Western Cape Government

Department of Environmental Affairs and Development Planning

2050 Emissions Pathway Analysis for the Western Cape

2018 Baseline GHG Emissions Profile

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Table of Contents

Abbreviations and Acronyms

AFOLU	Agriculture, Forestry and Other Land Use
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CH_4	Methane
DEA&DP	Department of Environmental Affairs and Development Planning
DFFE	Department of Forestry, Fisheries and the Environment
GHG	Greenhouse Gas
HFC	Hydrofluorocarbons
HFO	Heavy Furnace Oil
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Products and Product Use
LPG	Liquid Petroleum GAs
N_2O	Nitrous oxide
NDC	Nationally Determined Contribution
NERSA	National Energy Regulator of South Africa
NO_x	Oxides of Nitrogen
PFC	Perfluorocarbons
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

The Greenhouse Gas (GHG) Inventory for the Western Cape Province forms part of the completion of a 2050 Emissions Pathway exercise modelling a net-zero emissions future for the Western Cape.

The Climate Change Directorate in the Department of Environmental Affairs and Development Planning (DEA&DP) has maintained an Energy Consumption and CO_2e Emissions Database for the Western Cape for the last decade, continuously improving on the coverage and accuracy of the emissions data. This work is now being expanded to a full GHG inventory exercise including the development of a baseline emissions profile using 2018 data. The sectors covered in the GHG Inventory exercise are Energy (including Transport), Waste (including wastewater treatment), Industrial Process and Product Use[1] (IPPU) as well as Agriculture, Forestry and Other Land Use (AFOLU[2]). These sectors are included in the reporting guidelines for countries to report to the United Nations Framework Convention on Climate Change (UNFCCC) and align with the National Inventory Report for South Africa.

This report contains a high-level GHG emissions breakdown for the Western Cape based on the emissions for each of the four sectors, mentioned above, as well as highlighting key actions required to improve the emissions data going forward. It uses 2018 as a baseline year; that year being the most recent for which the necessary input data is available.

For each sector a specific report has been drafted including an introduction, a brief description of the methodology used in calculating the GHG emissions for that sector as well as the latest information and statistics on GHG emissions. These are represented by Annexures A – D of this report[3]. A high level of detail is present in the report on AFOLU sector emissions, as the component was specifically modelled in preparation for the GHG emissions inventory.

The 2050 Emissions Pathway analysis focuses on changes to be made in the Western Cape for the achievement of a net-zero future, while considering the principles of a Just Transition as guided by the Presidential Climate Commission. There are disparities that exist in our economy in terms of gender equality, and we need to ensure that measures are put in place to redress this through intentional efforts that ensure women, youth and other marginalized groups are afforded the opportunity and appropriately represented in our engagements, whilst ensuring that their voices are carried through to influence decision-making and implementation priorities. The work required to frame an alternative development trajectory around planning a net-zero future also allows the Western Cape Government to lead in identifying and strengthening opportunities for women and youth to excel. This will be brought in as a key driver for modelling the mitigation measures and implementation actions in the next phase of the work; and persist as key deliverable within project implementation.

[1] IPPU covers the greenhouse gas emissions resulting from various industrial activities that produce emissions not directly the result of energy consumed during the process and the use of man-made greenhouse gases in products (IPCC, 2006)

[2] The AFOLU sector produces GHG emissions and removals through a variety of pathways, including land-use changes that alter the composition of vegetation and soil, management of forests and other lands, methane produced in the digestive processes of livestock and nutrient management for agricultural practices.

[3] It is recommended to read the Energy report first in order to get an understanding of the background and context of the GHG data collection exercises that have been undertaken for the Western Cape.

The National Context

In August 2021, the national Department of Forestry, Fisheries and the Environment (DFFE), released the 7th National Greenhouse Gas (GHG) Inventory Report 2000 – 2017 (DFFE, 2021). The Inventory is developed in partial fulfilment of South Africa's commitment to the UNFCCC, which requires countries to not only address climate change, but also to monitor trends in anthropogenic greenhouse gas emissions.

The National Inventory Report covers sources of GHG emissions and removals by sinks, resulting from human-induced activities for the major greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Indirect greenhouse gases, including carbon monoxide (CO) and oxides of nitrogen (NO_x) are also included in biomass burning.

The gases are reported under four sectors: Energy, Industrial Process and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), and Waste. This follows convention outlined by the Intergovernmental Panel on Climate Change (IPCC)(IPCC, 2006).

The information gleaned from the National Inventory Report supports policy development and decision-making related to a viable climate change mitigation response as South Africa transitions to a low carbon and climate resilient society as outlines in the National Development Plan's Vision 2030 and the National Climate Change Response Policy (2011). It is also used to support implementation of South Africa's Nationally Determined Contribution (NDC) submitted periodically to the UNFCCC.

Energy related emissions, which includes emissions from liquid fuel use in the transport sector, remain the biggest contributor to GHG emissions in South Africa at 80% of total emissions (Figure 1). While emission reductions are required in all sectors, the actions required to achieve significant reductions in GHG emission for the country need to be focussed on the energy and transport sectors in particular.

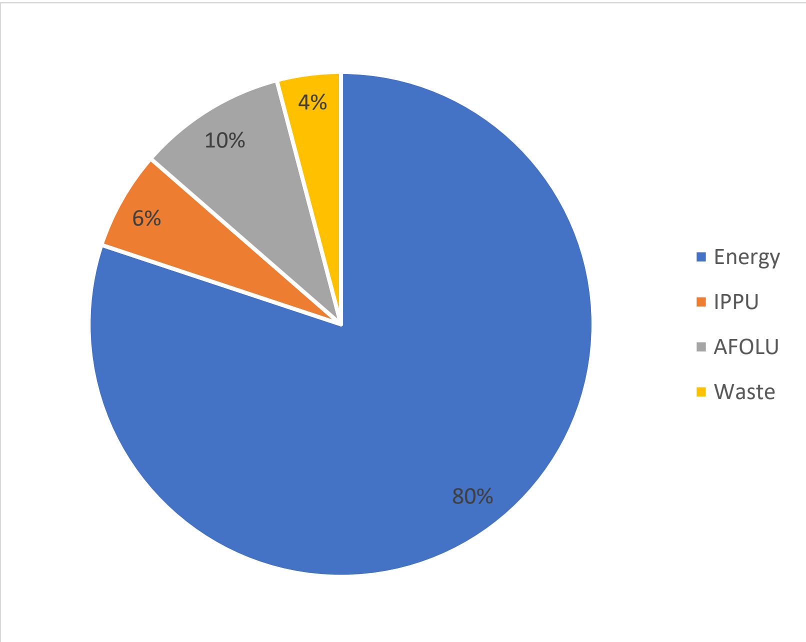

Figure 1: National sectoral GHG emissions contribution in 2017 from the National Inventory Report (DFFE, 2021)

Methodology for calculating GHG emissions for the Western Cape GHG Inventory exercise

Each sector has its own detailed methodological description included in its sector report, but a summary for each sector is provided below. A key component for calculating sectoral emissions is allocating the correct emissions factors to activities and ensuring that all emissions are converted to carbon dioxide equivalent (CO_2e)[4] units to compare the sectors to each other.

Energy Sector

Modelling of the energy sector emissions is based on a demand-side energy use assessment according to key energy sectors (industrial, commercial, residential, transport etc) and main fuel types (electricity, coal, petrol, diesel, etc.) across the province. The data used in the analysis was collected for the 2018 calendar year, which is then used as the baseline year for the GHG Inventory for the Western Cape.

Data for each fuel type is collected, allocated to sector and geographical regions, and then multiplied by the relevant conversion factors in order to determine the CO_2e. Table 1 provides a summary of the fuel type, sector allocation and data sources that have been used in the energy sector report. A detailed description of the methodology is outlined in Annexure A.

Table 1: Energy Data Sources

Fuel Type	Relevant Sectors	Data Sources
Electricity	Residential, Commercial, Industrial Agriculture, Transport Local Government	Eskom cross referencing with NERSA municipal information where available Cape Town Energy and Carbon Report 2021
Liquid Fuels – Petrol and Diesel, LPG, Paraffin, Fuel Oil, Aviation Gas and Jet Fuel	Residential, Commercial, Industrial Transport	Department of Mineral Resources and Energy (Quarterly Magisterial District Liquid Fuel Sales Figures) Cape Town Energy and Carbon Report 2021
Coal	Industrial	Atmospheric Emissions License information for the Western Cape National GHG Inventory for South Africa (2000 – 2017) Cape Town Energy and Carbon Report 2021

Solid waste disposal and wastewater treatment

Solid waste disposal

The quantification of GHG emissions from solid waste is determined by two main factors, namely the mass of waste disposed and the amount of degradable organic carbon within the

[4] Carbon dioxide equivalent (CO_2e) is a term for describing different greenhouse gases in a common unit. It allows "bundles" of greenhouse gases to be expressed as a single number and it allows different bundles of GHGs to be easily compared (in terms of their total global warming impact potential).

waste which determines the methane generation potential. It is also important to understand the composition of the solid waste stream in order to determine the waste material types, such as paper, wood, textiles, organics etc. Three calculation steps are present:

Step 1 – determine the quantity of waste generated, and how and where it is treated / disposed of.

Step 2 – Determine the emissions factor to be used.

Step 3 – Multiply the quantity of waste disposed of by relevant emission factors to determine the total emissions.

Wastewater Treatment

Municipal wastewater can be treated aerobically (in the presence of oxygen) and anaerobically (in the absence of oxygen). When wastewater is treated anaerobically, methane is produced. Both types of treatment also generate N_2O through nitrification and denitrification of sewage nitrogen. N_2O and CH_4 are potent GHGs as they have a much higher global warming potential than CO_2, although they have a much shorter lifespan in the atmosphere.

In order to quantify the methane emissions from wastewater treatment, the following information is required:

- The quantity of wastewater generated
- How the wastewater and sewage is treated
- The wastewater source and its organic content.

As for solid waste, the amount of wastewater is multiplied by an emission factor specific to the treatment type to determine a final emissions value.

Industrial Process and Product Use Sector

There were a number of challenges in calculating the emissions for the IPPU sector in the Western Cape due to data not being publicly available or reported to a centralised system. The information retrieved from the National Inventory Report covered only two sub-sectors, namely the Minerals Industry and Metals Industry. The calculations had already been done as part of the national GHG Industry analysis, so no further analysis was undertaken.

In terms of both processes, the following information is required in order to estimate the emissions:

- Annual production output and the raw material consumption in the processes
- The emissions factors of the different products / raw materials
- An understanding of the number of production industries in the relevant sub-sectors.

Agriculture, Forestry and Other Land Use Sector

The AFOLU analysis follows the internationally accepted framework and guidance provided by the IPCC for national-scale GHG inventories (IPCC, 2006). The IPCC (2006) framework and guidelines are specifically aimed at national scale GHG inventories but are applicable at provincial or regional scales. Importantly, the framework is designed to measure and report the GHG emissions of an area in which there may be a diversity of economic sectors and activity.

In addition, the IPCC (2006) methodology uses a system of three tiers to allow flexibility in the accuracy of reporting relative to the information that is available:

- Tier 1: Is the least accurate and is typically an international default value listed in the IPCC guidance, for example, the international average weight of each type of livestock.
- Tier 2: Is a more accurate, country- or area-specific value, for example, the average weight of each type of livestock in South Africa.
- Tier 3: Is the most accurate and often a highly calibrated area specific model of carbon stocks and fluxes, emissions from livestock or agrochemical application.

The rationale for the tiered approach is that it allows parties with little access to country-specific activity data or emission factors, to use Tier 1 values to provide an initial estimate of GHG emissions and submit a National GHG Inventory to the UNFCCC. However, parties are encouraged to move towards Tier 2 or 3 data and emission factors as soon as is reasonably possible. For this reason, national- or province-specific data has been sourced wherever possible. Furthermore, where Tier 1 data is used, guidance is provided on how a Tier 2 or 3 approach could be followed in future.

Specific methodologies for each component in the AFOLU sector are covered in the detailed AFOLU GHG analysis report (Annexure C).

GHG emissions for the Western Cape

This chapter includes a summary of the GHG emissions for each of the emissions sectors as well as an overview of the total GHG emissions for the Western Cape based on the information from the Sector reports.

It should be noted that the IPPU sector, in particular, has some significant data gaps and does not provide a true reflection of the sector's emissions for the Western Cape. In order to fill these gaps, further detailed analysis of the sector and additional data collection will be required. This was not possible given the financial and capacity constraints in this project and will be highlighted as an area of future work.

The waste sector has also been identified as a sector experiencing some data challenges. The reporting of waste generation figures is lacking in some of the districts of the Western Cape, the wastewater treatment data is extremely difficult to capture and not available in a central data repository. This is also an area that needs a greater level of data analysis and collection going forward.

Overview

Similar to the national picture, the Western Cape's emissions profile is completely dominated by the Energy sector, which also includes transport related activities (Table 2 and Table 2.

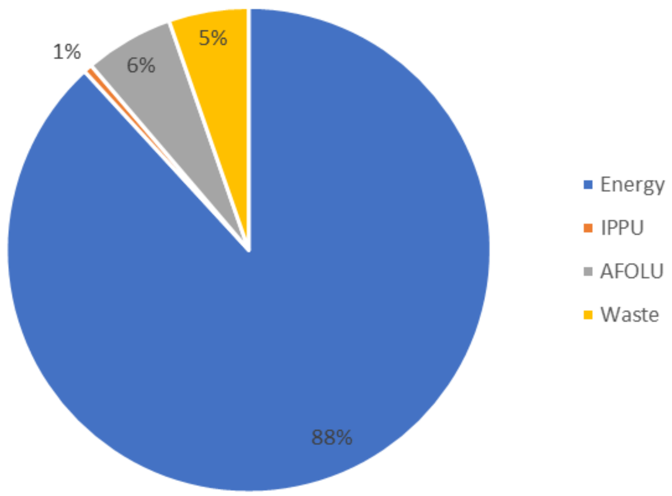

Figure 2: Breakdown of GHG Emissions by Sector for the Western Cape 2018 (tCO_2e)

The challenges with IPPU data mean that Figure 2 is not a true reflection of the emissions associated with the sector and once improved data is available there should be some sector shifts as the IPPU contribution increases. Note that at national level, which reflects the industrial activities in provinces such as Gauteng, Mpumalanga and Kwa Zulu-Natal, the IPPU sector contribution is around 6%. At this stage we do not have enough information in order to make any assumptions about the full contribution of the sector in the Western Cape.

Table 2: GHG Emissions for the Western Cape

Source	GHG emitted (tonnes)			
	CO_2	CH_4	N_2O	CO_2e
Energy Sector	34 950 183			**34 950 183**
IPPU Sector	231 369			**231 369**
Waste Sector		104 895	232	**2 346 161**
AFOLU Sector	- 1 566 601*	91 815	4 185	**2 113 372**
TOTAL	**33 614 951**	**20 210**	**4 417**	**39 641 085**

*Note that the CO_2 component of the AFOLU sector constitutes a nett carbon sink, hence a negative sign

Energy

The Energy and Emissions Picture for the Western Cape

The Energy sector, inclusive of energy use for transport, accounts for an estimated 34 950 183 tons CO_2e in Western Cape in 2018 (Table 3). The GHG emissions in the Western Cape are dominated by the energy sector, which is consistent with the national GHG inventory. The energy sector which is primarily based on the use of fossil fuels, such as electricity (from coal-fired power stations), diesel, petrol, and coal, has a very high global warming potential due to the emissions released from fossil fuel combustion. The shift towards increased renewables will play a role in reducing the emissions associated with the energy sector.

Table 3: Key Sustainable Energy Indicators for the Western Cape Province

	Unit of measure	2009 (Provincial Value)	2012/13 (Provincial Value)	2015/16 (Provincial Value)	2018 (Provincial Value)
Total energy consumption	GJ	2792 420 231	276 594 683	299 401 470	272 579 266
Total GHG emissions	tCO_2e	37 637 336	36 345 801	38 901 581	34 950 183
Energy consumption for capita	GJ/capita	64	46	48	41
GHG emissions per capita	tCO_2e / capita	8	6	6	5
Energy per GDP (R 'million)	GJ / GDP	1 428	629	792	625
GHG emissions per GDP (R 'million)	tCO_2e / GDP	178	82	103	80

The energy picture in the Western Cape is dominated by the City of Cape Town, which accounted for 56% of all energy used in the province. The more energy-intense, heavy industry of the West Coast (notably iron and steel and cement/ sand industries) brings the relatively less populated area of the Province as the 2nd highest energy consumer at 24%. These two regions are there responsible for 80% of the total energy consumption in the Western Cape and actions to reduce energy-related GHG emissions should therefore be focussed predominantly here. There are however challenges with taking this approach, particularly given that decisions around energy supply are made by the National Government.

Garden Route and Cape Winelands Districts, with some of the largest towns in the province, including George, Mossel Bay, Paarl and Stellenbosch, are the next highest consumers of energy at 10% and 7% respectively. Overberg and Central Karoo, particularly due to the nature of their economic activities and low population figures only contribute 2% and 1% respectively to the total energy consumption in the province.

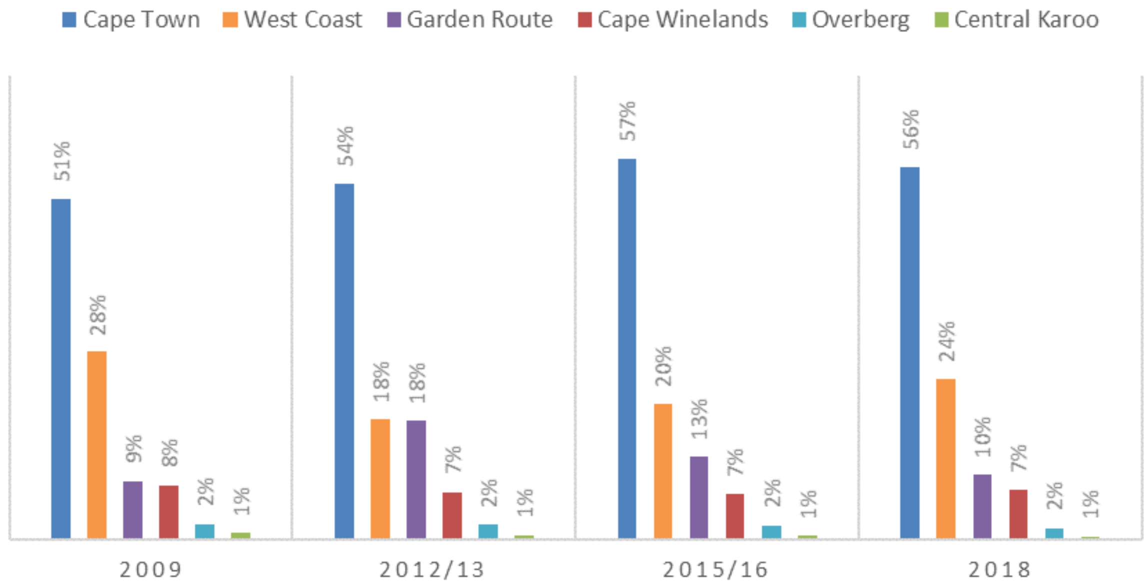

Figure 3 : Energy consumption by district / metropolitan municipality as a percentage of total province consumption

The overall CO_2e emissions in the Western Cape have taken a fluctuating trajectory, with emissions between 2009 and 2012/13 decreasing, then increasing again between 2012/13 and 2015/16 and now showing a decreasing trend again up to 2018 (Figure 4 and Table 4). There could be a number of reasons for this fluctuation, including fluctuations in the energy consumption over the years, and changes in the quality / source of data received for the exercise. However, the general shift towards low carbon energy sources and greater energy efficiency by residential, commercial and industrial users should realise a downward trend in emissions.

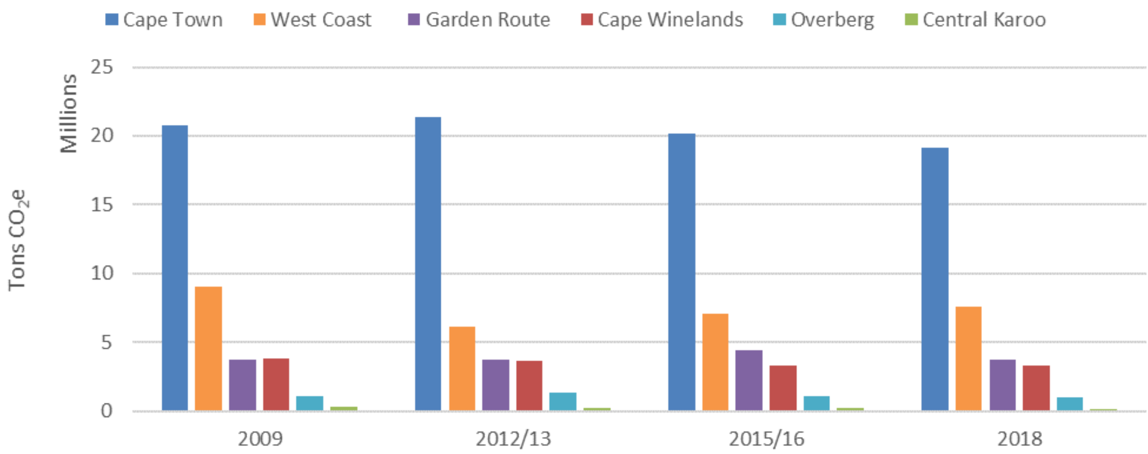

Figure 4: CO_2e emissions by district / metropolitan municipality (tCO_2e)

Table 4: CO_2e emissions by District / metropolitan municipality for the period 2009-2018

	2009	2012/13	2015/16	2018
	Tons CO_2e	Tons CO_2e	Tons CO_2e	Tons CO_2e
Cape Town	20 794 987	21 373 421	20 138 163	19 124 469
West Coast	9 005 816	6 106 299	7 028 336	7 609 157
Garden Route	3 687 649	3 696 461	4 409 571	3 719 728
Cape Winelands	3 787 892	3 650 283	3 270 397	3 333 169
Overberg	1 089 324	1 289 416	1 096 535	1 002 705
Central Karoo	277 318	229 873	185 665	160 955
Total	**38 642 986**	**36 345 753**	**36 128 668**	**34 950 183**

Electricity, diesel, petrol and coal dominate the mix of energy carriers / fuels consumed in the province (Figure 5). The coal figures need to be read with some caution as the methodology for collecting coal data has had to be adjusted over the four iterations of the database, predominantly due to availability of data and the capacity to undertake a detailed assessment. As stated in the Methodology chapter, the sale of coal is not regulated, so this makes it difficult to get accurate figures. There has also been a significant decrease in the consumption of diesel to below 2012/13 levels (after a big increase in consumption in the 2015/16 database). There are a number of reasons for this, but a more detailed analysis will need to be undertaken to fully understand these shifts.

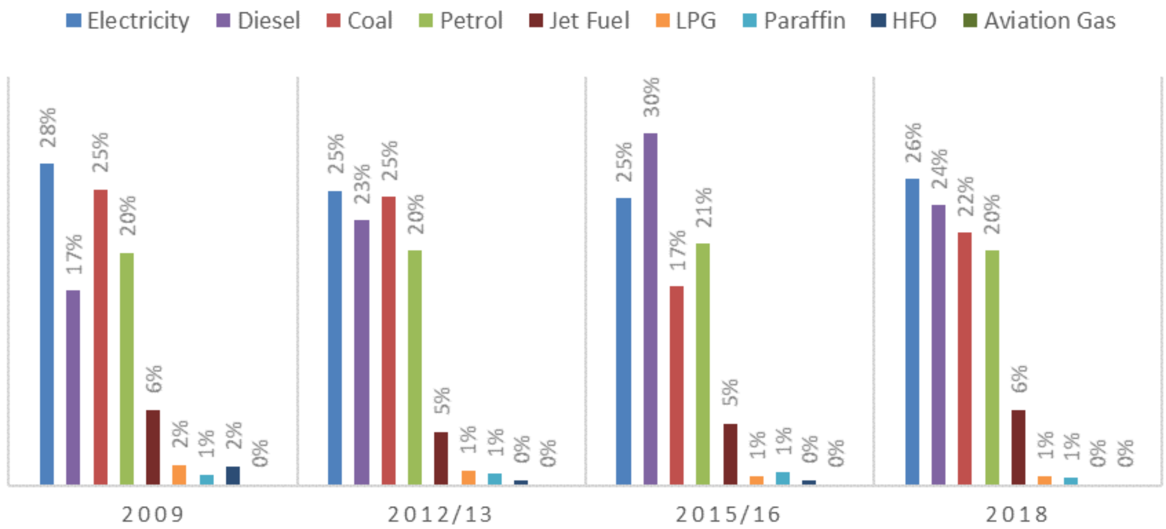

Figure 5: Energy use by fuel type in the Western Cape

The fuel picture continues to demonstrate a reliance on fossil fuels in the province. Electricity is taken to be derived proportionally from the national mix, which in 2018 was still dominated by coal-fired power generation, as well as some nuclear. The percentage of renewable energy as part of the national grid has been increasing, but not by so much that it made a significant impact on the emissions factor for electricity. Other than electricity generated by nuclear power (Koeberg Nuclear Power Station in Cape Town) and diesel-powered peaking stations in the Western Cape, the balance of the electricity is brought in from the north of South

Africa. Direct use of coal in industrial processing contributes sizeably to the province energy picture, particularly in the West Coast District.

The majority of energy-related emission in the Western Cape come from electricity. Electricity, with its high carbon potential due to the role that coal plays in its generation, will continue to dominate the emissions profile until significant changes are made to the energy mix. This is followed by diesel, coal and petrol, which these figures fluctuating over the years based on consumption and use of particular fuels. The other fuels do not make a significant impact on the emissions profile.

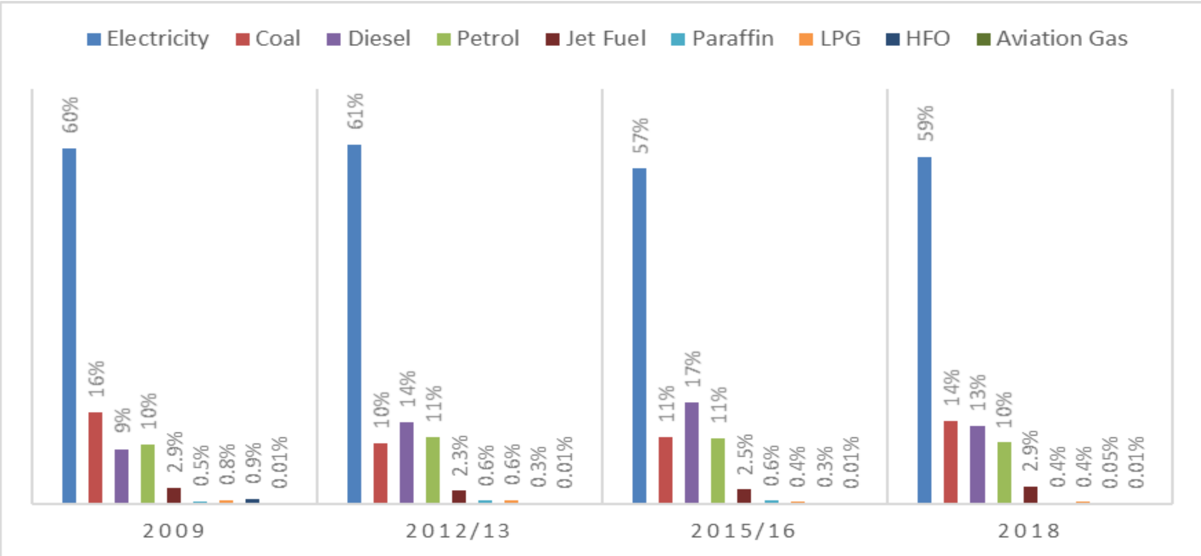

Figure 6: Emissions by fuel type for the Western Cape

Tracking energy over time

Energy related data for the province was first collected in 2007 using 2004 data and in some cases a different data analysis methodology and data sources. It was collected in its current form from 2009 – 2018. Although it is difficult to draw strong conclusions from this information, some of the trends are discussed and areas where more information is needed are identified. The emerging picture continues to show a fluctuating picture in terms of energy consumption, with decreases in 2012/13 and 2018.

It is also important, to include some information about loadshedding, which is defined as planned supply interruptions which may need to be carried out when demand for electricity exceeds the available supply. South Africa experienced approximately 139 hours (calculated as just under 6 days of loadshedding across the year)[5] in June and November / December of 2018. This is significantly less than the estimated 2000 hours (85 days) experienced in 2015 and the 532 hours (22 days) experienced in 2019.

Loadshedding would therefore not have a had a significant impact on the electricity figures for 2018, although the knock-effects of the 2015 loadshedding has shown reduced electricity consumption, which can show can increased investment by industrial, commercial and

[5] Source : www.mediahack.co.za based on data collected by the EskomSePush loadshedding cellphone app. The information provided here represents the number of hours of loadshedding over the year and the various stages over the periods.

residential customers in renewable energy and energy efficiency in order to be less dependent on the national grid. The economic impact of loadshedding is however, much greater. In a 2021 Press Release, MEC David Maynier[6] states that loadshedding cost the Western Cape Economy an estimated R75 million per stage, per day.

Table 5: Tracking energy consumption by sectors between 2004 and 2018 in the Western Cape

Sector	2004[7]	2009	2012/13	2015/16	2018
	TJ	TJ	TJ	TJ	TJ
Residential	19 529	27 479	24 652	28 970	22 993
Commercial	8 872	14 434	10 921	14 430	22 577
Industrial	120 365	113 293	85 383	87 531	80 591
Transport	86 382	128 063	146 296	161 817	139 209
Agriculture	12 604	4 698	6 98	5 092	4 350
Local Government[8]		1 244	2 111	1 561	2 855
TOTAL	**247 752**	**292 342**	**276 333**	**299 401**	**272 579**

Table 6: Tracking energy consumption by fuel type between 2009 and 2018 in the Western Cape province[9]

Fuel	2009	2012/13	2015/16	2018
	TJ	TJ	TJ	TJ
Electricity	81 022	77 054	81 019	71 509
Coal	74 587	46 531	51 579	58 971
Petrol	58 588	61 326	59 746	54 777
Diesel	49 016	69 228	84 984	65 351
Paraffin	2 62	3 080	2 985	1 801
LPG	2 864	3 690	2 399	2 228
HFO	4 588	1 390	1 225	222
Jet Fuel	18 941	14 027	15 398	17 643
Aviation Gas	94	77	66	73
TOTAL	**292 342**	**276 333**	**299 401**	**272 579**

[6] https://businesstech.co.za/news/energy/497749/load-shedding-cost-south-africa-around-r25-billion-in-the-last-two-weeks-mec/

[7] The 2004 data was collected in 2007 as part of the development of the Sustainable Energy Strategy for the Western Cape. Energy data collect practices during this time were not as developed as they are now and there are some challenges and uncertainties with this data.

[8] For the 2004 data, local government was included in the commercial sector

[9] The fuel breakdown for the 2004 data is not available

There was decrease in electricity consumption between 2015/16 and 2018 adding to the fluctuating trend of increasing and decreasing consumption across the database years. The same period exhibits an increase in coal consumption figures. It is not clear whether this is due to an actual increase in consumption of coal or due to improved data collection. The HFO figure for 2018 is also much lower than the preceding years. This could be linked to the reporting on HFO sales as these are reported at a wholesale level and there may have been shifts in terms of the sale and supply of HFO in the Western Cape. It can also be linked to a reduction in actual consumption. A detailed analysis of the data may be necessary in order to understand this shift in more detail, however, the impact on the total energy consumption for the Western Cape is not significant.

In terms of changes across the sectors, there were decreases experienced across all sectors, except for local government and a large increase in the commercial sectors. The local government increase can be attributed to better quality data, as we were able to access information from NERSA to verify and cross check. But the significant increase in the commercial sector needs to be assessed and understood in greater detail.

Challenges and uncertainties with regard to energy data collection remain and the fluctuations in the figures across the years show that there is currently no consistent trend evident. It is therefore risky to draw finite conclusions in comparing the figures from the different data collection periods. There is a need more in-depth analysis and collection of data, but current capacity and financial constraints in the Department do not allow for these more detailed data collection and analysis exercises. However, the current format is useful in that it gives an indication of consumption in terms of types, sectors and geographical areas. This identifies where interventions are possible in terms of energy consumption and emissions reductions going forward.

Sector disaggregation

The largest proportion of energy consumed in the province is by the Transport sector, which remains at over 50% of all energy consumption (Figure 7). Industry remains the 2nd largest energy consumer in the province. The residential and commercial sectors both contribute 8% to the total consumption, following a significant jump in energy consumed by the commercial sector since the last reporting cycle. The other sectors, with smaller contributions (agriculture and local government) have remained relatively consistent over the reporting periods.

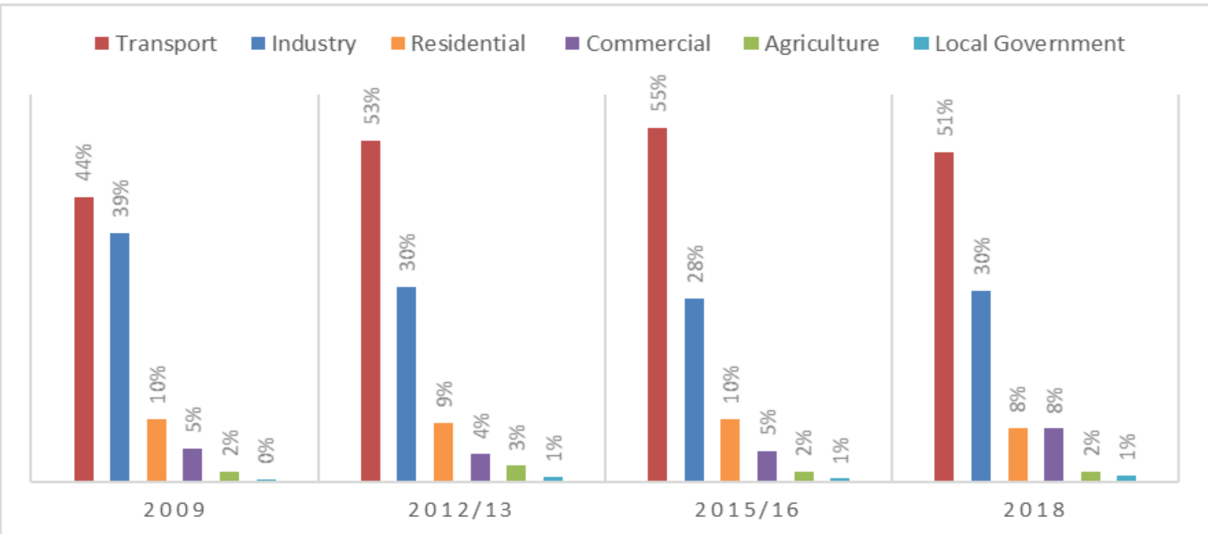

Figure 7: Energy Consumption by Sector for the Western Cape

It is Industry, however, and not the transport sector that contributes the most to the provincial emissions profile, at 31%, which is a drop from 36% in 2015/16 (Figure 8). Industrial emissions emanate from the use of fossil-fuel based electricity as well as the use of primary coal in industrial purposes. A drop in diesel usage in the transport sector as well as the overall reduction in electricity (and increase in the commercial sector) all contribute to the changing sector profile from the previous years.

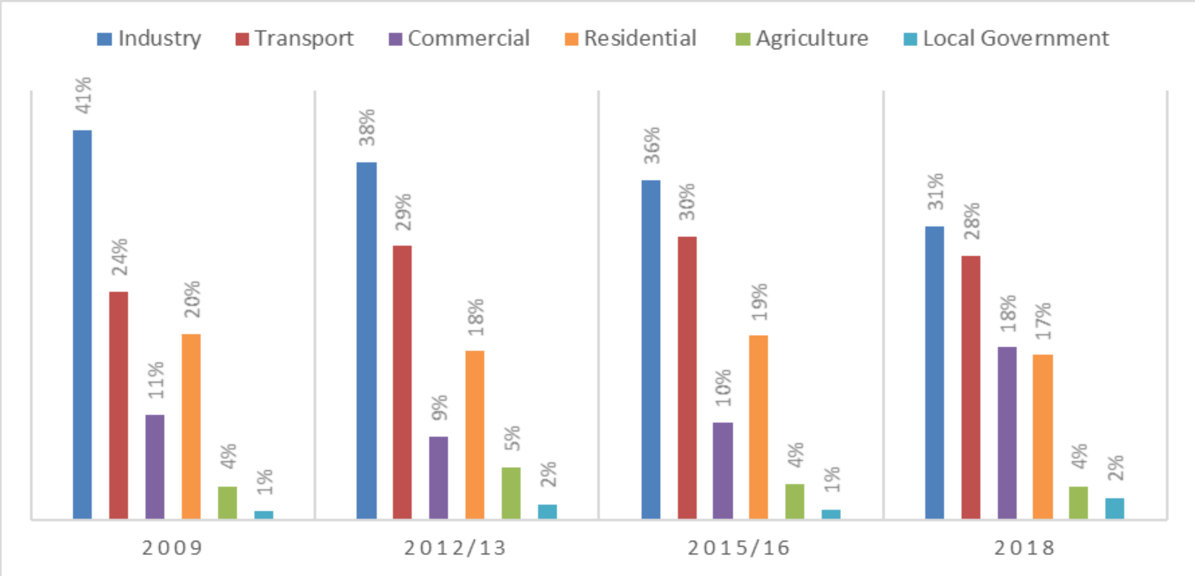

Figure 8: Emissions by sector for the Western Cape

It is worth exploring electricity consumption by sector, given that this is the single largest energy source in the Western Cape. The breakdown across sectors has shifted in the latest database, due to the increase in electricity used for commercial purposes (Figure 9). The industrial, residential and commercial sectors are each responsible for approximately 30% of total electricity consumption in the Western Cape.

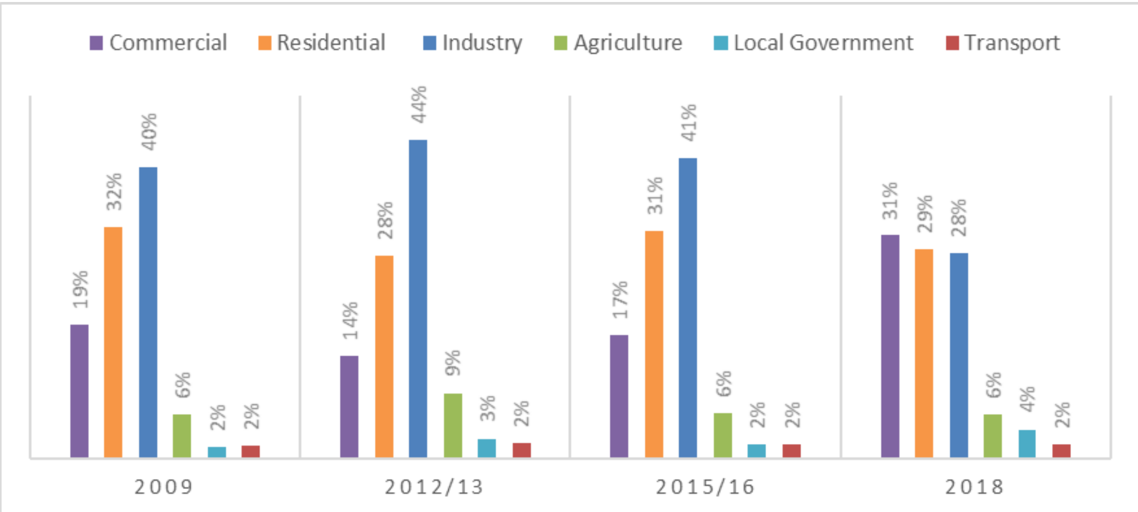

Figure 9: Electricity consumption by sector for the Western Cape

Waste

As mentioned earlier in this report, there are some major gaps in the data from waste disposal and wastewater treatment in the Western Cape. The information presented below is based on the best available data at this stage, but there is a need to undertake a more detailed analysis of the waste and wastewater sectors in order to improve the quality of GHG emissions reporting.

There is also currently no information or available on the biological treatment of solid waste as well as incineration and open burning of waste, either at the national or provincial level and this is another gap that will require further assessment.

The emissions from Solid Waste Disposal included in Table 7 comes from the waste generation figures submitted to the provincial Integrated Pollutant and Waste Information System (IPWIS) as well as information from the national GHG Inventory for South Africa, which was used to supplement the Western Cape data. The wastewater treatment information is taken from the national GHG inventory for South Africa.

Table 7: GHG Emissions for the Waste Sector

Source (IPCC category)	**GHG emitted (tonnes)**			
	CO_2	CH_4	N_20	**CO_2e**
4 A – Solid Waste Disposal		101 711		**2 197 425**
4.D – Wastewater treatment				
4.D.1 Domestic wastewater treatment		2 373	232	**128 461**
4.D.2 – Industrial wastewater treatment		811		**20 275**
TOTAL		**104 895**	**232**	**2 346 161**

Next steps for this sector are to work on identifying data sources for the gaps that are currently found, which will then allow us to under more detailed district assessments and specify key areas where action needs to take place.

AFOLU

The Western Cape AFOLU sector is a net source of GHG emissions into the atmosphere (Table 8, Figure 10), releasing a net amount of approximately 2 113 000 tCO_2e per year. Emissions from livestock are the largest contributor, accounting for 73% of all AFOLU emissions. The application of nitrogen-based fertiliser and lime to cultivated land is the second most significant source, contributing 20% of emissions from the sector. Activities aimed at reducing emissions from these particular sources, for example, the provision of supplements to livestock and the implementation of conservation agriculture, may be significant opportunities to reduce emissions from the sector.

Table 8: GHG emissions generated by the Western Cape's AFOLU sector (Year 2018).

Source (IPCC category)	**GHG emitted (tonnes)**			
	CO_2	CH_4	N_20	**CO_2e**
3.A - Livestock				
3.A.1 - Enteric Fermentation		70 785		**1 981 991**
3.A.2 - Manure Management		21 021	678	**768 296**
3.B - Land				
3.B. Net change across land cover types	-1 701 586			**-1 701 586**
3.C - Aggregate sources and non-CO2 emissions sources				
3.C.1 - Emissions from biomass burning	4 650	8	1	**5 022**
3.C.2 - Liming	169 180			**169 180**
3.C.3 - Urea application				
3.C.4 - Direct N2O Emissions from managed soils			2 394	**634 483**
3.C.5 - Indirect N2O Emissions from managed soils			834	**221 019**
3.C.6 - Indirect N2O Emissions from manure management			279	**73 812**
3.D - Other				
3.D.1 - Harvested Wood Products	-38 844			**-38 844**
TOTAL	**-1 566 601**	**91 815**	**4 185**	**2 113 372**

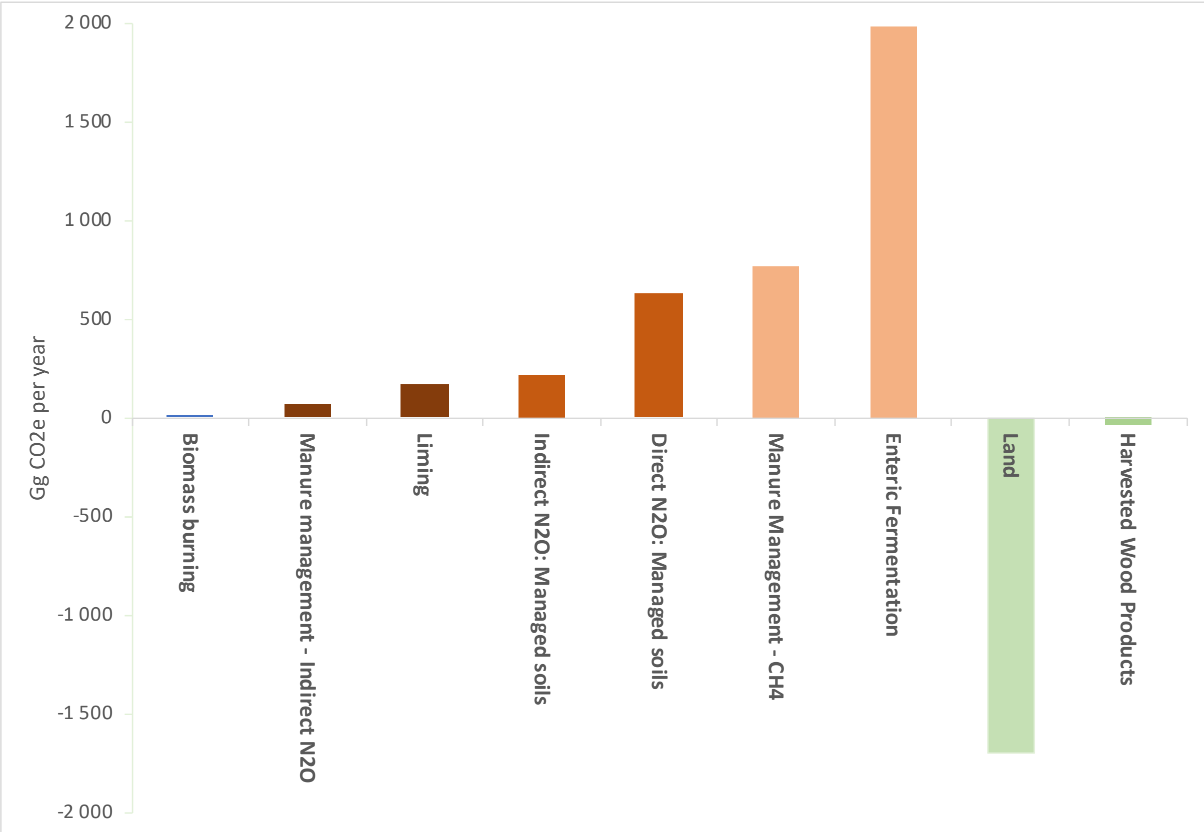

Figure 10: The proportion of GHG emissions generated by each sub-sector with the Western Cape AFOLU sector

Over the 2014-2018 period, Western Cape landscapes have been a net sink of carbon. This is largely attributable to an increase in woody carbon stocks within fynbos, old fields and orchards over the period. It should be noted that part of the reported sink in "*Fynbos*", approximately 50%, may be due to changes in the manner in which "*Shrubland: Fallow lands and old fields*" was classified in the 2014 and 2018 national land cover maps and not a true reflection of carbon sequestration over time. This inconsistency will be addressed by a more constant land classification system being adopted in future national land cover mapping iterations.

Whereas there has been an increase in woody carbon stocks in certain areas, at the same time there has been a decrease in carbon stocks within forest and wetland ecosystems. This is due to both a decrease in the area of each of these land cover types as well as a decrease in carbon stocks per hectare, which may be due to fires over the 2014-2018 period.

Although woody carbon stocks have increased over the 2014-2018 period, there has been a notable reduction in soil organic carbon stocks (Table 9). This is principally due to an increase in the area of cropland across the province and the associated turnover of soil and release of sequestered carbon into the atmosphere. 697 580 tC/year equates to 2 511 000 tCO_2e/year, which is larger than net emissions of the entire sector. Implementing activities that halt the release of soil organic carbon and restore soil carbon may be an opportunity to turn the Western Cape AFOLU sector into a net sink of GHGs.

Table 9: The change in terrestrial carbon stocks across the Western Cape between 2014-2018

Year	Tons of carbon in each pool (tC)					TOTAL
	Woody	Herbaceous	Litter	Soil (0-30cm)	Soil (0.3-1m)	
2014	55 905 691	8 329 384	34 006 806	492 511 186	2 345 653 904	**2 936 406 971**
2018	61 393 640	8 505 821	33 006 467	489 720 865	2 345 636 454	**2 938 263 247**
Change over 4 years (tC)	5 487 949	176 437	-1 000 340	-2 790 321	-17 450	**1 856 276**
Average change (tC/y)	1 371 987	44 109	-250 085	-697 580	-4 362	**464 069**
Percentage change	9.82	2.12	-2.94	-0.57	0.00	**0.06**

IPPU

There are significant data gaps for the IPPU sector, with the information from the national GHG inventory only providing a small sample of the total IPPU emissions for the Western Cape.

Discussions are underway with the Air Quality Directorate in the Western Cape Department of Environmental Affairs and Development Planning to determine what data can be accessed, how we can supplement the data we already have and what information will require a higher detail analysis in order to finalise the baseline profile for this sector.

Any information shared here, should not be seen as an accurate reflection of the sector and it has only been included in order to provide an indication of what data is available and what the next steps in this work are.

In terms of the information for the Western Cape, only two IPPU activity categories have been included – Minerals and Metals industries. Due to the small sample size, these are not separated out in the table below.

Table 10: GHG Emissions for the IPPU sector

Source (IPCC category)	GHG emitted (tonnes)
	CO_2e
2 – Industrial Process and Product Use	231 369

Next steps for this sector are to work on identifying data sources for the gaps that are currently found, which will then allow us to under more detailed district assessments and specify key areas where action needs to take place.

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