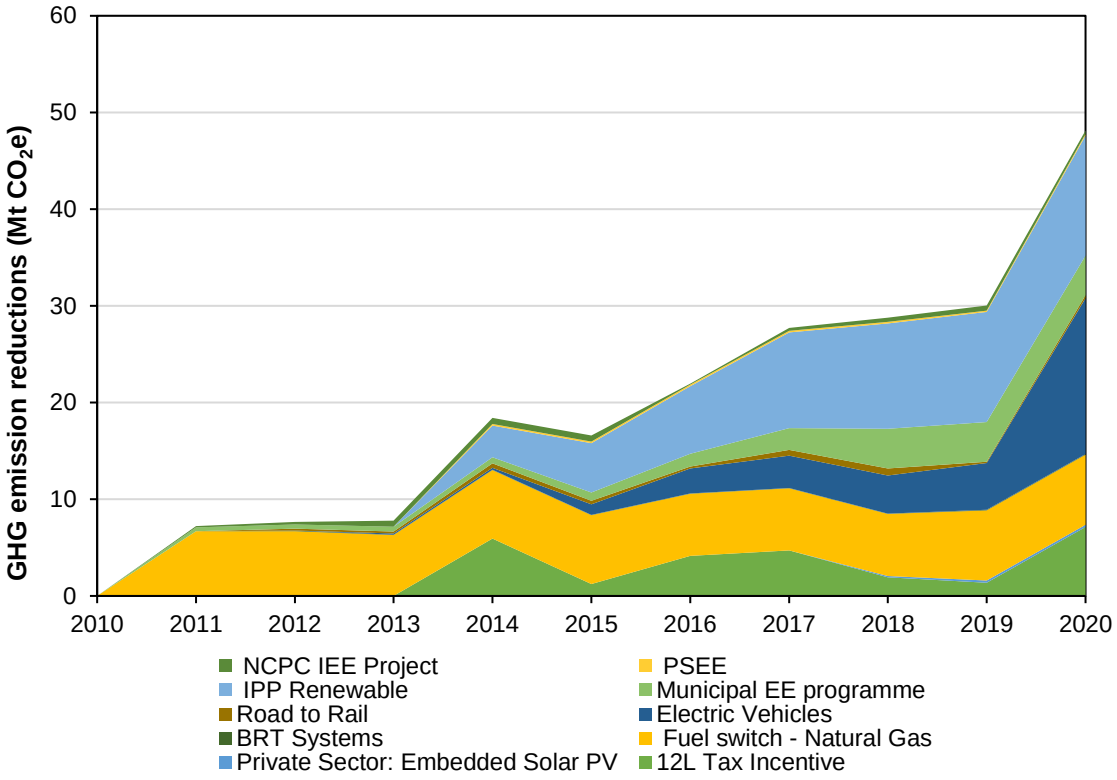
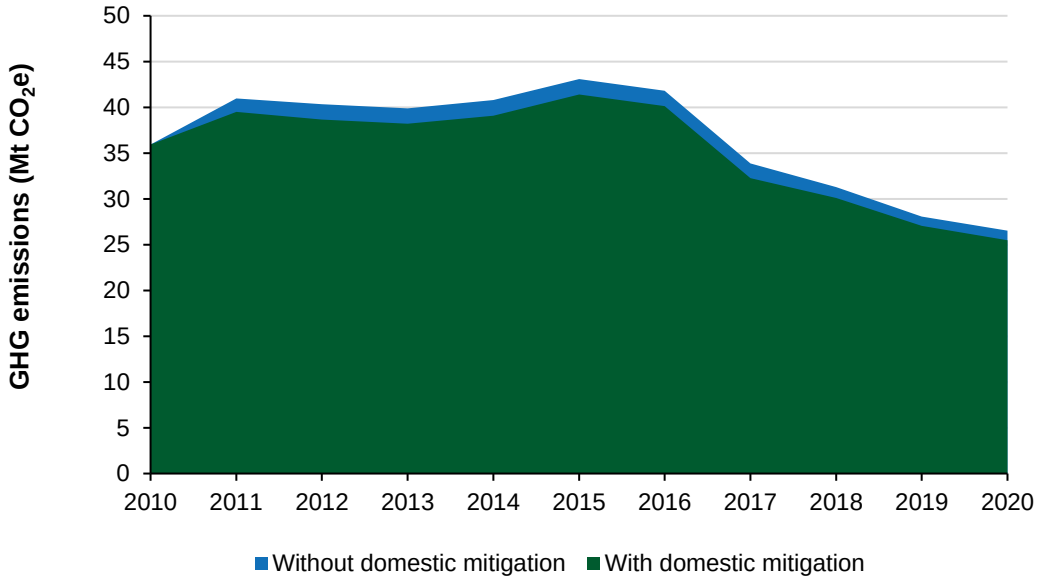


Figure 3.2: Annual trends and accumulated savings of emission reductions in the energy sector

3.5.2. IPPU

Figure 3.3 shows the impact of annual emission reductions from nitrous oxide reduction projects on the total GHG emissions of the IPPU sector. The without mitigation timeseries are the total annual IPPU sector GHG emissions plus the annual emission reductions from nitrous oxide reduction projects. The with mitigation timeseries indicate the values as reported for IPPU sector GHG emissions in the 2020 GHG inventory. The sharp decline in the total GHG emissions in both timeseries from 2015 onwards is due to the indirect effect of declining grid electricity supplied to the manufacturing sector and its adverse impact on manufacturing production.



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GHG emission reduction of Nitrous oxide reduction projects in Mt CO_2e	0.00	1.46	1.71	1.69	1.69	1.69	1.69	1.63	1.20	1.05	1.05

Figure 3.3: Impact of emission reductions from nitrous oxide reduction projects on total IPPU Sector GHG emissions

3.5.3. AFOLU

Overall, annual emission reductions from mitigation actions in the AFOLU sector have increased from 2010 to 2020 by 2.10 Mt CO_2e. Afforestation accounts for 83% of the accumulated emission reductions for the 2010 to 2020 period in the AFOLU sector and 42% of the accumulated emission reductions from all sectors. Figure 3.4 shows the impact of annual emission reductions from AFOLU sector mitigation actions on the total GHG emissions of the AFOLU sector. The without mitigation timeseries are the total annual AFOLU sector GHG emissions plus the annual emission reductions from AFOLU sector mitigation actions. The with mitigation timeseries indicate the values as reported for the AFOLU sector GHG emissions in the 2020 GHG inventory. The overall decline in the total GHG emissions in both timeseries from 2010 onwards is due to the indirect negative economic impacts of declining grid electricity supplied to the agriculture and forestry sector. Impacts of drought in 2016, 2017 and then 2019 and 2020 also impacted the economic productivity of the AFOLU sector, further compounding the decline in GHG emissions.

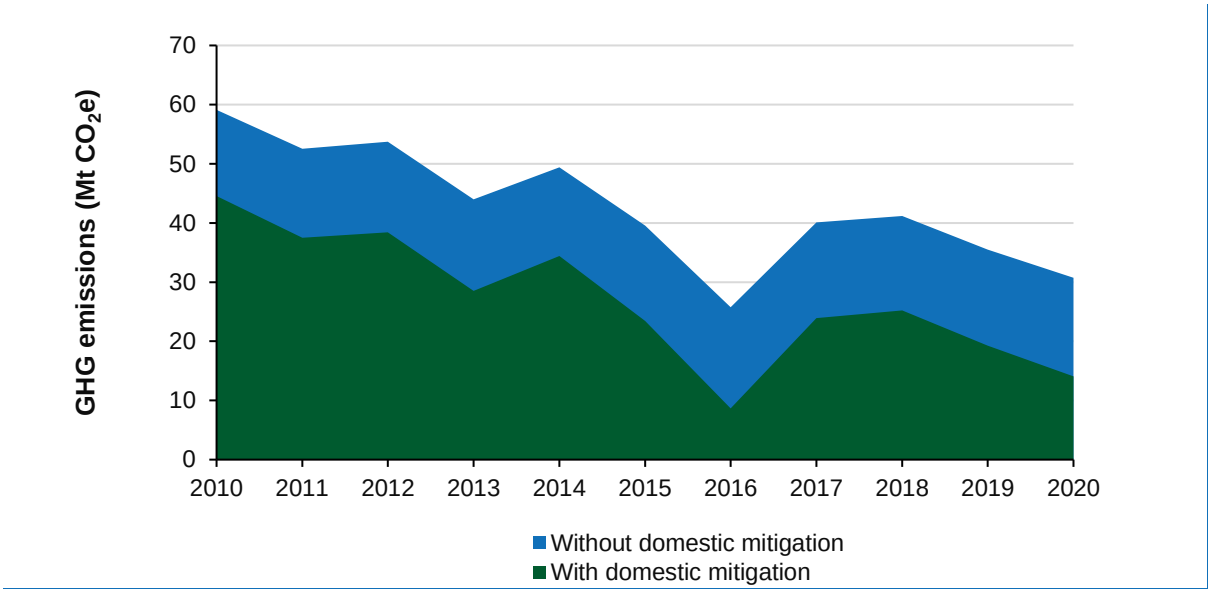


Figure 3.4: Impact of emission reductions from domestic mitigation actions on total AFOLU Sector GHG emissions

The annual emission reduction trends of individual mitigation actions in the AFOLU sector are shown in Figure 3.5. In 2016, the annual emission reductions for afforestation, forest and woodland restoration and rehabilitation (reforestation), thicket restoration and grassland rehabilitation increased as there was a decrease in biomass losses due to fire disturbances. Afforestation and reforestation emission reductions increased from 2018 to 2020 as there was a reduction in biomass losses from fire and wood collection.

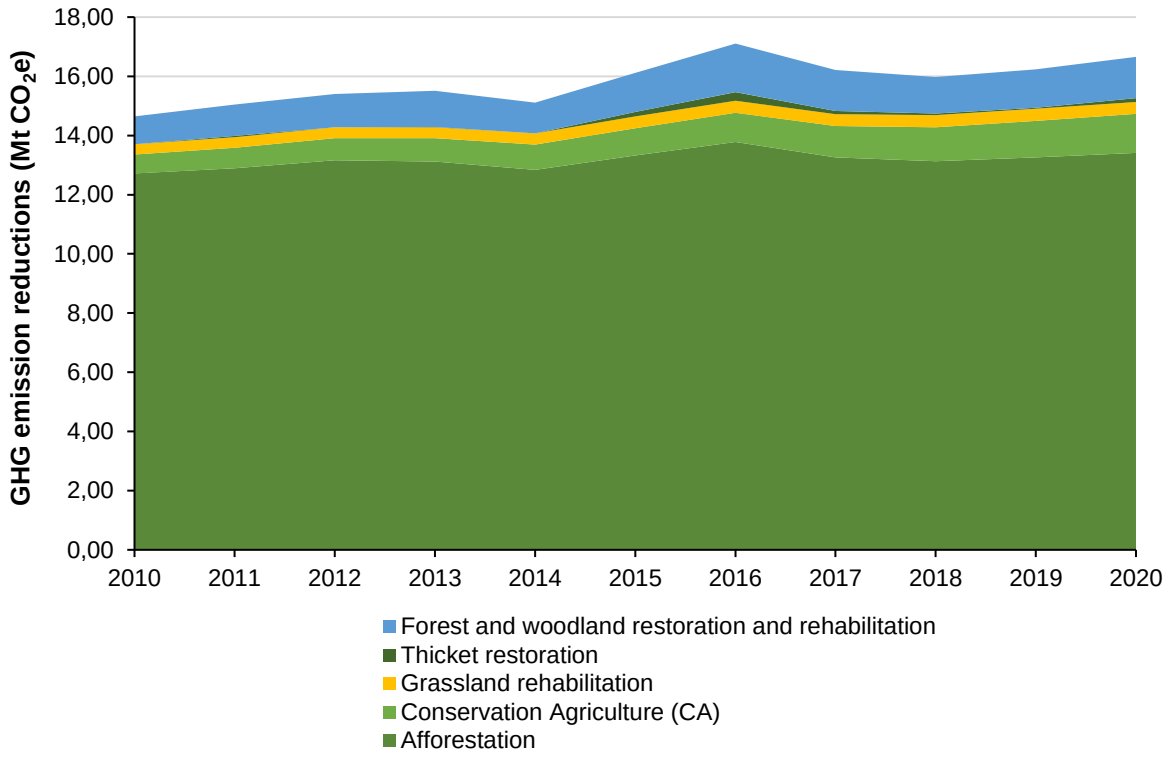
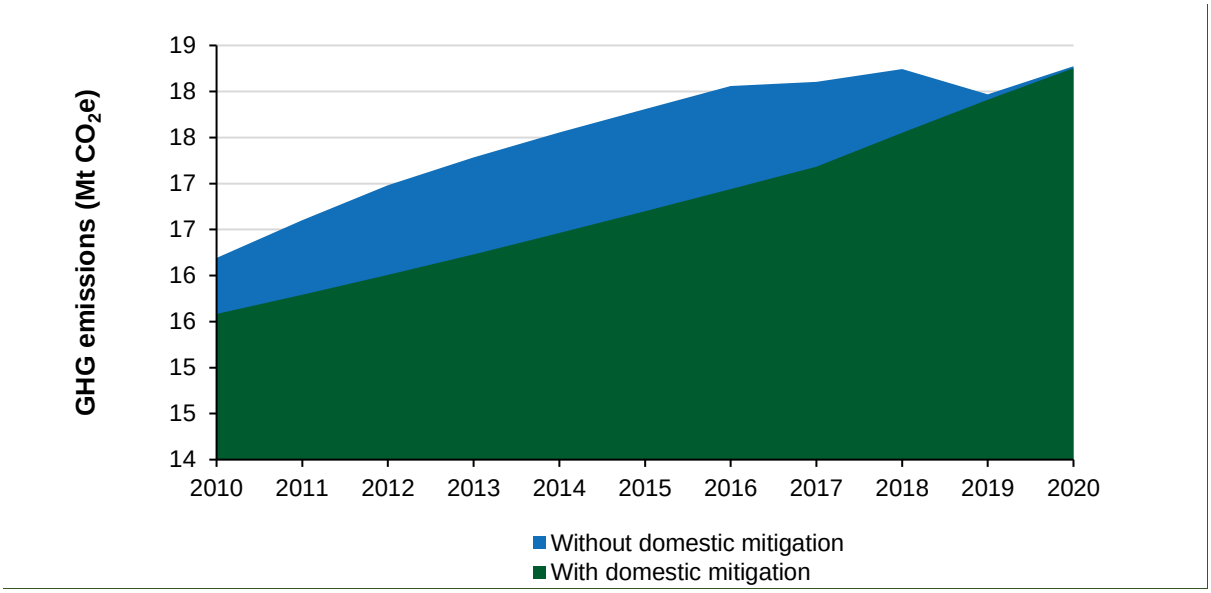


Figure 3.5: Annual trends and accumulated savings of emission reductions in the AFOLU sector

3.5.4. Waste

Figure 3.6 shows the impact of annual emission reductions of the National Waste Management Strategy 2020 (DFFE, 2021b) on the total GHG emissions of the Waste sector. The without mitigation timeseries are the total annual Waste sector GHG emissions plus the annual emission reductions from the National Waste Management Strategy. The with mitigation timeseries indicate the values as reported for the Waste sector GHG emissions in the 2020 GHG inventory. The increases of the GHG emissions in both timeseries are driven by the population growth and the increased quantities of solid waste disposed into landfills. Declining emission reductions from 2010 to 2020 of the National Waste Management reflects the current preference at local and district levels for waste disposal as opposed to waste diversion, as the former is seen as the cheaper option, although this may not be the case. At the same time, there are multiple challenges that weaken waste service delivery including underfunding, deterioration of old infrastructure, vehicle fleets and buildings, population growth and inadequate waste diversion.



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GHG emission reduction of the National Waste Management Strategy in CO_2e	0.61	0.81	0.97	1.05	1.09	1.11	1.12	0.92	0.69	0.06	0.02

Figure 3.6: Impact of emission reductions from the National Waste Management Strategy on total Waste Sector GHG emissions

3.5.5. Total Annual Emission Reductions of Domestic Mitigation Actions

Figure 3.7 indicates the sectoral shares of the total annual emission reductions of domestic mitigation actions for 2010, 2015 and 2020. Energy sector shares to emission reduction increase from 35% in 2010 to 62% due to the growth in IPP Renewables, which also displace the AFOLU sector as the largest contributor to emission contributions in 2020. AFOLU sector shares decrease from 62% in 2010 to 36% in 2020. Waste sector shares drop from 3% in 2010 and 2015 to 0% in 2020. IPPU sector shares increase from 0% in 2010 to 4% in 2015 and then decrease to 2% in 2020.

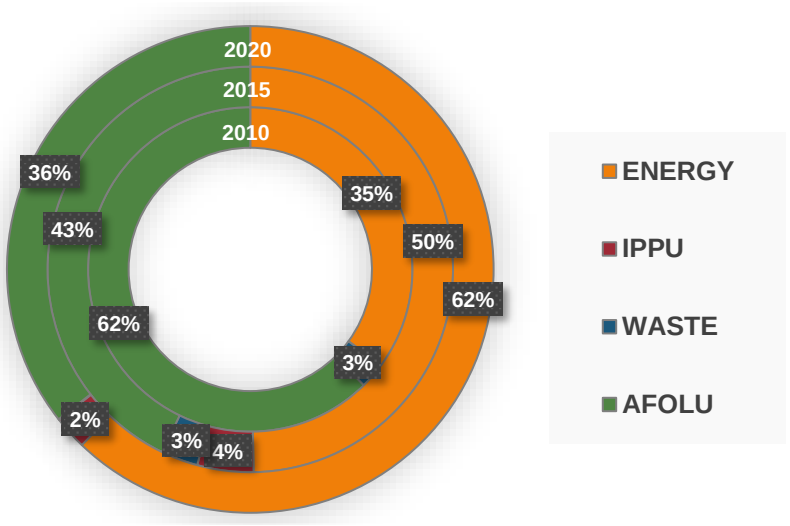


Figure 3.7: Sectoral emission shares of the total annual GHG emission reductions from domestic mitigation actions

Annual GHG emission reductions have doubled over the last ten years from 2010 to 2020. Figure 3.8 shows the impact of annual emission reductions of domestic mitigation actions on total GHG emissions from all sectors. The without mitigation timeseries are the total annual GHG emissions plus the annual emission reductions from domestic mitigation actions. The with mitigation timeseries indicate the values as reported for GHG emissions in the 2020 GHG inventory. The decreasing trend in GHG emissions is due to the impact of declining electricity generation from coal fired power stations. The increasing trend of emission reductions is driven by 1) unintended effects of the electricity crisis on large electricity users to invest in renewable energy sources 2) increases in forestland carbon sinks for afforestation and reforestation activities due to decreases in biomass losses from fire and wood collection.

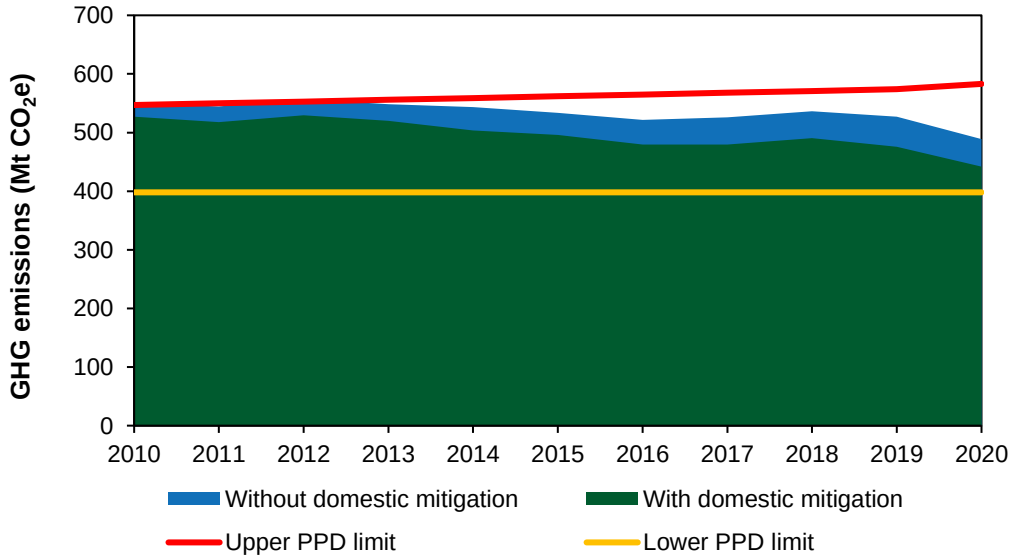


Figure 3.8: Annual GHG emissions with or without emission reductions from domestic mitigation actions and the PPD range for the 2010 to 2020 period

3.5.6. Co-Benefits of Actions

Since the submission of previous BURs, co-benefit metrics have been proposed for mitigation and climate change but are currently not regulated for MRV and thus not available to be reported. Mitigation actions stem from developmental programmes and grants which indirectly have benefits for climate change. It is not mandated under South African law for current planning, monitoring and evaluation metrics and indicators of developmental programmes and grants to include climate change metrics and indicators. For example, reporting the jobs created as shown in Table 3.5 is due to regulations for financial reporting in the Division of Revenue Bill and the enabling Money Bills Amendment Procedure and Related Matters Act No 9 of 2009.

Table 3.5: Number of jobs created for development and grant programs linked to mitigation actions in the Energy, Waste and AFOLU sectors.

Year	Renewable Energy Independent Power Producer Procurement programme	Comprehensive Agricultural Support Programme Grant	Land Care Programme Grant	Expanded Public Works Programme Integrated Grant for Provinces	Expanded Public Works Programme Integrated Grant for Municipalities	Local government waste management
2015	24 964	9363	972	65 863	41 063	0
2016	31 207	7894	1198	75 839	57786	651
2017	35 607	11155	935	84725	115502	950
2018	40 134	7840	1322	81190	64306	0
2019	48 334	3 713	830.89	82 114	66 875	5284
2020	67 033	4 788	778.21	67 325	62 729	No information

Additionally, guidelines have been developed by DPME, for applying a climate and ecosystems health criterion in the commissioning, design and implementation of project evaluations. This is expected to be applicable to all government interventions. The primary focus of this criterion is on assessing the impacts that result from the interaction between intervention activities/practices and climate and ecosystems and making recommendations about how intervention practices can be improved to make more positive contributions to climate and ecosystems health and to strengthen the resilience and adaptive capacity of the intervention and its beneficiaries.

3.5.7. Challenges, constraints and gaps to the reporting of mitigation actions and their effects

The DFFE is mandated to track and evaluate mitigation targeting fuel combustion (except road transport), forestry land use, solid waste management and wastewater treatment as regulated in legislation through the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004) and The Carbon Tax (Act No 15 of 2019). Irrespective of the climate change policy, the methodological guidelines for quantification of GHG emissions is central for setting out how

GHG emission and reductions thereof are quantified. Using this methodological guideline, regulated emitters have made submissions through the SAGERS. Aggregated activity data submitted in SAGERS has been used to quantify emissions where possible in the 2020 GHG inventory. The next step will be to publish aggregated information about emissions and emission reductions from SAGERS on the tracking and evaluation portal of The South African National Climate Change Information System.

While progress has been achieved for the reporting and collation of GHG emission data in SAGERS; a similar reporting system for co-benefits does not exist yet. Development of the co-benefit reporting system will be informed by the lessons learnt from institutionalising regulations for reporting GHG emissions, developing SAGERS and operationalising and disseminating information from the SAGERS reporting system.

3.6. Assessing the Impact of International Market-Based Mechanisms

The scope of reporting of international market mechanism projects in previous BURs included all registered projects with or without certified carbon credits issued. In this BUR, an update is provided for only the registered projects for which carbon credits were issued during the 2010-2020 reporting period. The total annual GHG emission reductions of International Market Mechanisms (IMM) from 2010 to 2020 are shown in Figure 3.9.

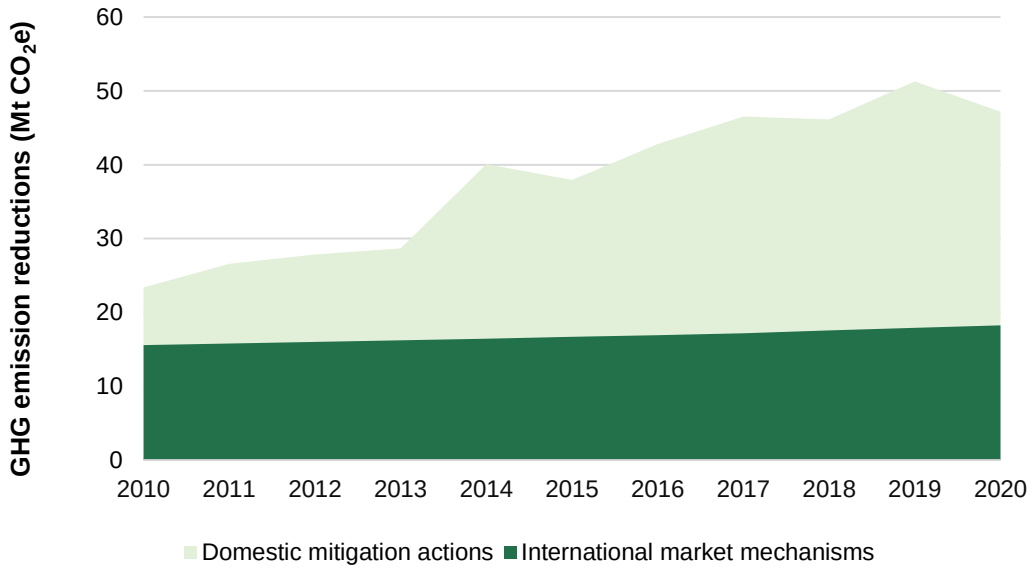


Figure 3.9: Emission Reductions from Domestic Mitigation Actions and International Market Mechanism projects

The accumulative emission reductions for these projects are 10.82 Mt CO_2e (Table 3.6). Sectoral contributions are 43% from energy; 29% from IPPU; 28% from Waste and 0% from AFOLU. Information about 58 carbon credit projects is provided in Table 3.7 to Table 3.10**.** Of these 58 projects, there are 32 Clean Development Mechanism (CDM) projects; 12 are Verified Carbon Standard (VCS) projects and 14 are Credible Carbon projects. There are 23 energy-related projects; 5 IPPU-related projects; 18 waste projects and 2 AFOLU-related projects.

Table 3.6: Summary of the South African IMM project emission reductions

Year	Savings ($MtCO_2e$)				
	Energy	IPPU	AFOLU	Waste	Total
2010	0.27	1.16	0.0000	0.21	1.64
2011	0.33	1.08	0.0019	0.24	1.66
2012	0.35	0.40	0.0055	0.38	1.13
2013	0.64	0.06	0.0006	0.98	1.69
2014	0.59	0.44	0.0002	0.26	1.29
2015	0.08	0.00	0.0002	0.23	0.31
2016	0.12	0.00	0.0002	0.21	0.33
2017	0.94	0.00	0.0019	0.25	1.19
2018	0.83	0.00	0.0049	0.12	0.96
2019	0.28	0.00	0.0049	0.06	0.34
2020	0.22	0.00	0.0035	0.07	0.30
TOTAL	**4.66**	**3.15**	**0.0240**	**2.99**	**10.82**

Table 3.7: Emission reduction of actions in the Energy sector

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Bethlehem Hydroelectric project, South Africa	A hydroelectricity project which will be distributed into the currently coal intensive South African grid.	From 2009-2023	0.39	CO_2	366 737	Energy Industries	CDM	Registered with Issuances
Coega Industrial Development Zone Windfarm, South Africa	Construction and operation of 25 wind turbines which will generate 141.7 GWh annually.	From 2013-2020	0.86	CO_2	29 913	Energy Industries	CDM	Closed
Bokpoort Concentrating Solar Power Project, South Africa	The purpose of the proposed project activity is to reduce green- house gas emissions by installing a greenfield grid-connected parabolic trough concentrated solar thermal power plant. This type of technology is clean, safe, sound and environmentally friendly in comparison to conventional sources of fossil fuel power generation in South Africa.	From 2016-2026	1.03	CO_2	811 048	Energy Industries	CDM	Registered with Issuances
Transalloys Manganese Alloy Smelter Energy Efficiency Project, South Africa	An industrial energy efficiency project that will reduce the electricity consumption in the production of silicomanganese alloy (a key component in steel making) at its Witbank facility in South Africa.	From 2004-2014	0.61	CO_2	1 259 415	Energy Industries; metal production	CDM	Closed
The Capture and Utilisation of Methane at the Sibanye Gold Owned Beatrix Mine, South Africa	The proposed project activity involves the destruction and utilisation of methane at this mine.	From 2011-2020	2.24	CH_4, CO_2	89 966	Fugitive emissions from industrial gases	VCS	Closed
Use of waste gas at Namakwa Sands, South Africa	The project will use cleaned furnace off-gas, which was previously flared, to generate electricity using internal combustion engines. The actual quantity of gas available for the project depends on the furnace	From 2013-2022	0.68	CO_2	284 710	Energy Industries; Manufacturing Industries	CDM	Closed

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
	performance and availability.							
Green Power for South Africa	The objective of the proposed programme of activities is to install wind and solar projects to generate electricity. The generated electricity will be connected to the national grid.	From 2011-2039	9.87	CO_2	598 331	Solar PV	CDM	Registered with Issuances
Solar Academy of Sub Saharan Africa (SASSA) Low Pressure Solar Water Heater Programme, South Africa	The objective of the programme of activities is to install South African Bureau of Standards approved non-pressure storage tank and vacuum tube solar collectors of Solar Academy of Sub Saharan Africa (SASSA) to low-income households.	From 2011-2038	2.61	CO_2	99 170	Solar Water Heating	CDM	Registered with Issuances
South Africa Renewable Energy Programme (SA-REP), South Africa	The purpose of the Programme of Activities is to support the development and implementation of small-scale grid connected renewable energy projects.	From 2012-2040	0.51	CO_2	88 537	Solar, Wind and Other	CDM	Registered with an Issuance Request
Kuyasa low-cost urban housing energy upgrade project, Khayelitsha, Cape Town, South Africa	Energy efficiency project involving the installation of solar water heaters, ceiling insulation and compact fluorescent light bulbs (CFLs) in government subsidised houses.	From 2005-2012	0.05	CO_2	9 532	Household energy efficiency	CDM	Closed
Saving the Planet, One Stew at a Time, South Africa	This project regards broad adoption of a heat-retention-cooking device in kitchens throughout South Africa. By using the device trademarked the "Wonderbag".	From 2010-2020	0.63	CO_2	25 371	1. Energy (renewable / non-renewable	VCS	Closed

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Longyuan Mulilo De Aar 2 North Wind Energy Facility, South Africa	The project envisages the installation of a new grid connected wind farm on a farm located in the Pixley Ka Seme District close to the town of De Aar in the Northern Cape Province.	From 2017-2020	0.87	CO_2	457 457	1. Energy (renewable / non-renewable	VCS	Closed
Longyuan Mulilo De Aar Maanhaarberg Wind Energy Facility, South Africa	The project envisages the installation of a new grid connected wind farm on a farm located in Swartkoppies and Maanhaarberg mountains to the south west of the town of De Aar in the Northern Cape Province.	From 2017-2020	1.13	CO_2	568 713	1. Energy (renewable / non-renewable	VCS	Closed
Sun exchange	Sun Exchange is a privately owned micro scale solar PV project developer. The business supports the financing of rooftop solar PV projects for smaller organisations.	2020 - 2041	0.00	CO_2	5 806	Solar PV	Credible Carbon Credits	Registered
uMdoni	The project involves support for the sustained roll-out of bioethanol gel-fuel for bio-fuel stoves to over 4,000 rural households in the Umdoni Municipality. Coal, wood, paraffin and dung fuel sources are replaced with bioethanol gel (a by-product of the local sugarcane industry).	2012 - 2020	0.01	CO_2	9 806	Fuel switch to gel fuel stoves	Credible Carbon Credits	Closed
Grootbos Carbon Project Solar PV generation	A solar PV array has been installed in Grootbos Private Nature Reserve to power facilities that are not connected to the national electricity grid	2018 - 2030	0.00	CO_2	145	Off-grid Solar PV	Credible Carbon Credits	Registered

Table 3.8: Emission reduction of actions in the IPPU sector

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Project for the catalytic reduction of N_2O emissions with a secondary catalyst inside the ammonia reactor of the No. 9 nitric acid plant at African Explosives Ltd ("AEL"), South Africa	The sole purpose of the proposed project activity is to significantly reduce current levels of N_2O emissions from the production of nitric acid at one of AEL's nitric acid plants (the "No. 9 Plant") at Modderfontein, South Africa.	From 2007-2019	1.28	N_2O	348 255	Chemical industries	CDM	Closed
Sasol Nitrous Oxide Abatement Project, South Africa	Nitrous Oxide (N_2O) is an undesired by-product gas from the manufacture of nitric acid. Nitrous oxide is formed during the catalytic oxidation of Ammonia. Over a suitable catalyst, a maximum 98% (typically 92-96%) of the fed Ammonia is converted to Nitric Oxide (NO).	From 2007-2021	7.68	N_2O	5 999 872	Chemical industries	CDM	Closed
Omnia N_2O Abatement Project II, South Africa	A new nitric acid plant is currently being built and expected to be commissioned in the first half of 2012. This new plant is designed by Uhde GmbH with a confirmed production capacity of 400,000 tonnes 100% concentrated nitric acid per year.	From 2012-2022	3.13	N_2O, CO_2	1 696 219	Chemical industries	CDM	Registered
Omnia Fertiliser Limited Nitrous Oxide (N_2O) Reduction Project, South Africa	The project activity involves the installation of an N_2O catalytic Destruction Facility, EnviNox™, in the tail gas section of the process downstream of the absorption column at Omnia Fertiliser nitric acid plant in Sasolburg, South Africa.	From 2008-2022	3.79	N_2O, CO_2	3 439 556	Chemical industries	CDM	Registered
N_2O abatement project at AEL 11_, South Africa	This project aims at reducing waste gas emissions of nitrous oxide (N_2O) produced during the production of nitric acid (HNO_3).	From 2008-2028	1.08	N_2O	2 376 481(CDM); 55 974 (VCS)	Chemical industry	VCS	Registered

Table 3.9: Emission reduction of actions in the AFOLU sector

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS (MtCO2) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Grootbos Carbon Project Controlled burning	The use of controlled, low intensity prescribed burning of the fynbos vegetation helps to reduce the risk of unplanned wildfire across the full extent of the Grootbos Private Nature Reserve nature reserve.	2018 – 2030	0.01	CO_2	7 219	Biomass burning	Credible carbon credits	Registered
Grootbos Carbon Project Reforestation	Active tree planting and related reforestation and forest rehabilitation activities promote the restoration of indigenous hardwood forests in the Grootbos Private Nature Reserve nature reserve and improve the carbon sequestration potential of the forest areas.	2018 – 2030	0.00	CO_2	237	Forestry	Credible carbon credits	Registered
Spier Mob Grazing – regenerative agriculture	On this land regenerative agriculture is practised, with an emphasis on high-density "mob-grazing". This technique involves frequent stock rotations (cattle are moved up to 6 times a day) aimed at "using livestock to mimic nature" and restoring carbon and nitrogen contained in livestock and poultry urine to the soil profile.	2011 - 2032	0.02	CH_4, N_2O	25 385	Agriculture	Credible carbon credits	Registered

Table 3.10: Emission reductions of actions in the Waste sector

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
EnviroServ Chloorkop Landfill Gas Recovery Project, South Africa	The objective of the project is to extract landfill gas at the Site and combust the landfill gas (LFG) by flaring. Landfill gas consists of approximately 50% methane, which has a global warming potential 211 times greater than CO_2. Through the destruction of methane, the emissions of greenhouse gases are reduced.	From 2008-2022	1.76	CH_4, CO_2	560 165	Energy Industries; Waste	CDM	Closed
Ekurhuleni Landfill Gas Recovery Project, South Africa	The Ekurhuleni Metropolitan Municipality (the EMM) is proposing a CDM project activity at four landfills owned by the EMM in Gauteng province, South Africa. Greenhouse gas emission reductions will be achieved by the combustion of recovered methane contained in landfill gas that would be otherwise emitted to the atmosphere and by the generation of electricity from the gas which will displace largely coal-fired power generation on the South African grid.	From 2010-2017	2.45	CH_4, CO_2	62 526	Waste Handling and Disposal	CDM	Closed

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
PetroSA Biogas to Energy Project, South Africa	PetroSA is a state-owned corporation that has since 1987 operated a gas to liquids plant at Duinzicht, some 12 kilometres from the town of Mossel Bay on the south coast of South Africa. The production process at Duinzicht leads to waste process water that since the inception of the Plant has been dealt with by way of anaerobic digestion. The anaerobic digestion is continuous and a critical process for the operation of the PetroSA plant. In the anaerobic digestion process biogas is naturally generated.	From 2006-2017	0.33	CH_4, CO_2	32 730	Waste	CDM	Closed
Tugela Mill Fuel Switching Project, South Africa	Coal fired boilers were used at Tugela Mill to generate steam used for the production of pulp and linerboard. During the production of this pulp and linerboard, bark was generated as waste which was landfilled. The boiler bed and fuel feed conveyor system for the coal fired boiled has been replaced with a biomass-fired fluidised bed boiler. The biomass fired boiler uses the bark waste as feedstock instead of disposing this waste into the landfill.	2007-2015	0.45	CH_4, CO_2	104 938	Waste Handling and Disposal	CDM	Closed
Durban Landfill-gas-to-electricity project Mariannhill and La Mercy Landfills, South Africa	The project involves the recovery of landfill methane for electricity generation.	From 2006-2020	0.99	CH_4, CO_2	154 088	Landfill Power	CDM	Closed
City of Cape Town Landfill Gas Extraction and Utilisation Programme, South Africa	The objective of the programme of activities is to capture and combust landfill gas (LFG) to generate electricity and heat at solid waste disposal sites (landfills) in the municipality of Cape Town, South Africa.	From 2014-2021	1.62	CH_4, CO_2	241 511	Landfill Gas	CDM	Closed

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Reliance Composting Project in Cape Town, South Africa	Reliance composting company collects green waste from drop-off facilities within the City of Cape Town Municipality (CoCT) that is used to produce compost.	From 2008-2027	1.56	CH_4, CO_2	1 602 373	Biological treatment of waste	Credible carbon and VCS credits	Registered VCS
Interwaste Landfill gas Grouped Project, South Africa	Interwaste has developed a municipal waste landfill gas recovery project and is looking towards producing compressed biogas fuel that can be supplied into external customers with the distribution in trucks. The project instance is located at the Interwaste Frik Groenewald landfill site.	From 2016-2016	0.12	CH_4, CO_2	41 396	Energy (renewable / non- renewable) waste	VCS	Closed
Johannesburg Landfill Gas to Energy Project, South Africa	The objective of the project is to collect and destroy / utilise the LFG generated at the Johannesburg landfill sites.	From 2012-2020	0.21	CH_4, CO_2	27 832	Waste handling and disposal	VCS	Closed
Durban Landfill-Gas Bisasar Road, South Africa	The project consists in an enhanced collection of landfill gas at the Bisasar Road landfill site of the municipality of Durban and the use of the recovered gas to produce electricity. The produced electricity will be fed into the municipal grid and replace electricity that the municipal electric company is currently buying from other suppliers.	From 2009-2023	1.89	CH_4, CO_2	418 980	Waste handling and disposal	VCS	Registered

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
Walker's Recycling	Walkers Recycling is a South African business (Pty, Ltd) based in Coleman Park, in the Elsie's River industrial area of Cape Town. Walkers Recycling operates a vehicle fleet that collects waste from homes, restaurants and nightclubs for sorting by team of employees. The business sorts and on-sells the recyclable material that would otherwise end up in a municipal landfill	2012 - ongoing	0.01	CH_4, CO_2	14 254	Waste handling and disposal	Credible carbon credits	Registered
Grootbos Carbon Project waste recycling	Recycling of cans, bottles, plastics and cardboards waste collected in Grootbos Private Nature Reserve that would have otherwise gone to landfill	2020 - 2030	0.00	CH_4	17	Waste handling and disposal	Credible carbon credits	Registered
Grootbos Carbon Project composting	The collection of greenwaste and food waste that would have otherwise gone to landfill. The collected waste is composted.	2020 - 2030	0.00	CH_4	15	Biological treatment of waste	Credible carbon credits	Registered
The PACE Centre - Wildlands Recycling Project	Enables the establishment of local recycling operations, focused around community based "waste--preneurs", schools and local businesses in Gauteng and KwaZulu--Natal.	2010 - 2020	0.01	CH_4, CO_2	10 457	Waste handling and disposal	Credible carbon credits	Closed
Hout Bay Recycling Co-op	A social enterprise started by Thrive Hout Bay saw residents of Imizamo Yethu township in Hout Bay begin recycling in 2009.	2009 - ongoing	0.00	CH_4, CO_2	4 611	Waste handling and disposal	Credible carbon credits	Registered
Stellenbosch Community Recycling	The Stellenbosch Community Recycling Project is owned and operated by CL Trading who has established local recycling operations, focused on community-based waste collectors.	2019 - 2031	0.02	CH_4, CO_2	39 977	Waste handling and disposal	Credible carbon credits	Registered
ReCarbon Ground Trading Uitenhage Composting	ReCarbon Ground Trading company in Uitenhage diverts food, liquid waste	2019 - 2021	0.00	CH_4, CO_2	8 014	Biological treatment of waste	Credible carbon credits	Closed

NAME OF PROJECT	PROJECT DESCRIPTION	TIME HORIZON	ACTUAL EMISSION REDUCTIONS ($MtCO_2$) IE. RESULTS ACHIEVED TILL 2020	COVERAGE (GREEN-HOUSE GAS TARGETED)	AMOUNT OF CREDITS ISSUED	SUB-SECTOR	CREDIT TYPE	PROJECT STATUS
	and sawmill matter from landfill to be used in the production of compost.							
ReCarbon Hermanus Composting	The project by ReCarbon Ground Trading company entails diverting municipal green waste (plant residues, garden waste, park waste) from landfills in the Overstrand Municipality (Hermanus) Western Cape. The diverted green waste is used to produce compost	2018 - 2021	0.01	CH_4, CO_2	30 209	Biological treatment of waste	Credible carbon credits	Closed

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4. Financial resources, technology transfer, capacity building and technical support received and needs

4.1. Introduction

The chapter provides an update from the previous Biennial Update Reports (BURs) on financial, capacity and technical support received and needed by South Africa. South Africa is gearing up domestic action to achieve its enhanced ambition under the Paris Agreement. Since reporting in the 4th Biennial Update Report (covering the period from 2018-2019) the country has made milestones in climate change policy space. Government is implementing several policy interventions which will need to be matched with adequate finance, technology and capacity building support. The Change Bill, currently undergoing parliamentary promulgation process, will steer national efforts to move towards enhancing climate action implementation at scale. The country has defined and adopted a clear roadmap on climate change mitigation and adaption. In the case of climate change mitigation, the Low Emission Development Strategy (2050) submitted to the UNFCCC in 2018 provides an overarching framework for achieving the country's mitigation ambition under the Paris Agreement in line with the NDC commitment. The country's roadmap on adaptation is guided by the National Climate Adaptation Strategy adopted by government in 2017. The South African updated NDC states that implementation of these strategic interventions will require sustained, scaled up financing and capacity building support. The revised NDC states that its ''implementation and ambition will be enabled by finance, technology and capacity building support'.

The National Development Plan (NDP) provides a '2030 vision' to guide South Africa's sustainable development and advocates for a transition to a low-carbon, resilient and just society. The Integrated Resources Plan (IRP 2019), the Energy Act, the National Energy Efficiency Strategy (NEES), as well as the Climate Change Bill, all serve as blueprints that provide guidance on how the country has determined to embark on an envisioned low-carbon transition path and reduce its GHG emissions, with particular focus on highly energy intensive sectors.

The gateway for realising full finance mobilisation will be through the yet to be developed National Climate Finance Strategy which will inform the country's climate finance mobilisation plan of action. The strategy will take a holistic view of climate finance activities and will cover all aspects of climate finance, including: the quantum of climate finance required; identifying

stakeholders and activities along the climate finance value-chain; increasing climate finance flows from different types of finance providers (e.g.: bilateral finance, multilateral finance, domestic public finance and private sector finance), monitoring and evaluation and climate finance governance structures.

To realise the country's ambition under the Paris Agreement, the country is aiming to mobilise the much-needed climate change finance resources to achieve the minimum target of at least USD 8 billion per annum by 2030 to benefit the up-scaled ambitions defined in the revised NDC. However, at this stage South Africa has not been successful in accessing climate finance on a transformational scale to match its NDC targets and ambitions. Government is pursing efforts to enhance its domestic and international climate finance base as well as its implementation readiness on mitigation and adaptation, as stipulated in the country's revised NDC. South Africa has potential to attract financing for the energy transition that could have global scale mitigation benefit. There are indications that the development and implementation of the full swing of the National Climate Finance strategy will bear fruit over time.

Government is intent on fast-tracking climate finance mobilisation. In 2021 the country secured a joint bilateral cooperation with the European Union, Government of Germany, the United States, the United Kingdom and France that cumulatively, have pledged to mobilise an initial US$8.5 billion over three to five years which will be in the form of range of instruments, including grants and highly concessional finance. This package of a pledge was confirmed by collaborating bilateral partners at the COP26 climate conference in Glasgow. These resources will be allocated primarily to the implementation of the Integrated Resource Plan (IRP) 2019 programme that aims to transition the country from the predominately coal-based energy source to a renewable energy source. The presidential Climate Finance Task Team has been instituted to mobilise funds for 'just transition' under the Presidency.

The current update on financial resources, technology transfer, capacity building and technical support received and needs, covers the period from January - December 2020 only. The country's upcoming Biennial Transparency Report (BTR) which is currently in preparation will include the information for the period 1 Jan 2021 – 31 Dec 2022. Selected sections in the chapter, for example, Section 4.3.4 Non-monetised support received, will include information from 2021 to highlight the country's progress towards preparing for reporting considering modalities, provisions and guidelines for the Enhanced Transparency Framework. Furthermore, it is also for this reason, that where possible, the format of tables presented in this sought to follow that of the BTR tables in Decision 5/CMA.3. Note, due to limited space in presenting tables, selected columns were not illustrated in the chapter, however, this information for these columns is included in the Excel spreadsheets for the relevant sections that supported the compilation of the chapter.

This chapter presents an analysis of international and domestic climate-related finance flows, as well as non-monetised support, received within the reporting period. 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, 2011). The report also includes financial support needed (or requested) by South Africa to develop its response to climate change by sector as well the description of non-monetised technical and capacity-building needed.

4.2. South Africa climate finance update – progress since previous BUR

Climate Finance Landscape Analysis

Since the previous reporting period (2018-2019 in BUR-4) (DFFE, 2021), South Africa undertook a comprehensive analysis of South Africa's Climate Finance Landscape (CPI, 2021) to establish a baseline of information that aims to inform future analysis of climate finance in South Africa. The report tracked annual climate finance totalling R 62.2 billion for 2017 and 2018 providing a comprehensive picture of private, public and blended climate finance flows in South Africa by compiling available data on climate finance from a range of national and international sources.

It also aimed to identify gaps, needs and potential barriers to climate finance flows. Key issues and aspects examined by the study included the determination of climate finance flowing through the South African economy, domestic stakeholders providing climate finance, the identification of stakeholders handling climate finance, the financial instruments and mechanism currently being applied in South Africa and the quantification of finance that was spent on supporting mitigation and adaption in South Africa. The assessment continues to assist policy making by informing sectoral strategies and policies on climate finance and will also supporting the tracking of climate finance in the country. ***Climate Finance Accelerator (CFA)***

South African launched the Climate Finance Accelerator (CFA) in 2021. The purpose of the programme is to improve the flow of finance to low carbon projects in South Africa. The CFA is a global technical assistance programme funded by the UK International Climate Finance to

support countries efforts in implementing their NDCs under the Paris Agreement. The programme supports climate project proponents to improve the bankability and appeal to financiers of their projects. A Climate Budget Tagging (CBT) system will be implemented to quantify and track expenditure on climate relevant activities.

Climate Budget Tagging (CBT) system

Under the auspices of the National Treasury, South Africa is developing a CBT system to support climate-centric budget reform. CBT involves classifying and tagging public expenditure according to its expected contribution to climate change mitigation or adaptation. The intent is to implement a CBT system at all three levels of government (national, provincial and local government), given the distribution of expenditure responsibilities in key climate change sectors. The Stakeholders of CBT include the Department of Forestry, Fisheries and the Environment (DFFE), Department of Planning, Monitoring and Evaluation in the Presidency (DPME), Cooperative Governance and Traditional Affairs (CoGTA) and provincial and local government representatives. The process is funded by the World Bank.

Since reporting in the previous BURs South Africa has been devoting efforts to enhance its reporting on climate finance to inform domestic decision making as well meeting its reporting provisions under the UNFCCC. The DFFE in partnership with National Treasury (NT) and other key role-players have initiated the development of National Climate Finance Strategy to inform South Africa's efforts to mobilise, direct and co-ordinate flows of finance to address climate change imperatives and address the national triple challenge of poverty, unemployment and inequality. The strategy will be informed by and respond to inputs from key stakeholders and implemented in collaboration with key stakeholders, to enhance the national climate change response and key implementation systems and actions. A National Climate Finance Strategy for South Africa is built on a shared vision and common understanding of South Africa's finance mobilisation approach and will enable a coordinated, long-term, inclusive and participatory national approach to resource mobilisation across the entire chain value of South Africa's climate change response sector. The strategy will provide the impetus for collaborative action by government, private sector and civil society, to respond to the South Africa's climate change priorities and realise sustainable development goals, while addressing the national social and economic challenges and will thus give effect to South Africa's commitment to mobilising the resources that are necessary for both mitigation and adaptation.

Green Finance Taxonomy

South Africa’s Green Finance Taxonomy (GFT) project was developed by the Taxonomy Working Group, as part of South Africa’s Sustainable Finance Initiative, chaired by National Treasury. The first edition of the South African Green Finance Taxonomy (GFT 1st Edition) (NT, 2022) outlines the results of the work to date in developing the 1st Edition of the South African Green Finance Taxonomy for environmentally sustainable economic activities.

A draft Technical Paper on “Financing a Sustainable Economy” was published by NT in May 2020 with the aim of unlocking access to sustainable finance and stimulating the allocation of capital to support a development-focused and climate-resilient economy. A recommendation in this technical paper was to “develop or adopt a taxonomy for green, social and sustainable finance initiatives, consistent with international developments, to build credibility, foster investment and enable effective monitoring and disclosure of performance”.

A green finance taxonomy is an official classification or catalogue that defines a minimum set of assets, projects, activities and sectors that are eligible to be defined as “green” or environmentally friendly in line with international best practice and national priorities. The intended users of the green finance taxonomy are investors, issuers and other financial sector participants to track, monitor and demonstrate the credentials of their green activities in a more confident and efficient way (NT, 2022).

4.3. Support received

Climate finance support 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’ if more than one country/entity provides 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.

The financial support committed and non-monetised capacity building and technology support received from international donor funding sources, as well as domestic funds committed through government grants and loans, are reported in the section henceforth.

4.3.1. International financial support received

Detailed information on the breakdown of the international bilateral and multilateral financial support received between 2000 and 2014 was presented in South Africa’s BUR-1 (Tables 28 and 29) (DEA, 2014) and BUR-2 (Tables 34 and 35) (DEA, 2017). Support received during the reporting period, 1 Jan 2015 - 31 Dec 2017 was reported in BUR-3 (4.1 and 4.2) (DEA, 2019) and the BUR-4 provided this information for the period 2018 to 2019 (Tables B1.1 and B2.1) (DFFE, 2021). The current update in the BUR-5 provides information on additional climate finance flows recorded for the period 2020. Tables 4.1 and 4.2 provide information on bilateral financial support and multilateral financial support committed between 1 Jan to 31 Dec 2020, respectively. Data is not reported for 1 Jan – 31 Dec 2021 in this section since it will be reported

in the country's upcoming Biennial Transparency Report (BTR) which is currently in preparation. The BTR will include the information for the period 1 Jan 2021 – 31 Dec 2022.

The International Climate Finance that is unlocked through the COP process is channelled through the COP Financing Mechanism which currently consists of three Funds: the Green Climate Fund (GCF), the Global Environmental Fund (GEF) and the Adaptation Fund. The Green Climate Fund is suited for renewable energy projects. The Development Bank of Southern Africa (DBSA) is an Accredited Entity in South Africa through which project proposals can be submitted to the Green Climate Fund for funding consideration. The DBSA also manages South Africa's Green Fund and manages a Climate Finance Facility. A Project Preparation Facility which provides support and finance for early project preparation is also hosted through the DBSA and this can assist in bringing project proposals to a level of bankability. The World Bank, International Union for Conservation of Nature (IUCN) and Energy Environment Partnership Africa (EEPA) were among other implementing agencies listed under multilateral support received in 2020.

Over the reporting period for 2020, South Africa received in excess of USD$ 703 in bilateral support and US$ 469 million from multilateral sources that support or benefit climate change actions in the country. The bilateral support was in the form of grants, technical assistance and loans, while the multilateral support was mainly in the form of grants. Overall, Germany accounted for the largest share of climate finance committed in 2020, supporting the Energy sector. In terms of multilateral funding, the GCF and IUCN contributed 39% and 36% of the total multilateral support received, respectively, followed by the GEF (22%) (Figure 4.1).

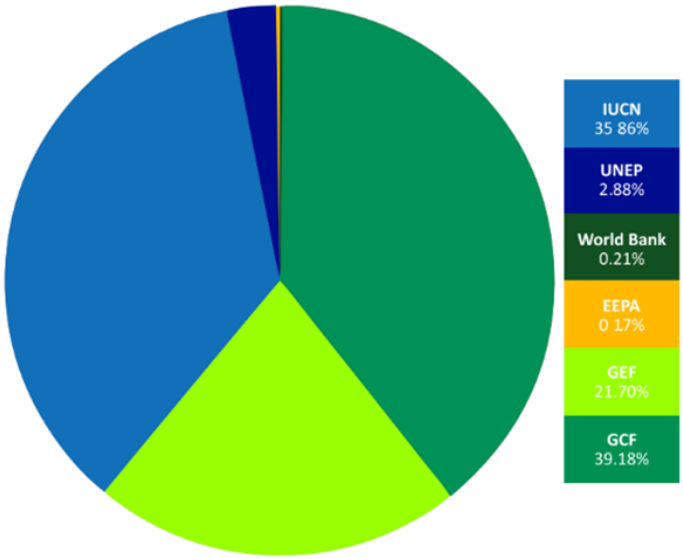

Figure 4.1: Percentage contribution of multilateral support per donor funder between 1 Jan – 31 Dec 2020

Table 4.1: Bilateral financial support committed between 1 Jan to 31 Dec 2020

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
Switzerland	The Cities Support Programme (CSP) - Phase II	The Cities Support Programme (CSP) is an initiative of the South African Government to support cities in sustainable urban development, efficient public investment and an improved business enabling environment.		State Secretariat for Economic Affairs (SECO)	9 198 280	161 889 728	9 829 370	01-04-2020	31-12-2024	Grant	Cross-cutting	Finance
Switzerland	INCA Municipal Debt Fund and Capacity Building Fund	To mobilise local institutional investors into the secondary cities' infrastructure debt market, the Agence française de développement (AFD) has committed to invest to a new Municipal Debt Fund. SECO is providing a First Loss Facility, which covers any late payments and defaults on the loans granted by the Municipal Debt Fund and is thus acting as an important liquidity buffer and credit enhancement. Objectives are 1) An improved access to better urban		State Secretariat for Economic Affairs (SECO)	5 850 000	102 960 000	6 251 366	01-10-2020	30-09-2038	INCA Municipal Debt Fund	Cross-cutting	Infrastructure

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
		infrastructure services through municipal infrastructure investments that support sustainable economic growth and help mitigate/ adapt to climate change risks. 2) The strengthening of municipal authorities to realise their economic potential and improve the quality of life for their citizens.										
Switzerland	Piloting Phase: Transition from Learning to Earning and Jobs retention	The piloting phase was aimed at addressing the quality and relevance of skills development. The piloting phase is part of an ongoing program, the Skills Development for Green Economy II (2018-2022) and aims to complement this program by working mainly on the demand side of skills development, i.e., with the private sector. Its overall objective is to improve the		State Secretariat for Economic Affairs (SECO)	1 610 000	28 336 000	1 720 461	01-08-2020	31-05-2022	Grant	Cross-cutting	

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
		quality of technical vocational education and training and skills development in South Africa regarding its labour market relevance.										
Switzerland	Global Eco-Industrial Parks Programme-South Africa country level intervention	This project will address Eco-Industrial Parks development in South Africa, under the framework of the Global Eco-Industrial Parks Programme (GEIPP) in Developing and Transition Countries currently implemented by UNIDO and funded by the Government of Switzerland through its State Secretariat of Economic Affairs.	DTI, DFFE	UNIDO, State Secretariat for Economic Affairs (SECO)	995 575	17 522 120	1063880.996	01-Oct-20	30-Jul-23	Grant	Cross-cutting	Industry

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
Germany	JETP Policy-based loan to National Treasury	Support of the implementation of comprehensive energy sector reforms to meet South Africa's commitments under the Paris Climate Agreement and the NDC	National Treasury	DMRE, DFFE,DOT	300 000 000	4 929 000 000	347 400 000	2020	TBD	Loan	Mitigation	Energy
Germany	Climate Support Programme 4	Support to implementation of national climate and biodiversity policies	National Treasury		10 000 000	164 300 000	11 580 000	2020	TBD	Technical assistance	Adaptation	
Germany	Support to the Energy Sector Reform Programme	Promotion of a sustainable energy transition, e.g., by expanding renewable energy capacities			200 000 000	3 286 000 000	231 600 000	2020	TBD	Loan	Mitigation	Energy
Germany	Investments in the Power Sector Reform Programme	Promotion of a sustainable energy transition, e.g., by expanding renewable energy capacities			7 000 000	115 010 000	8 106 000	2020	TBD	Grant	Mitigation	Energy
Germany	Innovative Financing of Green Infrastructure	Promotion of municipal investments in renewable energies, including the establishment of a sustainable refinancing mechanism for a municipal energy fund	Private entities		20 000 000	328 600 000	23 160 000	2020	TBD	Grant	Mitigation	Energy
Germany	Just Transition to a Decarbonised Economy for	Establishment of framework conditions to achieve a just transition to an			15 000 000	246 450 000	17 370 000	2020	TBD	Technical assistance	Cross-cutting	Energy

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
	South Africa (JUST SA)	environmentally sustainable, climate change resilient, low carbon economy and just society; reducing barriers to decarbonise the SA energy sector; support to environmental rehabilitation of mining sites										
Germany	Pathways to PtX - Support to the development of a national hydrogen strategy	Support the development of sustainable markets for hydrogen (H2) and H2 based synthetic products (PtX) in South Africa and other countries.			3 000 000	49 290 000	3 474 000	2020	TBD	Technical assistance	Mitigation	Energy
Germany	South African German Energy (SAGEN) Programme 4	Integration of renewable energy (especially solar energy) into the existing energy grid as well as measures to increase energy efficiency are promoted in cooperation with municipalities, the energy supplier ESKOM and the Ministry of Energy	Department of Mineral Resources and Energy (DMRE)/Various		12 500 000	205 375 000	14 475 000	2020	TBD	Technical assistance	Mitigation	Energy
Germany	Career Path Development for Employment (CPD4E)	Employment Promotion in Green Economy/Energy Transition			6 000 000	98 580 000	6 948 000	2020	TBD	Technical assistance	Mitigation	Energy

Donor	Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	Foreign currency	Domestic currency (ZAR)	USD	Start date	End date	Financial instrument	Type of support	Sector
Germany	Support to Climate Policy and Decarbonisation Strategy Development	Support to Climate Policy and Decarbonisation Strategy Development			10 000 000	164 300 000	11 580 000	2020	TBD	Technical assistance	Mitigation	Energy
Germany	Skills and Employment Challenge Programme	Investment program for the promotion of skills development and employment for SMEs in township economies including future economic activities in renewable energy	National Treasury		8 000 000	131 440 000	9 264 000	2020	TBD	Grant	Mitigation	Energy

Table 4.2: Multilateral financial support committed between 1 Jan to 31 Dec 2020

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
Air Quality Management in the Greater Johannesburg Area	The project's development objective is to improve South Africa's capacity to address air pollution levels and support development of full-scale Air Quality Management (AQM) plans in the Greater Johannesburg Area (GJA).	National Treasury	World Bank	16 470 000	1 000 000	Grant	Mitigation	Air quality	Completed installation and functionality of air quality management equipment and monitors; Completed procurement of targeted air quality management equipment.
Supporting inclusive green economy approaches to sustainable development	Science-based approaches that support the transition to sustainable development through multiple pathways, including an inclusive green economy and sustainable trade and adoption of sustainable consumption and production patterns at all levels	CAEP, TIPS	UNEP	223 035 208	13 541 907	Grant	Adaptation	Infrastructure	Dialogues, webinars, consultations, launch events and workshops.
Women in Biodiesel: Empowering a Green Future for All	This project will pilot decentralised biodiesel production and distribution by establishing 10 women-owned enterprises that will produce and sell biodiesel made from used cooking oil (UCO) collected from local restaurants. iLive and its partners will provide the technology, business acceleration support	iLive Sustainable Development	Energy Environment Partnership Africa	8 676 736	526 821	Grant	Mitigation	Biofuels Liquid	The 10 women-owned businesses are expected to scale up to producing and distributing 3 million litres of biodiesel per annum. This will support 30,000 MWh per year and annually reduce an estimated 7,900 tonnes of CO_2e emissions. The project will create 75 jobs (70% for women) and enhance access to clean energy for over 3,000 people, resulting in annual energy savings of EUR 370,000 (USD 391 719)

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
	and market access, as well as offering guaranteed off-take of excess biodiesel.								
Wastewater-to-energy project	This project is a feasibility study that aims to bring stand-alone, off-grid wastewater-to-energy plants to financial close at two sites of a fast-moving consumer goods (FMCG) manufacturer.	Talbot	Energy Environment Partnership Africa	4 498 261	273 118	Grant	Mitigation	Wastewater treatment	The project is expected to lead the way for energy and water recovery in the fast-moving consumer goods (FMCG) sector in Africa. Once implemented, the two plants will add 3.3 MW renewable energy generation capacity, resulting in 4,186 tonnes in avoided CO_2e emissions and over 850 million litres of recovered water per year.
Preparation of South Africa's Fourth National Communication and Fifth Biennial Update Report under the UN Framework Convention on Climate Change (UNFCCC)	To support the Republic of South Africa, prepare and submit its Fourth National Communication (NC4) and Fifth Biennial Update Report (BUR5) that comply with the United Nations Framework Convention on Climate Change (UNFCCC) reporting requirements while responding to its national development goals.	UNDP/ DFFE	GEF trust fund, UNEP	14 032 440	852 000	Grant	Cross-cutting	Various	Republic of South Africa prepares and submits its Fourth National Communication (NC4) and Fifth Biennial Update Report (BUR5) that comply with the United Nations Framework Convention on Climate Change (UNFCCC) reporting requirements while responding to its national development goals.
Environmentally Sound Management and Disposal of PolyChlorinated Biphenyls [PCBS] in the Republic of South Africa	To reduce and eliminate the use and releases of PCBs to the environment through development and implementation of the environmentally sound management (ESM) and disposal of PCBs and PCB-contaminated	Africa Institute	GEF trust fund, Development Bank of Southern Africa	135 753 975	8 242 500	Loans - DBSA	Mitigation	Chemicals and waste	Key institutions are enabled to manage PCBs in an environmentally sound manner and awareness raised on the adverse effects of PCBs; Collection and final treatment and disposal of PCBs and PCB contaminated oil, equipment and wastes;

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
	oil, equipment and wastes in South Africa.								
Leapfrogging South Africa's Markets to High Efficiency LED Lighting and High Efficiency Distribution Transformers	Accelerating South Africa's efforts to transition the economy to energy-efficient products, by a) developing South Africa's market for LEDs on the electricity demand-side; and, b) developing South Africa's market for high-efficiency distribution transformers on the electricity supply-side, resulting in climate change mitigation, stable power supply and therefore economic development and improved energy access.	Department of Energy (DOE)	GEF trust fund, UNDP, Development Bank of Southern Africa	1 474 559 100	89 530 000	Grant	Mitigation	Energy	Promote the timely development, demonstration and financing of low carbon technologies and mitigation options; Strengthened government capacity and regulatory frameworks for LEDs and distribution transformers; Awareness, knowledge and capacity enhancement of end-users, municipalities and private sector.
Nature-based Solutions for transforming smallholder farming systems that are vulnerable to the impacts of climate change in South Africa	The proposed project will adopt a participatory, action-learning approach using nature-based solutions to enhance the resilience of smallholder farmers in vulnerable catchments in the provinces of KwaZulu-Natal, Eastern Cape, Mpumalanga and possibly Limpopo in South Africa.	South African National Biodiversity Institute	Green Climate Fund (GCF)	329 400 000	20 000 000	Grant	Adaptation	Agriculture	The proposed GCF project will contribute to two strategic level Adaptation impacts: GCF Results Framework Outcome 1.0 "Increased resilience and enhanced livelihoods of the most vulnerable people and communities and regions" and Outcome 2.0 "Improved resilience of health and well-being and food and water security".

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
Global Subnational Climate Fund (SnCF Global) – Equity	The goal of the Global Sub-national Climate Fund (SnCF Global or the "Fund") is to catalyse climate mitigation and adaptation solutions at the subnational level through a transformative finance model. The model is designed to attract public and private investment and to deliver certified Climate and Sustainable Development impacts and Nature-based Solutions at global scale (climate, SDGs, NbS).	Multiple Countries, including South Africa	International Union for Conservation of Nature (IUCN)(Green Climate Fund (GCF))	2 470 500 000	150 000 000	Grant and Equity	Cross-cutting	Water, Agriculture, Infrastructure	The program's main and direct outcome is to raise a fund, the SnCF, to enable the implementation and financing of 30 to 45 low carbon and resilient infrastructure projects. Expected mitigation impact - 77 634 432 t CO_2eq; Expected adaptation impact - 20 072 jobs created 17 000 000 citizens positively impacted with better public services
Technical Assistance (TA) Facility for the Global Subnational Climate Fund	The project's objective is to integrate climate mitigation solutions into infrastructure projects at the subnational level and where possible with adaptation co-benefits.	Multiple Countries, including South Africa	International Union for Conservation of Nature (IUCN)(Green Climate Fund (GCF)) R20 Regions of Climate Action (R20), Gold Standard Foundation (GS)	304 695 000	18 500 000	Grant	Cross-cutting	1. Water and sanitation; 2. Restorative agriculture/aquaculture; 3. Urban development solutions; 4. Waste optimisation; 5. Renewable energy generation; 6.	The SnCF programme comprises both the SnCF Fund project and the technical assistance project. Its main outcome is to enable the implementation of approximately 30-35 low carbon and resilient infrastructure projects through a direct equity investment via a dedicated blended investment vehicle, the SnCF Global. The programme's overall activities are focused on delivering the project pipeline (including via the Technical Assistance), de-risking investments through the structure of the Fund, measuring impacts (via metrics, tools and indicators developed via the Technical Assistance) and enable further replication at scale.

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
								Energy efficiency retrofits.	
Strengthening the capacities of national and regional development banks, which are members of the International Development Finance Club (IDFC), to access GCF resources	The proposal focuses on two main objectives: I. Capacity building of Direct Access Applicants and Accredited Entities (DAEs) amongst the members of the IDFC, to make them fit for GCF co-funding and, II. Establishing strategic frameworks for guiding and developing climate-related project pipelines, with special emphasis on key sectors relevant for post COVID-19 economic recovery.	Agence Française de Developpement, Multiple countries	GCF	11 529 000	700 000	Grant	Cross-cutting	Finance	Building on the IDFC-GCF strategic collaboration, the successful implementation of the potentially transformative activities planned in this cross-regional Readiness proposal will help to remove the main barriers to catalyse access of DAE- IDFC members to GCF resources, turning national and regional development banks into key actors for climate action at regional and country level to support the transition to a low carbon and climate resilient economy.
Securing Strategic Water Source Areas in South Africa towards enhancing adaptation to climate change exacerbated water scarcity	The project aims to support the achievement of the targets for securing strategic water source areas (SWSAs) that are set out in South Africa's 2019-2024 Medium Term Strategic Framework (MTSF), the South African government's 5-year plan. The proposed GCF project will address the climate change adaptation needs and overcome the barriers to the rehabilitation and	SANBI/DFFE	GCF	164 700 000	10 000 000	Grant	Adaptation	Water	Estimated adaptation impact - 5 800 000 direct beneficiaries

Title of activity, programme, project	Programme/ project description	Recipient entity	Implementing entity	ZAR	USD	Financial instrument	Type of support	Sector	Use, impact and results
	sustainable management of these SWSAs, through the project Components and Outputs.								
SA Water reuse Programme (“WRP”)	The objective of the Project Preparation activities is to design a Water Reuse Programme (“WRP”) for South Africa. The WRP will comprise two components being (i) the establishment of a national water reuse programme (programme support office) and (ii) a blended finance option to support the scaled implementation of water reuse projects in SA.	DBSA	GCF	2 526 498 000	153 400 000	Grant and Subordinated Loan	Cross-cutting	Water	The estimated mitigation and adaptation impacts will be quantified during Project Preparation.
Accelerating cleantech innovation and entrepreneurship in SMEs to support transition towards a circular economy and create green jobs in South Africa	The project aims to support the identification, fostering and growth of innovative cleantech solutions by SMES by helping them to scale within South Africa and, through the global program, to scale internationally through the provision of commercialisation support and links to markets and finance.	UNIDO	Global Environment Facility (GEF)	54 783 848	3 326 281	Grant	Mitigation	Water, waste and food	Promote innovation and technology transfer for sustainable energy breakthroughs for cleantech innovation.

4.3.2. Domestic financial support received

The South Africa Government continues to play a vital role in creating the conditions for inclusive economic growth and development and in establishing the appropriate economic framework to encourage and facilitate the shift to environmentally cleaner technologies and low carbon activities in the country. At national level there are a number of government departments that are integrating and mainstreaming climate change into sector plans. The National Climate Change Response Policy (2011) has set as one of its primary strategic objective to spearhead the "*development of a comprehensive resource and investment mobilisation strategies, capacities, mechanisms or instruments that support and enable implementation of climate change responses at the scale required, including, but not limited to, public and private financial resources, incentives, non-market and market-based instruments, technical cooperation and partnership agreements and technology transfers at domestic, sub-regional, regional and international levels*". As a response to this, various national government departments are pursuing strategies to integrate and mainstream climate change into their respective sector plans.

National Treasury (NT) is responsible for managing South Africa's national government finances. One of the initiatives undertaken by NT is mapping domestic climate finance. The need for this initiative was as a result of the lack of an existing central repository of climate-relevant expenditure data, as well as the pending Institutionalisation of a climate tagging system across the three spheres of government. Further to that, the existing system does not account for ODA and some bilateral/ multilateral funding and there is no existing typology or reference list for identifying and classifying climate-relevant expenditure or activities, therefore no standard climate relevant assessment model existed.

Using data and information received from the NT's Public Finance Department, it is reported that in the financial year 2020/2021, there was approximately R 2.7 billion of domestic climate finance inflows, complementary to bilateral and multilateral financial support. Table 4.3 shows the aggregated domestic climate finance across various categories (Note: Data excludes local government spending and excludes administrative, policy and sectoral oversight). Spending supports mitigation programmes and activities classified under the energy sector, supporting the energy sector reforms; recapitalisation of Eskom spending is excluded since it was not possible to provide the disaggregated info on the recapitalisation to Eskom in terms of activities specifically related to climate change (e.g., related to the just energy transition). Spending which supported the AFOLU-related sectors includes the Expanded Public Works Programme (EPWP), biodiversity and conservation, human settlements, water and irrigation. Grants directly related to the category of climate change and resilience included grants associated with flood management, disaster relief and environmental protection. Of the identified spending

towards climate-related programmes, national spending accounts for 93%and provincial accounts for 7%.

Table 4.3: Aggregated domestic climate finance for 2020/2021 (Source: National Treasury)

Category	Description	Fund description	2020/2021 Expenditure (R'000)	2020/2021 Expenditure (USD'000) *
Energy	Emissions, transport, carbon, renewables and efficiency	ENERGY EF DMND SID MAN GRNT-MUNIC	192 597	11 694
AFOLU	Agriculture, forestry and other land use e.g., EPWP, biodiversity and conservation, human settlements, water and irrigation	EPWP INCENTIVE: WORKING FORESTRY	8 966	544
		EPWP INCENTIVE: WORKING ON FIRE	146 108	8 871
		EPWP INCENTIVE: WORKNG FOR WATER	18 879	1 146
		EPWP: ENVIRONM PROTECT&INFRA PROG	478 275	29 039
		EPWP: WORKING FOR WATER	537 938	32 662
		EPWP: WORKING ON FIRE	674 431	40 949
		WED ES-DROUGHT	7	0.4
Climate and resilience	Climate resilience, disaster risk reduction and management, air quality	EPWP: ENVIRONM PROTECT&INFRA PROG	45 821	2 782
		DROUGHT RELIEF FUND	1 456	88
		AGRICULTURE DISASTER MANAGEMNT	3 597	218
		INT FUNDING FAC FOR CLIMATE IMMU	14 831	900
		MUNICIPAL DISASTER GRANT	150 970	9 166
		PROVINCIAL DISASTER GRANT	170 152	10 331
		PROVINCIAL DISASTER RELIEF GRANT	6 291	382
		WED ER DISASTER FUND (EIG)	6 020	366
Waste	Solid waste, wastewater treatment, biological treatment, hazardous waste	WASTE BUREAU TYRE RECYCL INI: OPS	247 889	15 051
Grand Total			**2 704 227**	**164 191**

**Note: Exchange rate used for 2020 USD/ZAR = 1 USD/ZAR 16.47*

4.3.3. Non-monetised support received for climate change response actions

Technical and capacity building support received from developed countries for the 2019 - 2021 is summarised in Table 4.4 and is additional to the support that was reported in Table 4.2 of BUR-4. Table 4.4. also reflects information on the training received for the compilation of the Biennial Transparency Report (BTR) even though it is out of the reporting period for BUR-5 to highlight the country's progress towards preparing for reporting considering modalities, provisions, and guidelines for the Enhanced Transparency Framework.

Table 4.4: Non-monetised technical support and capacity building support received from developed countries for the period 2019 – 2021

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity	Type of support	Sector	Status of activity	Additional information
Consultative Group of Experts (CGE) regional training – Algeria	GHG Institutional Arrangements and Data management	Sep 2019	DFFE	Consultative Group of Experts (CGE)	Capacity building	Energy, Waste, AFOLU, IPPU	Completed	
UNEP/UNDP Global Support Programme (GSP)	Virtual training programme: • GHG inventories • Use of 2006 IPCC Software • National Green House Gas Inventory Information Management System • Mitigation Assessment and NDC Tracking • Climate Vulnerability and Adaptation Assessment • GHG Inventories Information Management System	1 January 2020 - 31 December 2021	DFFE	Consultative Group of Experts (CGE)	Capacity building	Energy, Waste, AFOLU, IPPU sectors for GHG Inventory and mitigation assessment and NDC tracking courses	Completed	

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity	Type of support	Sector	Status of activity	Additional information
UNFCCC - Enrolment of National Experts for Certification in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Enrolment of National Experts for Certification in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	2021	DFFE	UNFCCC	Capacity building	Energy, Waste, AFOLU, IPPU	Completed	The courses were supported financially by the UNFCCC secretariat, are offered by the GHG Management Institute, a non-profit organisation and leader on national greenhouse gases inventories
UNFCCC Secretariat - Global webinar on "Uncertainty analysis in national GHG inventories applying the Monte Carlo simulation"	Uncertainty analysis in national GHG inventories applying the Monte Carlo simulation	16-20 November 2020	DFFE	UNFCCC Secretariat	Capacity building	Energy	Completed	
CGE webinar on "Integration of the NSOs into the national climate reporting process" for Africa and Eastern	Integration of the NSOs into the national climate reporting process (Africa and Eastern European Regions)	30 Sep 2021	DFFE	CGE	Capacity building		Completed	

Title of activity, programme, project or other	Programme/project description	Time frame	Recipient entity	Implementing entity	Type of support	Sector	Status of activity	Additional information
European Regions								
CGE Webinar on “Synergies at national level in data collection for reporting under MRV/ETF, SDGs and other international instruments” for Africa and Eastern European regions	Synergies at national level in data collection for reporting under MRV/ETF, SDGs and other international instruments” for Africa and Eastern European regions	Jul 2021	DFFE	CGE	Capacity building		Completed	
CGE regional virtual training workshop on the institutional arrangements for the existing MRV arrangements and the enhanced transparency framework, including data management for national GHG inventories	Institutional arrangements for the existing MRV arrangements and the enhanced transparency framework, including data management for national GHG inventories	5 -7 July 2021	DFFE	CGE	Capacity building	Energy, Waste, AFOLU, IPPU	Completed	

4.4. Support needs

4.4.1. Financial support needed

Significant and scaled up resources are needed in South Africa for mitigation and adaption actions across all strata of the economy. The South African Government is implementing an enabling institutional environment that can support a sustainable climate finance model where mitigation and adaptation actions are funded over the long term and where this funding is accessible in a timeous manner to a broad range of stakeholders, from both domestic public finance and private sector finance.

The basis for South Africa's NDC is the assumption that support will be provided for the implementation of the targets and goals therein, for mitigation, adaptation and loss and damage. The country requires support for a just transition towards net zero CO_2 emissions and with the increased level of mitigation ambition communicated in the NDC, international support will be required, with the key to the increased level of mitigation ambition lying in the electricity sector (RSA, 2021). In addition, support will also be required for longer term decarbonisation, which will require investments in the 2020s towards infrastructure, technology development and capacity-building (RSA, 2021). Over the next decade, the NDC will require a greater investment programme, as specified in IRP 2019, of between R860 billion and R920 billion (in 2019 Rands; USD 60-64 billion). The shift away from coal that IRP 2019 requires will require support in the form of transition finance and associated technology and capacity-building.

South Africa's Just Transition Investment Plan (JET IP) (2023-2027) is aimed at supporting South Africa's goal of establishing a low carbon and climate resilient society (PCC, 2022a). The JET IP is a South African needs-driven five-year initial plan, with clear financing principles and preferred terms and conditions, which promotes a "whole of society" approach". The JET IP draws on the Just Transition Framework to develop a portfolio that embeds just interventions in the three priority sectors: Electricity, New Energy Vehicles and Green Hydrogen, with cross-cutting measures including addressing skills development and municipal readiness.

The goal to decarbonise SA's economy to within the NDC target range of 350 - 420 Mt CO_2-eq by 2030 in a just manner is estimated to require approximately ZAR 1.48 trillion (US$98.7 billion) with an estimated funding gap of 44% (*ZAR 700 billion) (PCC, 2022a). The ZAR1.48 trillion financing targeted for the JET IP is categorised under infrastructure, planning and implementation capacity, skills development, economic diversification, and innovation, along with social investment and inclusion (Table 4.5). (*Note: The funding gap and scale of need is indicative and assumes the commitments and pledges of the funded portions materialise). The estimated availability of funding per sector and source, together with the outstanding funding to meet targets, is shown in Figure 4.2.

Table 4.5: Financing needs of the JET IP for the period, 2023–2027 (PCC, 2022a)

ZAR (US$) billions	Electricity	NEV	GH_2	Subtotal
Infrastructure	978	83	313	1 374
Planning and implementation capacity	2.14	2	5.5	9.9
Economic diversification and innovation	40.4	43	–	83.4
Social investment and inclusion	9.6	–	–	9.6
Skills development			2.7	2.7
Subtotal	1 030.4 (68.7)	128 (9)	319 (21)	
TOTAL				**1 480 (98.7)**

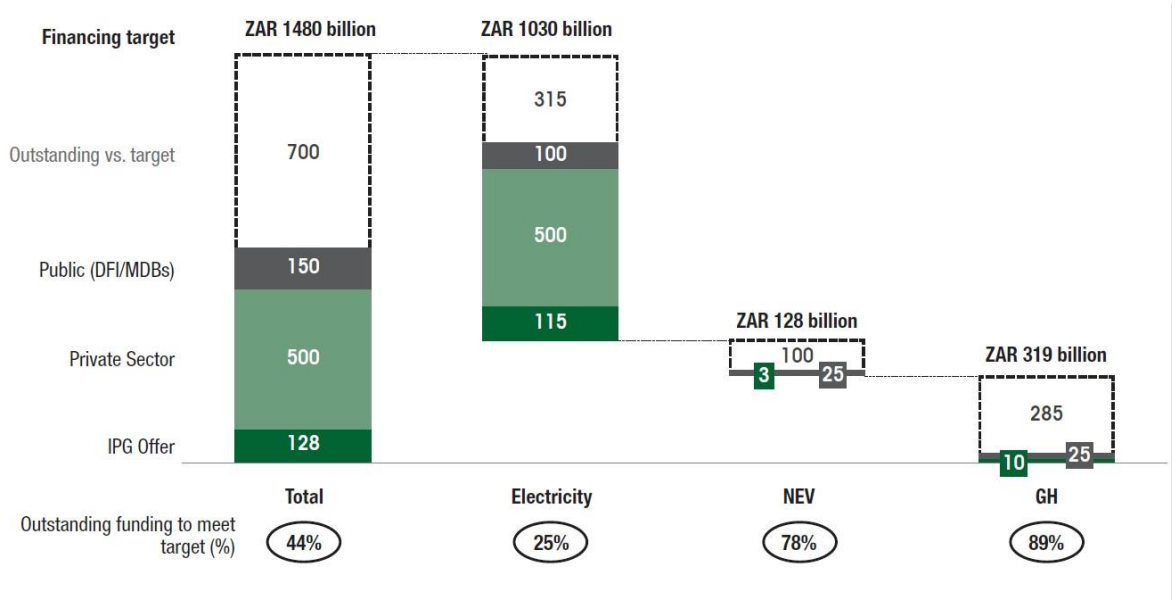

Figure 4.2: Projected funding needs and estimated availability by source (PCC, 2022a).

In addition to technologies that could help the country to further reduce emissions, in the revision of the NDC is an indication for the need for support in the form of concessional finance for low carbon projects; debt restructuring; support by the international climate, development and finance community for non-fossil-fuel development in Mpumalanga and elsewhere and infrastructure to support energy efficiency, transmission and green hydrogen in support of electric vehicles and public transport (RSA, 2021). Further to that, South Africa will endeavour to develop small, medium, and micro-enterprises, including energy service companies, to implement innovative technologies and create sustainable employment.

South Africa's revised Nationally Determined Contributions (NDC) (RSA, 2021) includes the country's first adaptation communication. The National Climate Change Adaptation Strategy (NCCAS) is the key domestic policy instrument to guide implementation of adaptation goals included in the country's updated NDC; these goals are consistent with elements of decision

9/CMA.1. The projected costs of adaptation over the 2021-2030 period are detailed in the adaptation communication and include the costs of adaptation measures themselves, as well as the costs of building the relevant human and institutional capacity. A summary of adaptation goals and associated the adaptation investment required for the period 2021- 2030 are included in Table 4.6.

Table 4.6. Adaptation goals and investment needed for the period 2021 – 2030 (Source: RSA, 2021)

Elements	Undertaking for the period 2021-2030	Adaptation investment 2021-2030
Element (a) of the Annex to decision 9/CMA.1 National circumstances, institutional arrangements and legal frameworks	Goal 1: Enhance climate change adaptation governance and legal frameworks	USD 13 million to build evidence-based support for policy implementation for the period 2021 to 2030
Element (b) of the Annex to decision 9/CMA.1 Impacts, risk and vulnerability	Goal 2: Develop an understanding of the impacts on South Africa of 1.5 and 2°C global warming and the underlying global emission pathways through geo-spatial mapping of the physical climate hazards and adaptation needs in the context of strengthening the key sectors of the economy	USD 8 million for developing tools, strategies and rollout for the period 2021 to 2030
Element (c) of the Annex to decision 9/CMA.1 National adaptation priorities, strategies, plans, goals and actions	Goal 3: Implementation of NCCAS adaptation interventions for the period 2021 to 2030	USD 3 - 4 billion required for the implementation of the NCCAS for a period 2021 to 2030 to support South Africa
Element (d) of the Annex to decision 9/CMA.1 Implementation and support needs of and provision of adaptation support to South Africa	Goal 4: Access to funding for adaptation implementation through multilateral funding mechanisms	Adaptation needs and costs for the period 2021 – 2030 is USD 16 –USD 267 billion. Adaptation needs and costs adapted by a minimum of 4% GDP impact is USD 122 billion by 2025 and USD 37 5 billion by 2030
Element (e) of the Annex to decision 9/CMA.1 Implementation of adaptation action and plans including (ii) Adaptation efforts of developing countries for recognition	Goal 5: Quantification and acknowledgement of the national adaptation and resilience efforts	(Not applicable to historical efforts up to 2020)

4.4.2. Capacity needs

A technical analysis conducted on South Africa's BUR-4 report (draft submitted on 28 September 2021) highlighted needs for capacity building that could facilitate the preparation of subsequent BURs and participation in the international consultation and analysis (ICA). These needs were identified by the technical team of experts (TTE), in consultation with South Africa and were listed as follows:

(a) Enhancing technical capacity to compile the GHG inventory, specifically to:

(i) Apply methodologies for deriving country-specific nitrogen excretion rates for cattle with a view to using them instead of default emission factors (EFs) from the 2006 IPCC Guidelines.

(ii) Implement higher-tier methodologies for estimating emissions.

(iii) Develop a QA/QC process for activity data (AD).

(iv) Collect and classify data on solid waste disposal sites.

(v) Improve time-series consistency, especially for the IPPU and waste sectors.

(vi) Draft technical reports (BURs and NIRs).

(b) Enhancing institutional capacity for communication, including continuous and face-to-face interaction, between DFFE and implementing agencies with a view to strengthening understanding of mitigation actions and enhancing the transparency of reporting on them.

(c) Enhancing institutional and technical capacity to effectively use the ex-post assessment model to report on and analyse mitigation actions.

(d) Enhancing technical knowledge on mitigation actions, especially those in the AFOLU sector, within various government departments through workshops and other training formats.

(e) Enhancing national capacity to develop systems, procedures, and methodologies for evaluating the effects of actions covered by international market mechanisms separately from the effects of domestic actions, in preparation for the enhanced transparency framework.

(f) Enhancing technical capacity to collect the data necessary for reporting on and to draft the sections of the BUR, relating to support needed and received and technology needs assessment.

Further capacity buildings need for the GHG inventory, mitigation actions and tracking support needed and received, as identified by the DFFE, is summarised as follows:

Capacity building needs for GHG inventory

1. Enhancing the technical knowledge in data collection and classification of Solid Waste Disposal Site (SWDS), collecting time series information, etc. to improve Greenhouse Gas (GHG) inventory in waste sector and implementing higher tier method.

2. Enhancing the technical knowledge in methodologies through training that will help to determine the actual data for N excretion rates for cattle instead of Intergovernmental Panel on Climate Change (IPCC) 2006 default values.

3. Enhancing the technical knowledge in Quality Control (QC)/ Quality Assurance (QA) process of the data provided and time series consistency improvements.

Capacity building needs for mitigation actions

1. Enhancing capacity in institutional arrangements for enabling continuous interaction and action-wise face-to-face communication practices with mutual capacity-building between Department of Forestry, Fisheries and the Environment (DFFE) and implementation agencies for a better understanding of the details of the action concerned and for enhanced transparent reporting.

2. Enhancing capacity to develop the systematic procedures and methodology for evaluating effects of actions covered by international market mechanisms separately from domestic actions.

3. Enhancing capacity to institutionalise and effectively utilisation of ex-post assessment model to report and analyse mitigation actions.

Capacity building needs for needs and support

1. Enhancing capacity for collecting the data and drafting the 'Support Needed and Received' and the 'Technology Needs Assessment' sections of the reports.

4.4.3. Technology needs

4.4.3.1. Just Energy Transition

A just transition is at the core of implementing climate action in South Africa, as detailed in both the mitigation and adaptation goals described in the country's revised Nationally Determined Contribution (NDC). As part of ensuring a just transition, measures need to be put in place that plan for workforce reskilling and job absorption, social protection and livelihood creation, incentivising new green sectors of our economy, diversifying coal dependent regional economies and developing labour and social plans as and when ageing coal-fired power plants and associated coal production infrastructure are decommissioned (RSA, 2021). Similar measures are also necessary to adapt to the impacts of climate change.

In December 2020, President Cyril Ramaphosa created the Presidential Climate Commission (PCC) to oversee and facilitate a just transition to a low-emissions and climate-resilient economy. One of the first tasks of the PCC was to design a Just Transition Framework for South Africa. The presidential cabinet adopted the Just Transition Framework in August 2022. The framework lays out a shared vision for shifting to an equitable, zero-carbon economy and identifies key policy areas and principles to achieve this.

The just transition framework is positioned at the nexus of climate and development issues in South Africa. The framework does not deal with climate mitigation and adaptation policies per se. Rather, the framework focuses on managing the social and economic consequences of those policies, while putting human development concerns at the centre of decision-making (PCC, 2022b). Economic models that may be needed to enable a just transition are also considered in the framework. The Just Transition framework currently focuses on four sectors and value chains that are at-risk in the transition, which

form part of the formal economy: (1) the coal value chain, (2) the auto value chain, (3) agriculture and (4) tourism, as a first illustration of these risks.

In the country's first NDC, South Africa identified various technologies that could help the country to further reduce emissions. These technologies included: energy efficient lighting; variable speed drives and efficient motors; energy efficient appliances; solar water heaters; electric and hybrid electric vehicles; solar PV; wind power; carbon capture and sequestration; and advanced bio-energy (RSA, 2016). Since the just transition in South Africa will require international co-operation and support, the revision of the NDC (RSA, 2021) provided an update on the support the country needed in addition to these technologies (refer to Section 4.4.1 Financial Support Needed in this chapter for further detail).

Innovation is also an important component of industrial development and economic diversification, which can minimise the impacts of climate change while boosting overall economic competitiveness and creating new jobs. Innovation and associated technologies in the South African economy, as outlined in the Just Transition Framework (PCC, 2022), may include:

- Developing competitive industries to produce inputs and support services (design, engineering and maintenance) for green technologies, including renewable energy inputs, battery cells, e-vehicles, green hydrogen and net-zero-emission cement or cement alternatives. The target markets for these industries may include domestic, regional and where viable, overseas markets.
- Developing innovative technologies that improve climate resilience, such as regenerative agriculture and artificial wetlands.
- Promoting the circular economy, including the promotion of it as a job creator.
- Establishing regulatory frameworks that promote new technologies, including the changing regulations that restrict them unnecessarily (as in the case of renewable energy for electricity),
- Setting technical standards that enable and encourage new technologies.
- Ensuring the South African National System of Innovation is "climate-aware" and fosters innovations which support net-zero-emissions and climate-resilient activities.
- Disseminating information about new technologies, including their up-front financial and technological requirements and longer-term viability.
- Managing lobbying from established producers that aim to protect older, uncompetitive production sites and that resist technological change and innovation.
- Stimulating technological advances that can generate employment and broaden ownership of productive assets, to support a just transition.

4.4.3.2. Hydrogen-related technologies

Hydrogen and its application in various sectors have the potential to reduce emissions and create jobs in its various value chains, which could be used to support the just transition in South Africa (DSI, 2022). The Hydrogen South Africa (HySA) Research, Development and Innovation (RDI) Strategy was approved by Cabinet in 2007 and officially launched in 2008 by the then Department of Science, Technology and Innovation (now the Department of Science and Innovation (DSI)). The DSI had identified hydrogen fuel-cell technologies (HFCT) for their potential to reduce emissions and secure the country's energy future. South Africa is home to 75% of the global reserves for PGMs and most are used as value-added materials or catalysts in HFCT (DSI, 2022). The objective of 15-year HySA Programme was to develop the hydrogen economy, with a focus on beneficiation of Platinum-group metals (PGMs) through the development of HCFT. Three Centres of Competence (CoC) were established to implement the HySA Programme (Table 4.7).

Table 4.7: HySA Centres of Competence and focus areas (DSI, 2022)

Name of CoC	Research Focus	Host Institution
HySA Catalysis	Catalysts and catalytic devices for fuel cells and hydrogen production	• University of Cape Town (UCT) • South African Minerals Research Council (MINTEK)
HySA Infrastructure	Technologies for hydrogen, production, storage and distribution	• North-West University (NWU) • Council for Scientific and Industrial Research (CSIR)
HySA Systems	Systems integration and technology validation	• University of the Western Cape (UWC)

The development of the Hydrogen Society Roadmap (HSRM) was initiated in 2020 and an Interdepartmental Committee developed the terms of reference for the development of the HSRM. The HSRM was published in February 2022 by the DSI and serves as a national coordinating framework to facilitate the integration of hydrogen-related technologies in various sectors of the South African economy and stimulate economic recovery, in line with the Economic Reconstruction and Recovery Plan (DSI, 2022). The HSRM sets national ambitions and sector prioritisation on the deployment of the hydrogen economy in South Africa, in line with the Integrated Energy Plan. The vision of the HSRM is "an inclusive, sustainable and competitive hydrogen economy by 2050" and has six high-level outcomes which include:

- Decarbonisation of the transport sector.
- Decarbonisation of energy-intensive industry.
- Creation of an export market for South African hydrogen.
- Development of a Centre of Excellence in Manufacturing for hydrogen products and fuel cell components.

- Green and enhanced power sector.
- Hydrogen generation, storage and distribution.

South Africa has existing policies and plans that could be used to support hydrogen-related technologies; however, South African legislation will require significant development to address the gaps in the current regulatory framework if the introduction and development of a hydrogen society are to be achievable (DSI, 2022). These policies include:

- White Paper on Renewable Energy Policy (2003).
- HySA Strategy (2007).
- National Energy Efficiency Strategy (2008).
- National Climate Change Response White Paper (2011).
- Beneficiation strategy for minerals industry of South Africa (2011).
- Department of Public Works and Infrastructure Green Building Policy (2018).
- Green Transport Strategy for South Africa (2018).
- Integrated Resource Plan (2019).
- National Development Plan 2030.

Opportunities also exist to leverage existing tax and incentive mechanisms to support the deployment of hydrogen-related technologies. These could be used to support, promote and incentivise the development of hydrogen technologies, increase the number of people with skills in hydrogen applications and technologies and promote investment in hydrogen technologies. Examples of existing tax and incentive mechanisms include (DSI, 2022):

- Section 11D of the Income Tax Act No 58 of 1962 (R&D tax deduction).
- Section 12L of the Income Tax Act No 58 of 1962 (Energy Efficiency Allowance).
- Special Economic Zones.
- Critical Infrastructure Programme.
- Capital Projects Feasibility Programme.
- Support Programme for Industrial Innovation.
- Technology and Human Resources for Industry Programme.
- South African Automotive Masterplan.

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5. Support received for the preparation of the BUR-5

South Africa received multilateral financial support from the Global Environment Facility (GEF) to develop the 5th Biennial Update Report (BUR-5) as well as 4th National Communication (FNC) of South Africa. The total amount of funding received was USD 852 000. This amount has been included as part of the overall funding received from the GEF in Chapter 4. The funding was administered using the UNEP as the implementing agency. Due to challenges of administering this funding directly through the government, the South African government then opted to further use the UNDP, South Africa, as the third party to implement the project on behalf of the DFFE. The CSIR was contracted to draft the BUR-5 together with the personnel from DFFE. Some of the chapters of BUR-5 were drafted together with the CSIR, internally by the personnel from DFFE from the International Climate Change Relations and Reporting as well as Climate Change Mitigation and Specialist Monitoring Services chief directorates. The CSIR provided additional technical support for the drafting of the Mitigation Actions and Effects as well as contributions on Support needed and received and Additional information chapters. The draft BUR-5 was also subjected to an independent review process by Promethium Carbon who were procured through the UNDP, South Africa using the BUR-5/NC-4 funding.

A portion of the funding received for the preparation of BUR-5 was also used to subject the BUR-5 to a public consultation process, as well as the designing and printing of BUR-5 copies. A Project Coordinator (PC) to support with the coordination of BUR-5 compilation will be hired by the DFFE and will be paid from the budget of BUR-5/NC-4 on a two-year contract. The Government of South Africa, through the DFFE, will provide co-finance to the project through offering the PC with office space, a mobile phone and land line, as well as internet access.

In addition, South Africa received capacity building support for preparation of the BUR-5 from the Consultative Group of Experts (CGE), the Partnership on Transparency in the Paris Agreement (PATPA), the UNFCCC secretariat as well as United Nations Environment Programme Global Support Programme (UNEP GSP) as reported in Chapter 4.

6. Measurement, reporting and verification in South Africa

6.1. Climate change monitoring and evaluation

The South African Climate Change Information System (NCCIS) is a web-based platform for tracking, analysis, and enhancement of country's progress towards a climate resilient society and low carbon economy. The platform, in its reconfigured structure (Figure 6.1) offers a series of decision support tools to inform policy and decision-making including a database of adaptation and mitigation actions undertaken by stakeholders across the country. The NCCIS includes sub-national systems and sector specific systems building on the work that has already been done on the NCCIS.

The NCCIS is supported by national, provincial and local scale systems of data-collection to provide detailed, complete, accurate and up to date data that ranges across adaptation and mitigation related topics. The information is contained within the themes of:

- Climate Information.
- Climate Services.
- Tracking and Evaluation (T&E) Portal.
- Carbon Sinks Atlas.

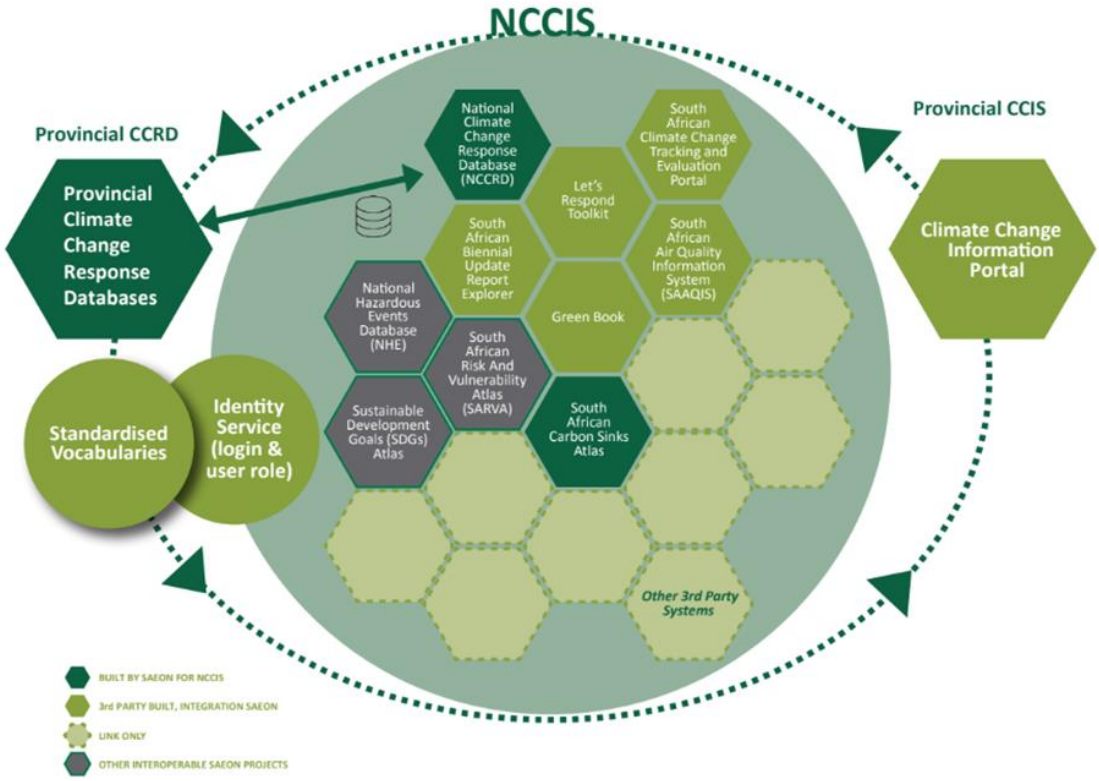

Figure 6.1: A diagram of the South African National Climate Change Information System (NCCIS) and its various expandable components

The NCCIS, is also known as the country's Monitoring and Evaluation (M&E) System thus provides a platform that demonstrates key climate data and information that spans across the Monitoring, Reporting and Verification (MRV) of GHG emissions, MRV of mitigation actions and MRV of support. Information that is key to informing domestic and international reporting is showcased making the M&E system the national central depository and portal of climate change information in South Africa.

6.2. Progress since BUR-4

The NCCIS was launched in August 2019 and is composed of a number of modules that are designed to facilitate access to data and information to tracking progress towards a low carbon and climate resilient society. The NCCIS is now fully operational, with progress made in the institutionalisation of the system. The T&E Portal and the National Climate Change Response Database (NCCRD) are examples of the existing hard linked tools to the NCCIS. It is expected that as other modules, tools or sub-systems are uploaded, the system will be expanded. These additional modules or tools will be added either as hard linked tools or soft linked tools. Future improvements will focus on aligning the system with new models and data extensions and improving functional aspects. Improvements for the T&E portal for example are planned through its integration with the Ex-Post Analytica Mitigation Assessment tool. This tool is aimed at easily quantifying actions and measures in terms of GHG emission reduced and related co-benefits. The purpose of the tool is to support international reporting requirements (such as the BUR) and to easily relay information to the Minister upon request on the status of projects, programmes, and other measures. A new module for the carbon budget is also planned to be added to the system.

The NCCIS was previously hosted by the South African Earth Observation Network (SAEON) on behalf of the Department of Forestry, Fisheries and Environment (DFFE). Technical work to the host system internally at DFFE was pursued resulting in the NCCIS currently residing within the DFFE web environment. A comprehensive handover process between SAEON and DFFE occurred to ensure seamless migration of the system. The DFFE appointed a systems administrator who manages the system and thus the DFFE has developed institutional capacity in support of hosting and maintaining the NCCIS.

6.2.1. Milestones reached since the BUR-4

A considerable amount of work has been achieved in terms of institutional arrangements, data flows and quality assurance since the BUR-4. A key initiative during the reporting period has been to support provinces in developing their own M&E system that can feed into the national reporting system. This bottom-up reporting approach is expected to facilitate data sharing and support national level reporting at an aggregated level and to prepare the country for reporting under the draft Climate Change Bill.

Sub-national frameworks at a provincial level have institutionalised, with the Initiative for Climate Action Transparency (ICAT) guide on non-state and sub-national action developed by ICAT also being used to support sub-national entities. Through the support of external donor funding the Mpumalanga Climate Change Response Database (https://mccrd.environment.gov.za/s) has been developed. Similar processes are also underway in three other provinces namely KwaZulu-Natal, Western Cape and Northern Cape.

In addition to the progress on the MRV of mitigation actions, there is also significant work that has been carried out in the M&E of adaptation, these include the development of a framework for the M&E of loss and damages from climate change and an M&E system for Multi-Hazard Early Warning Systems (ICAT, 2022). The DFFE has also institutionalised the development of the South African Climate Change Tracking Report to inform the South African audience on the country's progress regarding climate change. The report collates climate change related information on the tracking, analyses, and enhancement of the understanding of the country's progress in the transition to a low-carbon and climate-resilient society and economy. The Climate Change Tracking Report publishes indicators that are policy relevant, not policy prescriptive and which illustrates climate change in its full socio-economic and ecological/environmental context rather than an isolated phenomenon. The process of developing performance tracking indicators for the fourth Climate Change Tracking Report was also initiated in this reporting period. These systems and reports will be further unpacked in the country's first BTR. Further progress has been made in the roll-out/institutionalisation of the verification programme that has been supported by amendments to the GHG Reporting Regulations of 2016 wherein clauses on the verification programme have been included.

6.3. Institutional arrangements for MRV

The DFFE is responsible for the co-ordination and management of all climate change-related information, including mitigation, adaptation monitoring and evaluation and GHG inventories. The UNFCCC focal point sits within the International Climate Change Relations and Negotiations (ICCRN) unit of DFFE. This unit is responsible for the compilation and submission of the NIR, BUR and NC reports to UNFCCC. The overall institutional arrangements and data flows for the MRV of GHG emissions, mitigation, adaptation, and support are shown in Figure 6.2.

The compilation of the GHG emissions inventory and the NIRs are managed through the NGHGIS and are the responsibility of the Climate Change Monitoring and Evaluation (CCME) unit in DFFE. DFFE has in previous GHG emission inventories been responsible for collecting all the data from various data providers for all the sectors covered. The introduction of the National Greenhouse Gas Emission Reporting Regulations (NGERs) and South African Greenhouse Gas Emissions Reporting System (SAGERS) has allowed for the institutionalisation of the preparation of the National GHG Inventory. In particular, the system enables the country to strengthen the data collection process, therefore improving

the quality of the National GHG Inventory. The DFFE CCME is responsible for managing the SAGERS system.

The NCCIS is managed by DFFE CCME who has the responsibility of ensuring that various tools on the system are updated and that the various data providers update their information on the system. This includes drawing the information from the NCCIS to the inventory and initiating projects to update the tools on the NCCIS. This should be done every few years and will require financial support to complete. The South African Weather Service is responsible for updating the climate data on the Climate Information Portal (CIP) and National Hazardous Events Database (NHED). The National Climate Change Response Database is currently updated by DFFE CCME. In future a system can be setup to automatically filter data from the Provincial Climate Change Response Databases (PCCRD) to the national system since similar vocabularies have been used to allow for integration. It is the responsibility of the provinces to update the PCCRDs. In the future it could be setup such that data is collected at the local municipality level and filtered through to the PCCRD and then to the NCCRD (*to be updated with more recent information*).

The DFFE CCME unit is responsible for updating mitigation, adaptation and finance data to T&E system (Figure 6.3). The T&E Portal is a sub-module of the NCCIS specifically designed as a platform for tracking South Africa's progress towards NDC goals and commitments. The T&E Portal tracks South Africa's climate action and transparency under the Climate Change Paris Agreement in a transparent, simple, interactive, dynamic and informative manner to inform both the domestic and international audience.

Financial data is requested from donor organisations by DFFE CCME who are also responsible for uploading the data to the T&E system. The DFFE together with National Treasury and other stakeholders collaborated on the development of a National Climate Finance Support Strategy that will enhance tracking climate finance.

Not all components of the NCCIS are fully functional and these issues will be discussed below.

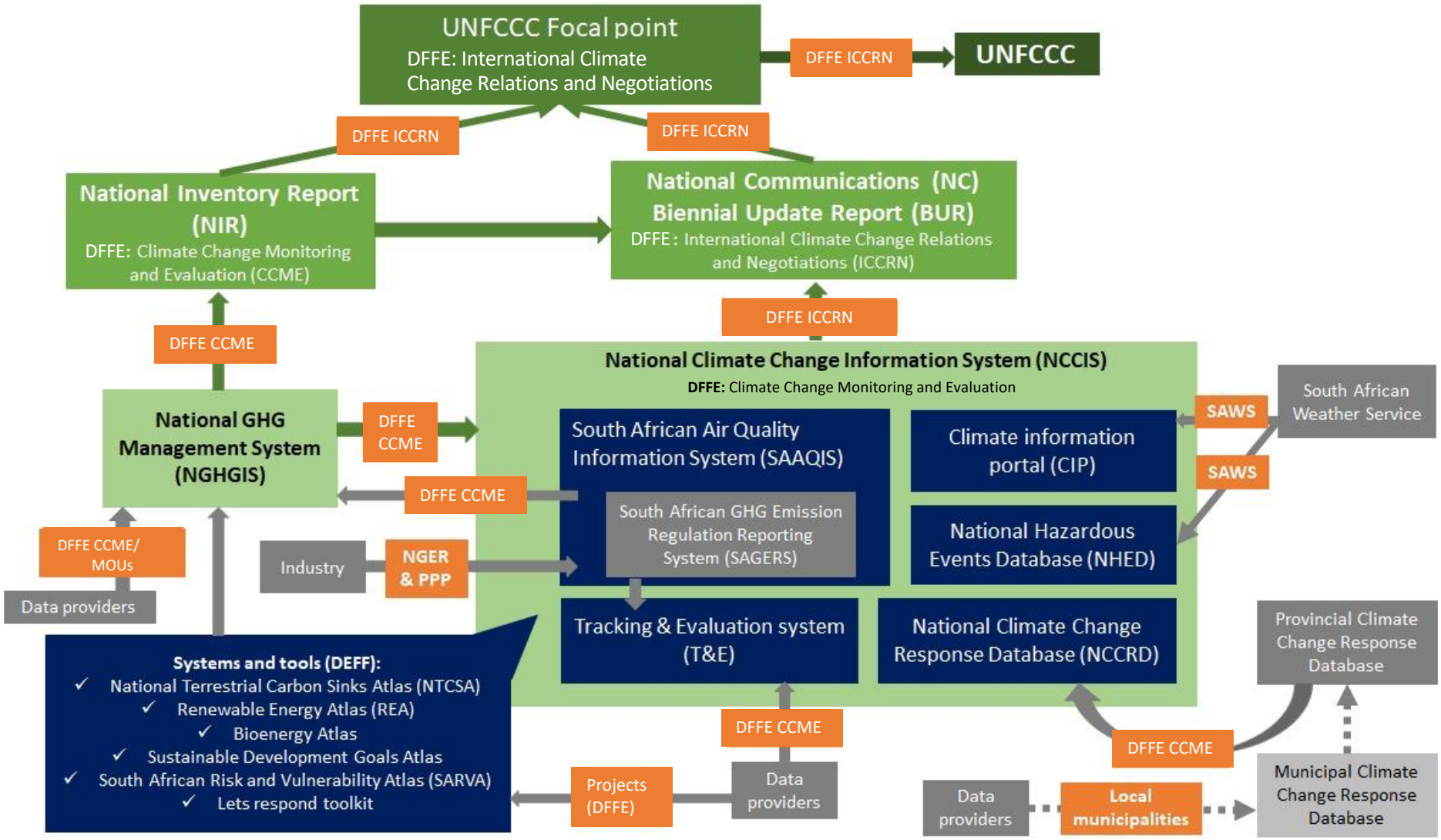

Figure 6.2: Diagram of the institutional arrangements and data flows for MRV in South Africa

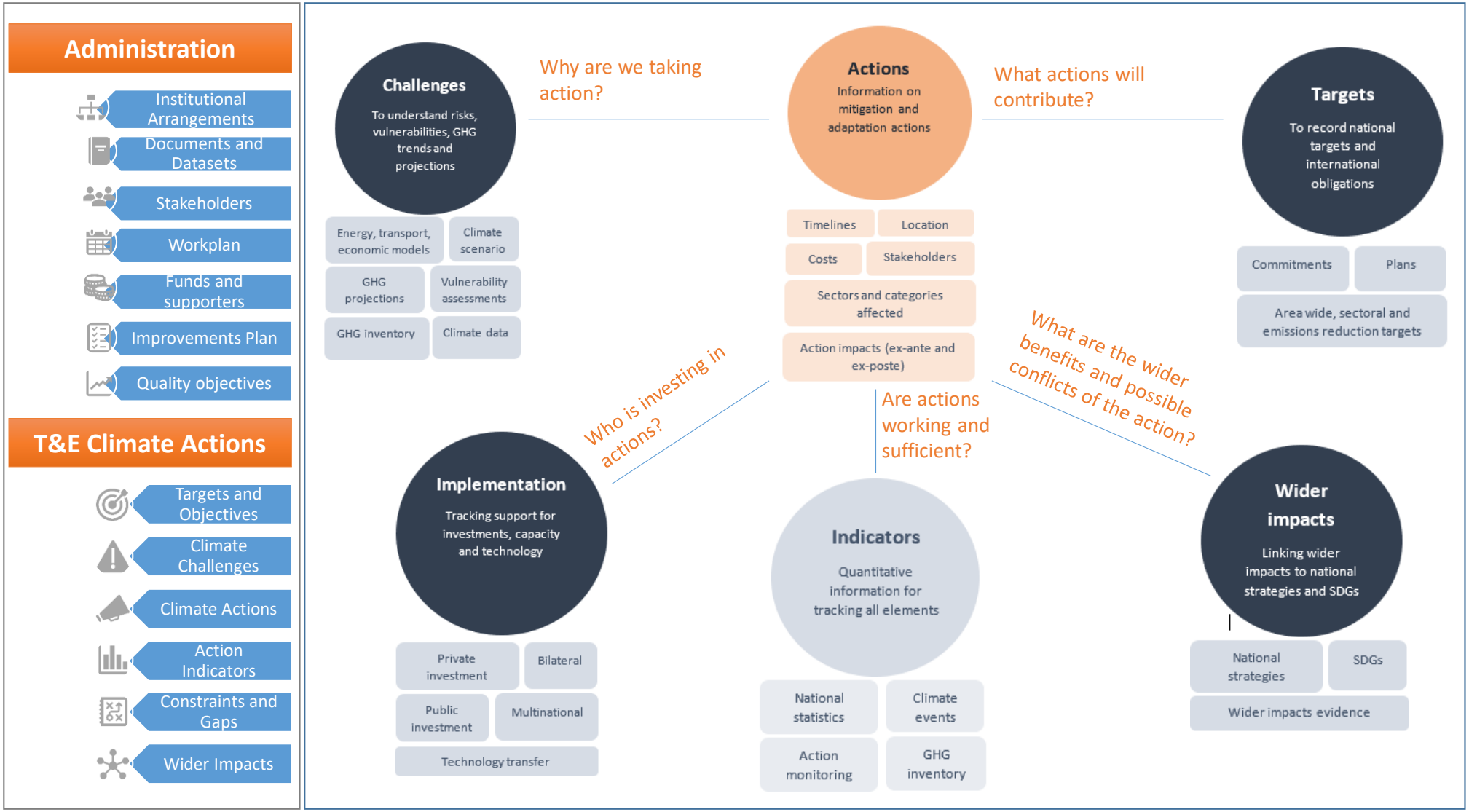

Figure 6.3: Components of South Africa's Tracking and Evaluation System.

6.3.1. GHG inventory MRV

DFFE, through the Climate Change Monitoring and Evaluation (CCME) unit takes a lead role in the compilation, implementation and reporting of the national GHG inventories. The compilation of the GHG emissions inventory and the NIRs are managed through the NGHGIS which is a secure web-based SharePoint platform that allows document management, sharing and storage. It serves as a GHG inventory process management tool to facilitate inventory planning, preparation, and management. DFFE CCME manages the NGHGIS system and other relevant agencies, and ministries play supportive roles in terms of data provision across relevant sectors. Since the last inventory a new inventory co-ordinator was appointed, along with a new Energy, IPPU and Agriculture expert. In addition, official proficiency in statistics was taken on board to assist with the improvement of the uncertainty analysis. All officials have undergone various IPCC training courses, including a course on uncertainty. The enlarged team also enabled a more in-depth quality control (QC) process.

The main data providers for the inventory are shown Figure 2.1 in Chapter 2 of this report. South Africa uses a hybrid (centralised/distributed) approach to programme management for the inventory. Management and coordination of the inventory programme, as well as compilation, publication and submission of the Inventory are carried out by the Single National Entity (being the DFFE) in a centralised manner. The branch responsible for the management and co-ordination of GHG inventories at the DFFE is the Climate Change and Air Quality branch (Figure 6.4).

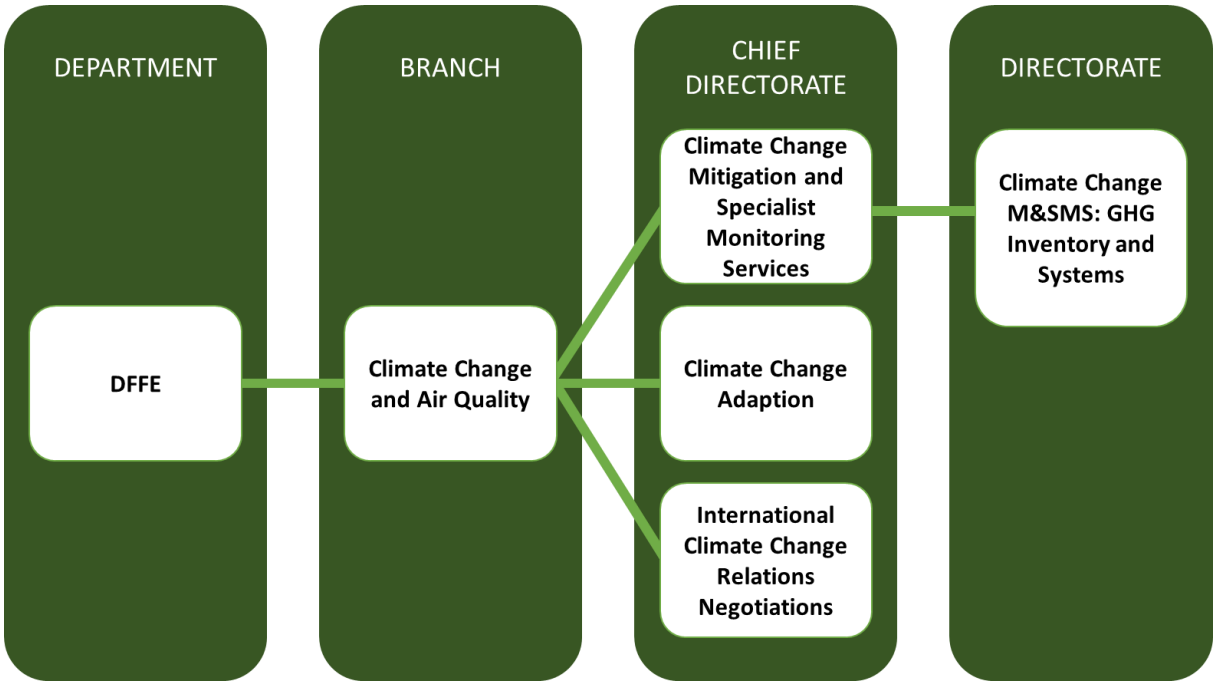

Figure 6.4: Organogram showing where the GHG inventory compilation occurs within DFFE

Currently DFFE is responsible for collecting data, compiling and QC of the Energy, IPPU, part of the Agriculture sub-sectors and Waste sector inventories (Table 6.1). The remainder of the AFOLU sector is compiled by external consultants (Gondwana Environmental Solutions (GES)) who are appointed via a formal project-based contract with the GIZ Climate Support Programme. The consultants are also responsible for combining and compiling the overall inventory and providing the draft National Inventory Report to DFFE. The NIR is then reviewed by the steering committee and is presented to parliament before being approved for submission to the UNFCCC (DFFE, 2022).

Table 6.1: Roles and responsibilities of the team involved in the GHG inventory compilation process

Role	Responsible organisation	Main responsibilities
Single national entity	DFFE CCM&E	• Responsible for submissions and its consistency with other related submissions; • Defines the National System (who is involved and agreements (contracts)); • Development of legal and contractual infrastructure; • Executive engagement with stakeholders (including data providers and users); • Ensuring participation of relevant stakeholders; • Management of contracts and delivery of GHGI; • Prioritising and facilitating improvements.
National inventory co-ordinator	DFFE M&E	• Manage and support the National GHG Inventory team, schedule and budget in order to develop the inventory in a timely and efficient manner; • Identify, assign and oversee national inventory sector leads; • Assign cross-cutting roles and responsibilities; • Manage QA processes and inventory review periods (if applicable); • Provide technical support to SNE with stakeholder engagement and setting up data supply agreements (designing specifications and timetables); • Manage NGHGIS; • Maintain and implement a National GHG Inventory improvement plan; • Prepare the submission; • Obtain all necessary government approvals for the NIR before submission; • Submit the NIR to the UNFCCC; • Foster and establish links with related national projects and other regional, international programmes as appropriate.
Steering committee	IGCCC and NCC	• Provide input to improvement planning; • Respond to requests to review high level data and assumptions.
Sector leads	Energy, IPPU and Waste, (DFFE M&E) AFOLU (Gondwana Environmental Solutions)	• Collaborate with the NIC to manage the sector budget and develop a sector-specific work plan; • Gather data and conduct technical engagements with data providers; • Compile the sector inventory estimates and the sector report; • Develop and implement a sector-specific plan for archiving; • Consider potential improvements identified in the previous inventory for the sector and assess whether to implement improvements; • Coordinate the response to comments received from QA (external) reviews of the sector GHG estimates and update the inventory if necessary; • Review the final sector GHG estimates and the narrative describing the assumptions, methodologies and results; • Ensure consistency of data; • Co-ordinate with lead compilers of other sectors to ensure no double counting; • Oversee the development of the uncertainty analysis for the sector;

Role	Responsible organisation	Main responsibilities
		• Identify and document any improvements needed; • Ensure all documents are submitted to NIC; • Ensure all relevant information is incorporated into the NGHGIS.
QA/QC co-ordinator	Limited resources for co-ordinator. Sector leads responsible for sector QA/QC	• Ensure the timely and accurate completion of QA/QC checklists; • Ensure all uncertainty analysis has been completed and included in QA/QC lists; • Deliver documentation of QA/QC activities to the NIC and archive co-ordinator; • Co-ordinate external reviews of the inventory document and ensure that comments are incorporated into the inventory.
Document manager	Gondwana Environmental Solutions	• Obtain all sector reports from lead compilers and compile the overall NIR; • Complete the overall key category analysis; • Incorporate all the introductory information by liaising and obtaining information from the various section managers; • Complete all the overall trends (graphs, tables and text); • Complete all the Appendices; • Collect uncertainty data from sector leads and complete overall uncertainty analysis; • Perform document QA/QC checks.
Archive manager	Gondwana Environmental Solutions	• Ensure inventory compilation sheet are archived on the NGHGIS; • Serve as the keeper of the permanent archive and respond to future requests to view archive materials.

In this inventory, data is sourced from many institutions, associations, companies and ministerial branches. The 2020 inventory included activity data directly from industry via the SAGERS through the GHG Reporting Programme (DFFE, 2022a). There are no formal agreements between the various government departments for the collection of data for the GHG inventory. The DFFE is in the process of developing a Memorandum of Understanding with Department of Agriculture, Land Reform and Rural Development (DALRRD) related to the provision of land and agriculture data.

Challenges, gaps and constraints

Limited resources have been a challenge for inventory compilation, however the DFFE CCME unit has recently employed more staff so that there is in-house expertise in each sector. In addition, system managers have also been brought into the team, so the inventory team is well placed to fully utilise the NGHGIS and compile the inventory in the next inventory cycle. The new team may require additional inventory compilation training, but additional training courses are expected to be developed through the Capacity-Building Initiative for Transparency funding.

6.3.2. Mitigation MRV

In this BUR cycle DFFE was responsible for collecting the information required for the BUR for the Energy sector. Data for emissions savings collected for mitigation actions falling under the energy sector were estimated by the DFFE. The SAGERS discussed below, and the T&E System directed by the Climate Change Monitoring and Evaluation Unit of the DFFE (described above) are two key components for the MRV of mitigation actions that have supported the DFFE in tracking the emissions

in this sector. Corrections and recalculations have been made to the previously reported emissions savings in BUR-4. The Council for Scientific and Industrial Research (CSIR) calculated the emission reductions in the IPPU, Waste and AFOLU sectors and were contracted for compiling the overall emission reductions. In addition, they were tasked with estimating reductions from CDM, VCS and Gold Standard projects, identifying co-benefits and also outlining institutional arrangements for mitigation action MRV. The CSIR contacted the various data providers in order to obtain the information (Table 6.2). Emission reductions were determined, and these were reviewed and approved by DFFE before being incorporated into the BUR. The BUR was subjected to an external review process prior to submission. The DFFE ICCRN is responsible for co-ordinating this review process and for submitting to the UNFCCC via the focal point.

Table 6.2: Data providers for the emission reduction analysis

Measures	Data providers
Carbon tax- GHG emissions reduced through retired carbon offsets	DMRE
12L tax incentive programme	SANEDI
Energy Efficiency Standards and Appliance Labelling project	Green House (2016) report.
Eskom IDM programme	DMRE
Municipal Energy Efficiency and Demand-side Management programme	DMRE
NCPC Industrial Energy Efficiency programme	National Cleaner Production Centre
PSEE programme	National Business Initiative
Private sector embedded solar generation	Association of Renewable Energy Practitioners
Landfill Gas to Energy Activities	CDM project design documents
Renewable Energy Independent Power Producer Procurement programme	IPP Office
Switch to natural gas	DMRE
Bus Rapid Transport System	Department of Transport
Transnet Road-to-Rail programme	Transnet
Nitrous oxide emission reductions	CAIA
Carbon budget and pollution prevention plans	DFFE
Afforestation	DFFE
Grassland rehabilitation	DFFE
Waste management flagship programme	DFFE

The country has begun a process to develop an ex-post assessment model that integrates methodologies and assumptions into the T&E system.

6.3.3. Challenges, gaps and constraints

The T&E system was not fully utilised for the current BUR**.** Updating the T&E system on the NCCIS portal is ongoing and the country has begun a process to develop an ex-post assessment model that integrated methodologies and assumptions into the T&E system. These updates to the T&E system are critical to ensuring that the information is updated and supports the MRV of mitigation actions and transparency reporting. Efforts to integrate International Market Mechanism information updates to the

T&E system is also ongoing. The limitation of resources is one of the main constraints towards increasing human resource capacity to ensuring information system improvements for tracking AFOLU and international market mechanism projects and periodic updates to existing information content on the T&E system.

As mentioned in the previous BUR submission, spreadsheet templates have been used to collate mitigation action activity data. This has been achieved for energy and waste sector mitigation actions. Efforts to integrate AFOLU sector mitigation MRV into the NCCIS are ongoing. A study addressing specific elements of REDD+ in South Africa outlines the potential institutional arrangements needed to integrate the MRV of forestation activities associated with REDD+ (DEFF, 2020).

6.3.4. Future reporting and data flows

The Minister of DFFE promulgated the NGERs under Notice No. 275 in the Gazette No. 40762 of 03 April 2017. The purpose of the NGERs is to enable the DFFE to collate and publish GHG emissions data and information in an effective and efficient manner. The NGERs were promulgated in fulfilment of the implementation of the regulatory framework to support the collection of the requisite activity and GHG emissions data necessary for the compilation of the National GHG emissions Inventory to improve the quality, sustainability, accuracy, completeness and consistency of the National GHG inventories. In accordance with regulation 7(1) of the NGERs the initial reporting cycle commenced on 31 March of 2018 requiring data providers to register and submit activity and GHG emissions data to the competent authority (DFFE). This inventory has started to incorporate information from the SAGERS system, however further data will be included in the next inventory.

With the introduction of the NGERs in 2017, the SAGERS data collection system has been put in place. This will formalise the data collection process for the energy and IPPU sectors (Figure 6.5). GHG data collected through SAGERS will be used for inventory estimates for the next inventory cycle. The SAGERS reporting will also have implications for the monitoring and reporting of mitigation actions.

Figure 6.5: Data flows for data used in the inventory compilation

6.3.5. SAGERS

The SAGERS portal has been developed under the NGHGIS project and will serve as a tool for the implementation of the online registration and reporting by industry in fulfilment of mandatory NGERS. SAGERS has been upgraded to integrate the submissions and annual reporting of pollution prevention plans (mitigation plans) and carbon budgets as combined or separate submissions (DFFE, 2022b).

The proposed subsequent process to manage the pollution prevention plans and carbon budgets has been published in 2020. The regulated pollution prevention plans have been approved and voluntary carbon budgets have been allocated for the period 2016-2020 and those cease to exist by 31 December 2020. It is proposed that once the National Climate Change Act is promulgated, the new carbon budgets Regulations will be linked with the mitigation plans (currently known as pollution prevention plans). The carbon budgets become mandatory on 01 January 2023, it is therefore not mandatory to use the SAGERS to submit or report on pollution prevention plans and carbon budgets at this stage. In the interim, user training is to be provided to the Data Providers by the DFFE and companies will be encouraged

to use the extended voluntary pilot period 01 January 2021 to 31 December 2022 to become familiar with the system and processes for reporting.

As mentioned above, the key benefits of the portal to South Africa include the institutionalisation of the preparation of the National GHG Inventory.

6.3.6. Carbon offsets administration system (COAS)

The Carbon offsets administration system (COAS) has been developed as part of the Carbon Offset Regulation. In BUR-4 the scope of COAS and the flow of information regarding the system was presented. The system facilitates the listing, transfer and retirement of carbon credits to offset carbon tax liabilities.

The South African government has selected the standards and the Carbon Offset Administrator will monitor the listing and retirement of credits for compliance under the carbon tax. The administrator of the system is the Department of Mineral Resources and Energy.

An Operations Procedure Manual provides specific guidance related to the processes and tasks within the ambit of control and function of the Carbon Offset Administrator.

6.4. Verification

The NGERs makes provision for the verification and validation of information submitted to the competent authority, established through DFFE. Furthermore, the NGERs makes provision for the reporting methodology through the Methodological Guidelines for Quantification of Greenhouse Gas Emissions. The aims and process flows of the verification programme were presented in the BUR-4. DFFE has designed its verification programme in line with the South African National Accreditation System (SANAS) accreditation programme for the accreditation of greenhouse gas (GHG) validation and verification bodies for use in related forms of GHG recognition against the requirements of SANS ISO 14065. The programme is structured in two phases, with Phase 1 running until 2022 and phase 2 from 2023. In Phase 1 of the Verification Programme, it will not be mandatory to have Independent Assessors accredited by SANAS and those that are not accredited must apply to the Competent Authority (Climate Change Monitoring and Evaluation Unit in DFFE) prior to appointment by the Data Provider, to demonstrate that they have sufficient competence to verify Emissions Reports as a part of the NGERs. In Phase 2, independent Assessors will need to become accredited by SANAS to perform GHG verification. The phased approach was adopted to enable flexibility and to enable domestic experts in the field to prepare themselves for the accreditation process under SANAS. A set of Verification Guidelines for the validation and verification of GHG emissions, applicable to all anthropogenic emissions by sources and removals by sinks as outlined in Annexure 1 of

the NGERs, has been produced for publication in 2021 (DFFE, 2021). The guidelines describe the process that will be followed to verify the GHG emissions data and submissions made by Data Providers in terms of the NGERs to the National Inventory Unit based at the DFFE.

Amendments have also been made to the National Greenhouse Gas Emissions Reporting Regulations of 2016, where the role of the competent authority in the verification and validation of information is prescribed. The competent authority is required to validate, in accordance with the assessment procedures in the latest version of the Technical Guidelines for Validation and Verification of Greenhouse Gas Emissions. The information submitted is reviewed to determine whether or not it meets quality assurance principles, which are transparency, completeness, accuracy, comparability, consistency and adherence to the latest version of the Methodological Guidelines for Quantification of Greenhouse Gas Emissions. If the information does not meet these principles, the competent authority then has to instruct the Data Provider to validate the information submitted and to provide the supporting information required to substantiate the submission.

6.5. Carbon Tax Act and carbon sequestration

Companies are to report their combustion based-, process based- and fugitive greenhouse gas emissions under the Carbon Tax Act (Act No. 15 of 2019). In addition, National Treasury (NT) introduced a carbon sequestration (“S”) component into the Carbon Tax Act (Act No. 15 of 2019). The Act attempts to motivate emitting entities to change practices to reduce fossil fuel emissions and to increase sequestration associated with the land use and forestry sectors. Carbon sequestration guidelines were developed to provide recommendations on the accounting approach to be adopted by DFFE to include carbon sequestration from plantation forests into the annual company tax accounting process. The guidelines also proposes a supporting set of rules and methods for measuring, reporting and verifying the associated GHG emissions and removal.

The guideline defines “S” under the Carbon Tax Act (Act No. 15 of 2019), assesses the various approaches and challenges with setting up a robust carbon accounting system and makes recommendations on the methods and process to be adopted for including carbon sequestration in the first carbon tax phase.

Verification procedures for the sequestration accounting is being compiled and will be incorporated into the Verification Guidelines mentioned above. This information will assist in the verification of emissions in the AFOLU sector inventory.

Additionally, a Memorandum of Understanding has been developed between the South African Revenue Services and DFFE in support of the implementation of the carbon tax.

6.6. Sectoral Emission Targets

One of the instruments that is to be included in the climate mitigation system for South Africa (Figure 6.6) is Sectoral Emission Targets (SETs) (previously known as Desired Emission Reduction Outcomes in the National Climate Change Response Policy). A framework has been developed outlining the approach that DFFE would follow when coordinating the process towards allocation and implementation of SETs with the line sector departments, provinces and local governments. Once the Climate Change Act is implemented the elements of the system will be legally enforceable.

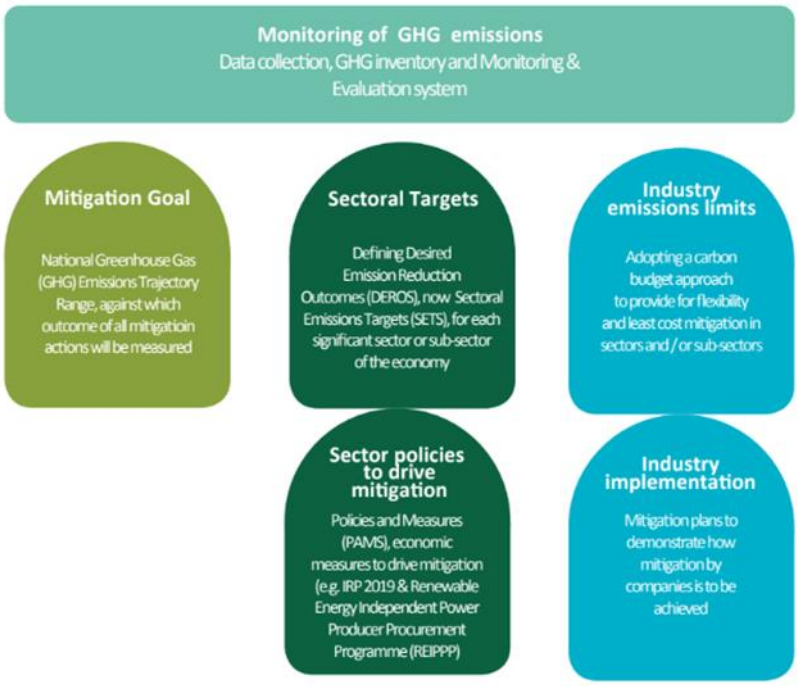

Figure 6.6: Climate mitigation system being developed for South Africa

6.7. References

DEA, 2016. Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry. Version No: TG-2016-1.

DFF, 2021. Technical guidelines for the Validation and Verification of Greenhouse Gas Emissions. Department of Forestry, Fisheries and Environment. Pretoria, Republic of South Africa.

DFFE 2022a. *Greenhouse Gas Inventory for South Africa, 2000 to 2020.* National Inventory Report. Department of Forestry, Fisheries and Environment. Pretoria, Republic of South Africa.

DFFE, 2022b, SAGERS Portal, https://ghgreporting-public.environment.gov.za/GHGLanding/SAGERSHome.html [Accessed December 2022]

ICAT, 2022. ICAT for adaptation in South Africa: SA factsheet. Initiative for Climate Action Transparency.

7. Additional information

7.1. Introduction

The purpose of this chapter is to provide a description of the additional actions undertaken to address a changing climate in South Africa, which are not presented in the BUR-5 in Chapters 1-6. This chapter will provide an overview of these initiatives which include an overview of the National Adaptation Strategy (NAS), progress in South Africa in terms of the Climate Change Bill, which covers both adaptation and mitigation and an overview of the country's Economic Reconstruction and Recovery Plan.

7.2. National Adaptation Strategy

South Africa's National Climate Change Adaptation Strategy (NCCAS), approved in August 2020, serves as the country's National Adaptation Plan (NAP) and presents South Africa's vision of climate change adaptation and climate resilience (DEFF, 2019). The NCCAS supports the country's ability to meeting its obligations in terms of the Paris Agreement and gives effect to the National Development Plan's vision of creating a low-carbon, climate resilient economy and a just society. Priority sectors in the NCCAS include biodiversity and ecosystems, water, health, energy, settlements (coastal, urban, rural), disaster risk reduction, transport infrastructure, mining, fisheries, forestry and agriculture. The NCCAS identifies interventions to meet adaptation goals which address both highly vulnerable sectors, as well as geographic areas. Implementation of the country's NCCAS adaptation interventions will rely heavily on the promotion of research and development in the application, localisation, transfer and the adoption of technology within key climate-sensitive sectors for the period 2021–2030.

7.3. Draft Climate Change Bill

The draft Climate Change Bill aims to provide a legal instrument towards the implementation of the National Climate Change Response Policy and provides a legislative basis for the implementation of the NCCAS (RSA, 2022). The proposed legislation seeks to enable the "development of an effective climate change response and a long term, just transition to a climate resilient and low carbon economy and society for South Africa in the context of sustainable development". A draft bill was published for comment in February 2019 and in May 2021, the bill had been certified by the state law advisor and was in the process of going through the Cabinet system in preparation for tabling in Parliament. Cabinet approved the bill in September 2021 for tabling in Parliament. The bill was referred to the DFFE by Parliament for further and a more robust public consultation. The bill is currently undergoing public

consultation across the nine provinces of South Africa through various workshops. Comments and inputs from the public consultation process will be addressed by the DFFE before it is tabled again for approval by Cabinet.

7.4. South Africa's Economic Reconstruction and Recovery Plan (2020)

South Africa's Economic Reconstruction and Recovery Plan, passed in 2020, sets out a reconstruction and recovery plan for the country's economy that is aimed at stimulating equitable and inclusive growth. The plan enables South Africa's stimulus package to combat the COVID-19-induced economic crisis. The noteworthy components of the plan that are relevant to climate change, include the intention to increase the use of green infrastructure bonds and green finance, to pursue green industrialisation and other green economy interventions (RSA, 2020).

The three phases of the plan include:

1) Engage and Preserve - which includes a comprehensive health response to save lives and curb the spread of the COVID-19 pandemic;
2) Recovery and Reform - which includes interventions to restore the economy while controlling the health risks;
3) Reconstruct and Transform - which entails building a sustainable, resilient and inclusive economy.

7.5. References

RSA (Republic of South Africa) (2020) South Africa's Economic Reconstruction and Recovery Plan. Available at: https://www.gov.za/sites/default/files/gcis_document/202010/south-african-economic-reconstruction-and-recovery-plan.pdf

RSA (Republic of South Africa) (2022). Draft Climate Change Bill, published for public comment (Government Gazette No. 45299 of 11 October 2021). Available at: https://www.parliament.gov.za/storage/app/media/Bills/2022/B9_2022_Climate_Change_Bill/B9_2022_Climate_Change_Bill.pdf

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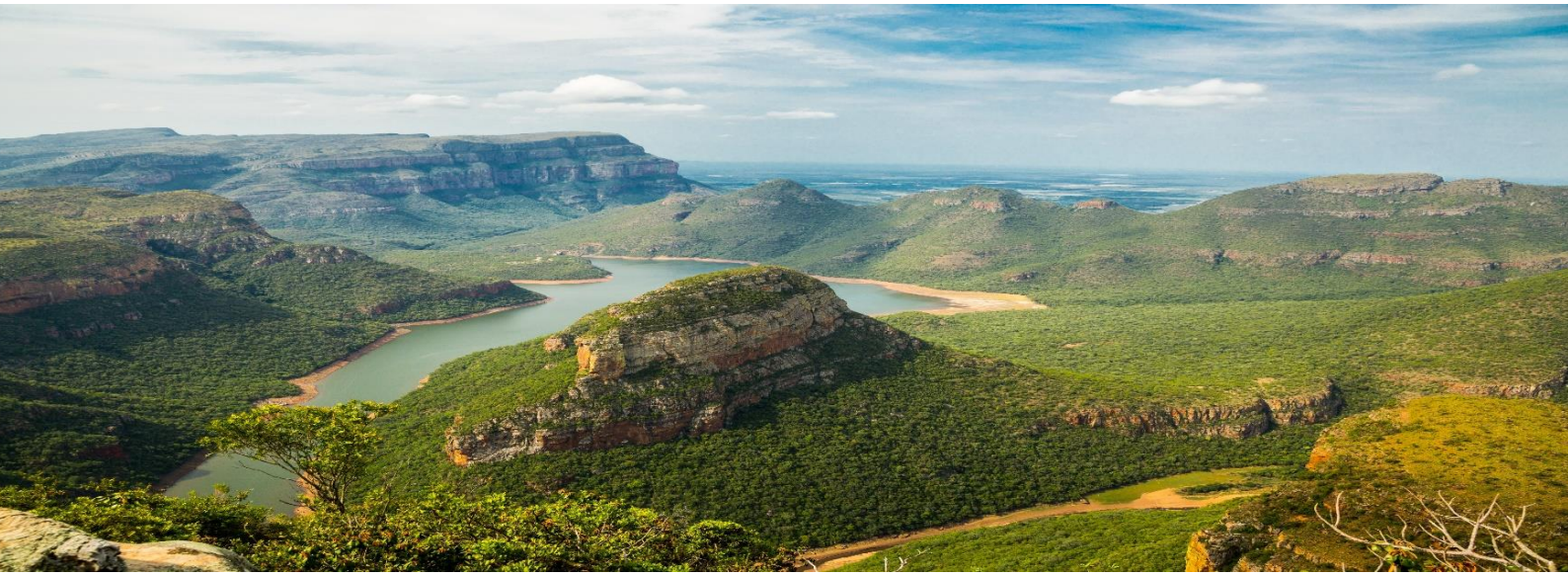

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