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Final Summary Document: eThekwini Greenhouse Gas Emissions Inventory 2013

1 Synopsis

A Greenhouse Gas Emissions Inventory (GHGEI) for the eThekwini Municipality has been compiled for the 2013 calendar year. The inventory identifies the sources of Green House Gas (GHG) emissions from both the local government and community sectors within the eThekwini Municipal Area. The eThekwini Municipality has compiled the GHGEI to help plan climate change mitigation strategies within the Municipality.

The GHGEI is divided into two sub-inventories, one for the broader eThekwini community and one for the municipality or local government emissions. The local government “sub-inventory” includes GHG emissions from activities under the control of the eThekwini Municipality entity, whilst the community inventory includes GHG emissions from various sectors within the boundary of the eThekwini Municipal Area.

The total greenhouse emissions recorded for the entire eThekwini Municipal Area was 28,741,558tCO₂e¹ for the 2013 year. As with previous GHGEIs, the largest contribution to this footprint was transportation sector (38% of the total GHGs) followed closely by Industry emissions (32%). A graph showing the inventory by sector is shown in Figure 1.

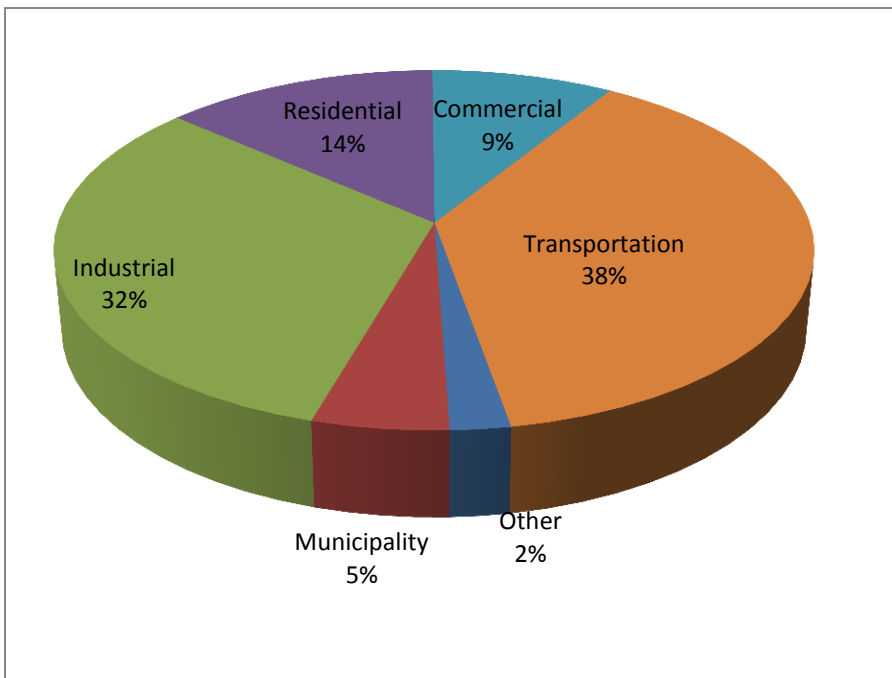


Figure 1: GHG emissions by sector

The 2010 Baseline GHGEI was developed as an easy to use EXCEL sheet and that allows for updating and reporting of GHG emissions on an annual basis. That tool has been updated in order to calculate 2013 emissions.

¹ Includes scope 1, 2 and selected scope 3 emissions

2 Background

In 2010 eThekweni Municipality, together with a number of cities across the globe, became a signatory of The Global Cities Covenant on Climate (the “Mexico City Pact”). Through this covenant, the Municipality committed to record its annual GHG emissions, climate change commitments, climate mitigation and adaptation measures, and actions. The 2011 eThekweni GHG Inventory, in addition to assisting in meeting the Municipality’s commitments to The Global Cities Covenant on Climate, is meant to aid the Municipality in forecasting emission trends, identifying the point and mobile sources of emissions generated, and setting goals for future reductions and mitigation.

The reporting of a municipal inventory also aligns eThekweni Municipality with the intentions of the National Climate Change Response White Paper (Department of Environmental Affairs, 2011) and the broader national government policy on climate change.

3 Methodology Used

The following Local Government GHG Emissions Analysis Protocols, developed by ICLEI – Local Governments for Sustainability, were used to guide the development of the eThekweni GHG Inventory:

- International Local Government GHG Emissions Analysis Protocol Version 1.0²; and
- Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories Version 1.1³.

These protocols provide a standardized set of guidelines to assist local governments in quantifying and reporting GHG emissions associated with their government and community operations. Both protocols are based upon the Corporate GHG Protocol⁴ developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) as well as technical guidance provided by the United Nations Intergovernmental Panel on Climate Change (IPCC). Activities that cause emissions are recorded in different emission scopes:

- Scope 1 are any direct emissions produced by the organisation or area, such as combustion of fuel.
- Scope 2 activities are indirect emissions produced by electricity that is purchased by the organisation or area.
- Scope 3 emissions are those that occur from the organisation or area’s activities but the sources of the emissions are owned or controlled by another entity, such as emissions from flights where planes are not owned by the organisation/area in question.

²Available at <http://www.icleiusa.org/tools/ghg-protocol>

³Available at <http://www.icleiusa.org/tools/ghg-protocol>

⁴Available at <http://www.ghgprotocol.org/standards/corporate-standard>

The figure below is a summary of the different types of scopes for GHG emissions.

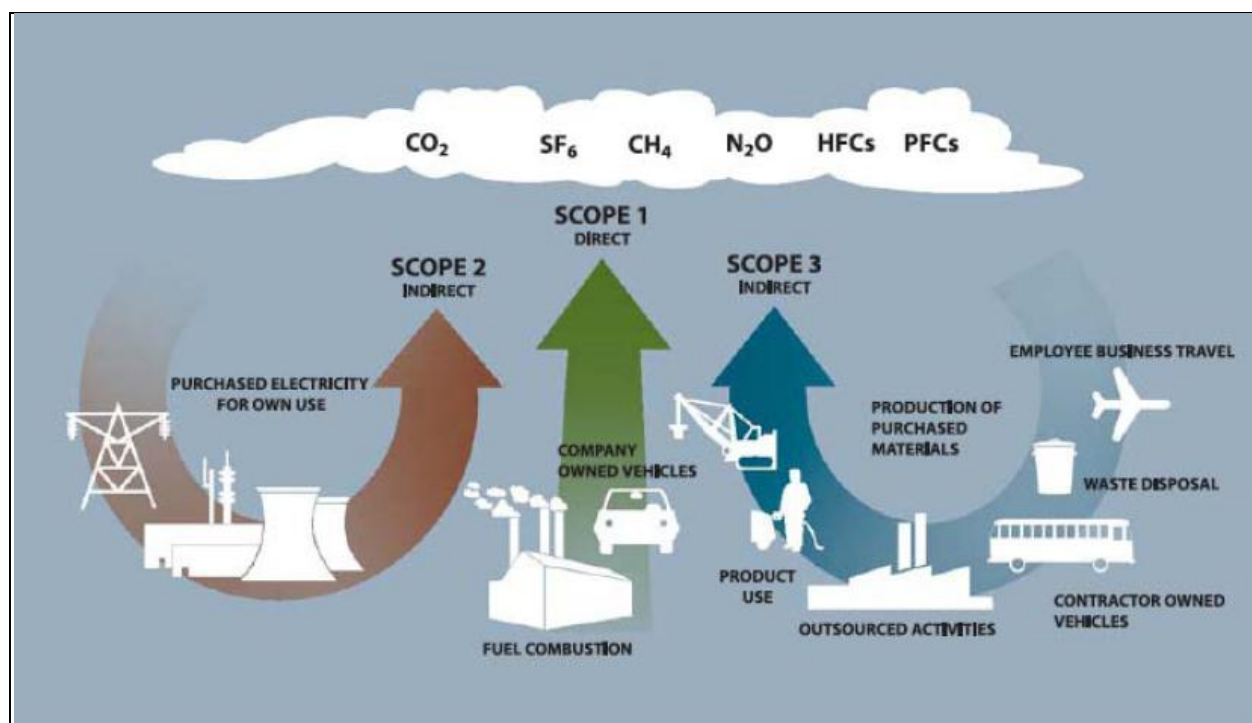


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

It is important that emission scopes are differentiated as this helps to avoid the possibility of double counting emissions and misrepresenting emissions when reporting. Scope 1 and 2 emission reporting is compulsory under the WRI's GHG Protocol.

The eThekweni 2013 GHG Emissions Inventory comprises 2 sub-inventories, includes emissions from the government sector and a separate sub-inventory documenting emissions from the broader community. The government inventory includes GHG emissions from direct and indirect activities under the control of the eThekweni Municipality. The community inventory includes GHG emissions from industry, commercial and residential sectors as well as transport, waste and agriculture within the boundary of the eThekweni Municipal Area. The tables below show the emissions sources for government and community that are included in the Inventory.

Table 1: Government Emission Sources collected according to Scope

Scope 1	Scope 2	Scope 3
Stationary Fuel Combustion	Electricity Consumption	Employee Air Travel
Mobile Fuel Combustion	Electricity Transmission & Distribution (Technical and Non-technical losses)	Transit vehicles operated by contractor
Wastewater Treatment		Electricity consumption by Eskom owned streetlights
Solid Waste Disposal		
Power Generation Facilities		

Table 2: Community Emission Sources collected according to Scope

Scope 1	Scope 2	Scope 3
Stationary Fuel Combustion	Electricity Consumption	Air Transport Systems
Mobile Fuel Combustion		Marine Transport Systems
Solid Waste Disposal		
Enteric Fermentation		
Pre-harvest Cane Burning		
Industrial Processes and Product Use		

In order to standardise reporting, activity data (such as fuel consumption) is multiplied by an emissions factor to convert all data to tonnes carbon dioxide equivalent (tCO₂e). Emission factors are generally internationally accepted values, but are published by a range of different entities. South Africa has not published a comprehensive list of emission factors for use in South Africa, with one of the exceptions being an emission factor for electricity provided by ESKOM⁵. Therefore the United Kingdom Government Department of Environment, Food and Rural Affairs (DEFRA) and the International Panel for the Climate Change (IPCC) published emission factors have been used.

4 Results

For 2013 the total carbon emissions recorded for the entire eThekweni Municipal Area was 28,741,558tCO₂e. The following section provides more detail on this figure but is divided into emissions from the Municipality and emissions from the broader community. The division into government and community emissions is standard practice as data for local government emissions is generally more readily available.

4.1 Local Government Emissions

Total local government emissions for the 2013 period were 1,450,928tCO₂e. The government emissions sub-inventory included operations that are directly under the eThekweni Municipality's control and emissions arising from the use of all significant assets and services during 2013. The table below summarises the municipal emissions by GHG scope.

Table 3: Municipal Emissions by Scope

Emissions Scope	GHG Sources	Municipal Emissions (tCO ₂ e)
Scope 1	Stationary Fuel Combustion, Mobile Fuel Combustion, Wastewater Treatment, Solid Waste Disposal	388,647 (27%)
Scope 2	Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses)	1,030,970 (71%)
Scope 3	Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights	31,311 (2%)

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2013. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 44 % to the Municipality's total 2013 emission inventory, was electrical transmission and distribution losses (scope 2). This figure includes technical and non-technical losses from electricity purchased from Eskom, which amount to 5.93% of the total electricity purchased from ESKOM.

⁵ 1kWh = 1.03kg CO₂e

The second highest municipal emission source was from the sale of Certified Emission Reductions (carbon credits), contributing 14% to the total Municipal emissions. The sale of CERs are from the municipal landfill gas to electricity project and are recorded as a separate category of emissions as the CO₂e reduction is claimed by the purchaser (see section 4.3 for more details). CERs are followed by Municipal Building and Facilities (12%); and Wastewater Facilities (8%), Streetlights and Traffic Signals (8%).

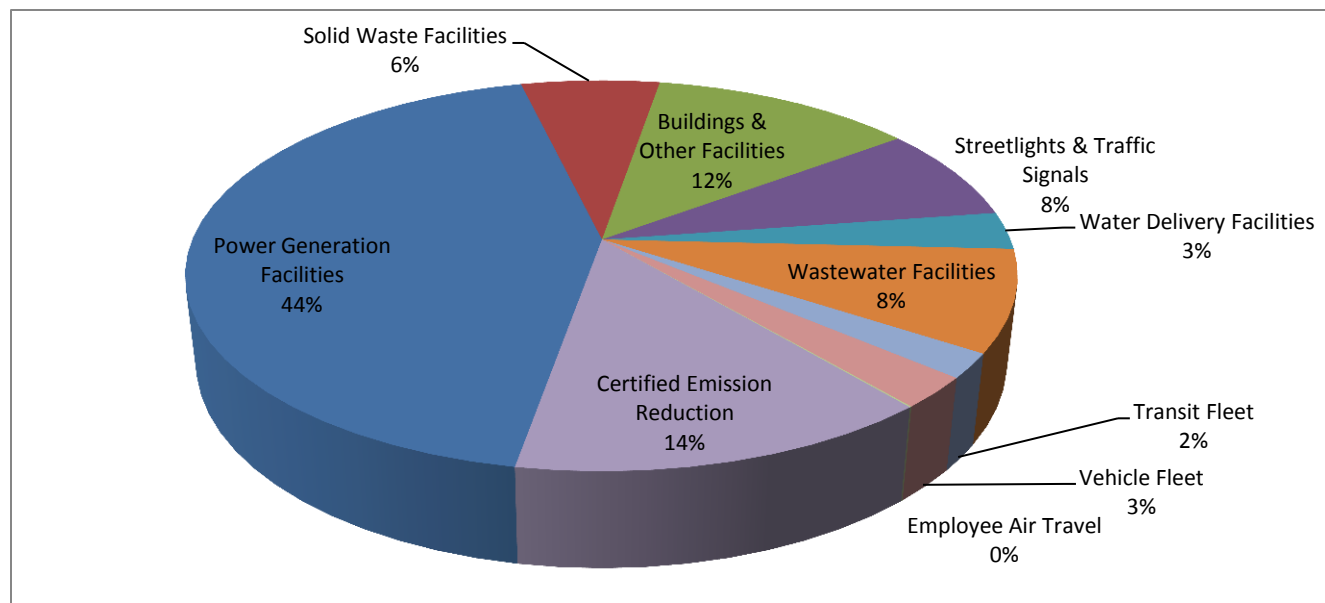


Figure 3: Total Government Emissions by Sector

Table 4: Municipal Operation Emissions by Sector and Source

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Buildings & Other Facilities	1	Stationary Fuel Combustion	5,884
	2	Purchased Electricity	171,108
Streetlights & Traffic Signals	2	Electricity consumption by municipal owned streetlights & traffic signals	112,287
	3	Electricity consumption by Eskom owned streetlights	1,043
Water Delivery Facilities	2	Purchased electricity	44,903
Wastewater Facilities	1	Stationary and process emissions	46,528
	2	Purchased electricity	74,987
Vehicle Fleet	1	Mobile fuel combustion	37,314
Transit Fleet	3	Mobile fuel combustion	29,292
Power Generation Facilities	1	Fugitive Emissions	3 552
Power Generation Facilities	2	Electrical distribution losses	627,172
Solid Waste Facilities	1	Fugitive emissions	92,768
	2	Purchased electricity	512
Employee Air Travel	3	Mobile fuel combustion	976
Certified Emission Reduction	1	Certified Emission Reduction	202,601
Total Government Emissions			1,450,928

4.2 Process Emissions

Fugitive Emissions (SF₆) of 3 552.0 tCO₂e were included from electricity switch gear equipment. SF₆ is an extremely potent greenhouse gas that is used amongst other things as an insulant gas in switch gear. SF₆ is also used in magnesium processing and semiconductor manufacturing, as well as a tracer gas for leak detection.

4.3 Certified Emission Reduction

As with the 2011 GHGEI, the 2013 GHGEI included Certified Emission Reduction (CERs). CERs are tradable commodities developed through the Clean Development Mechanism (CDM) Executive Board of the United Nations Framework Convention on Climate Change (UNFCCC). In essence the CDM allows project developers who are able to quantify emission reduction, to package and sell these reductions as CERs.

The eThekweni Municipality had one CDM project registered with the UNFCCC for the 2013 GHGEI reporting period, namely the *Durban Landfill-Gas-To-Electricity Project –La Mercy Landfills*⁶ and *Durban Landfill-Gas Bisasar Road*⁷. For the 2013 period, the eThekweni Municipality registered 202,601 CERs for this project (see table below).

Table 5: Municipal Intensity Figures

Source	Units	Total
Bisasar Road Landfill	tCO ₂ e	201,601.09

As with the 2011 GHGEI CERs are included under Scope 1 emissions for Sanitation and Solid Waste Facilities.

4.4 Community Emissions

Total community (excluding local government) emissions equated to 27,290,630 tCO₂e. The community emissions inventory includes GHG emissions associated with activities occurring within the eThekweni Municipality's geopolitical boundary generated during 2013. The table below shows community emissions by scope.

Table 6: Community Emissions by Scope

Emissions Scope	GHG Sources	Community Emissions (tCO ₂ e)
Scope 1	Stationary Fuel Combustion, Mobile Fuel Combustion, Solid Waste Disposal, Enteric Fermentation, Pre-harvest Cane Burning	11,620,661 (43%)
Scope 2	Electricity Consumption	11,035,847 (40%)
Scope 3	Air Transport Systems, Marine Transport Systems	4,634,121 (17%)

The largest sector contributing 34% to the total community GHG emissions is the industrial sector through purchased electricity and stationary fuel combustion. The second major contributor was the on-road and off-road (ground) transport sector contributing 24% to overall community emissions. The third highest contributor to community emissions was the air and water transport systems sector deriving its emissions from fuel consumption at 17%. Collectively (ground, air and water), transport sector emissions contribute the most significant proportion of the community emissions, at 41%. The residential sector is also significant, at 14% or 3,877,995tCO₂e. Figure 4 below

⁶<https://cdm.unfccc.int/Projects/DB/TUEV-SUED1154520464.04>

⁷<http://cdm.unfccc.int/Projects/DB/TUEV-SUED1214927681.45>

illustrates the total community emissions produced in eThekweni by sectors. A more in-depth breakdown of the sectors according to emission source can be found in Table 7.

Figure 4: Total Community Emissions by Sector

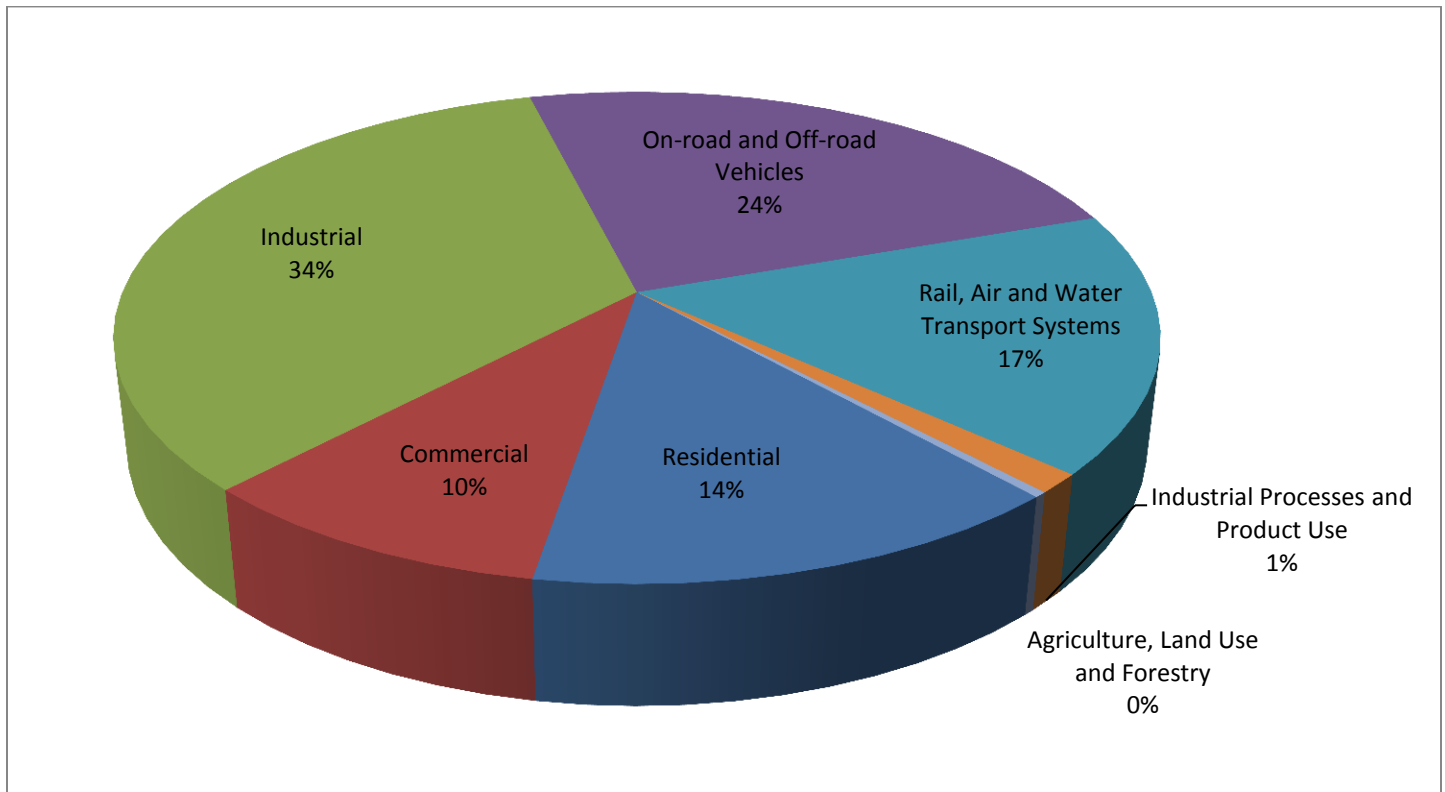


Table 7: Community Operation Emissions by Sector and Source

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Residential	1	Stationary Fuel Combustion	232,183
	2	Electricity Consumption	3,645,812
Commercial	2	Electricity Consumption	2,577,589
Industrial	1	Stationary Fuel Combustion	4,364,716
	2	Electricity Consumption	4,812,447
On-road and Off-road Vehicles	1	Mobile Fuel Combustion	6,383,881
Rail, Air and Water Transport Systems	3	Air Travel	4,634,121
Industrial Process and Product Use	1	Industrial Processes & Product Use	341,508
Solid Waste	1	Fugitive Emissions	205,740
Agriculture, Land Use and Forestry	1	Enteric Fermentation	92,634
Total Community Emissions			27,290,630

5 Analysis of the GHG Inventory

5.1 Total Emissions

For 2013 the total⁸ carbon emissions recorded for eThekweni Municipality was 28,741,558 tCO₂e. Local Government Emissions account for 5% of the total eThekweni emissions (Figure 5). Transportation (ground, air and water) and Industry contribute the highest to the total emissions (Figure 5). Emissions from the industry are also significant, which is representative of the influential manufacturing and processing component of the city's economy.

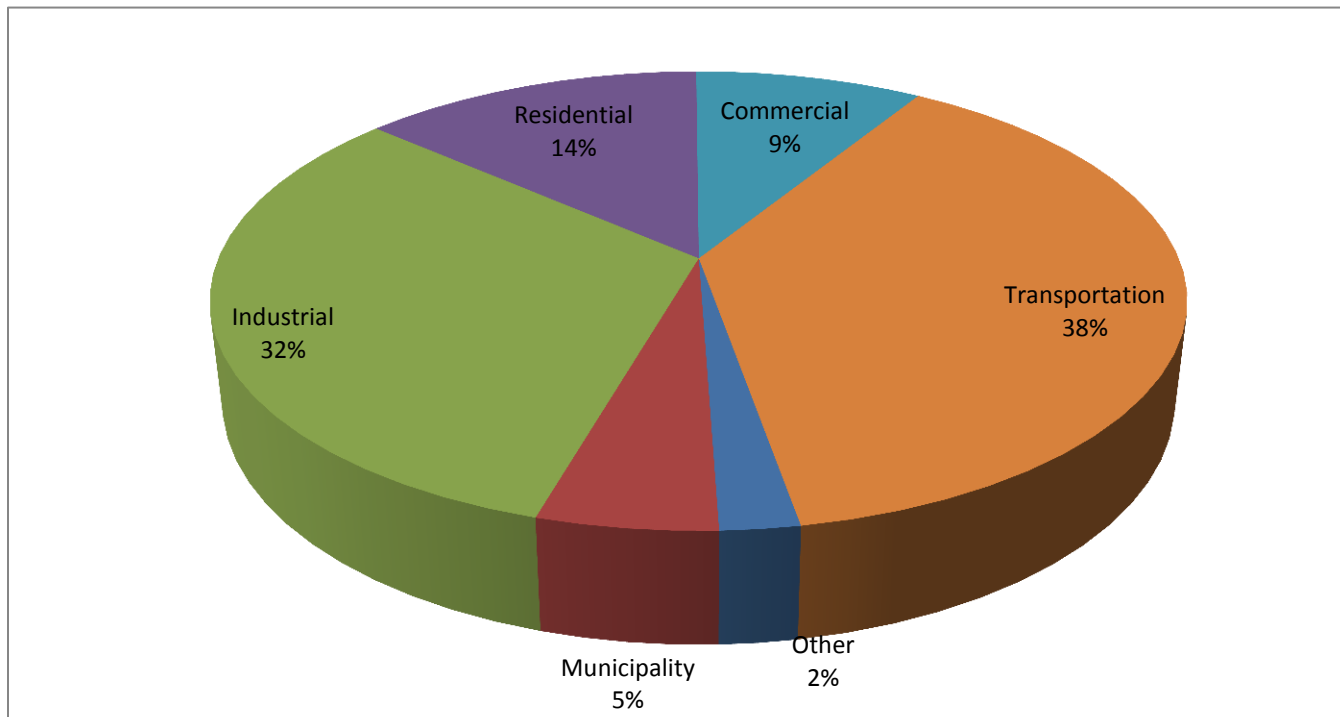


Figure 5: Carbon emissions by Sector

This “emission by sector” representation is largely an indication of the demand for energy in the city. The graph above illustrates that industry and transport have a large energy demand in comparison to residence and commercial activities. This sector comparison turn helps prioritize climate change mitigation interventions to sectors where there are large demands on energy.

Conversely, the total emission value of 28,741,558 tCO₂e can also be assessed by “source” or *supply*. The graph below, Figure 6, is an indication of where the greenhouse gasses in the city come from. As to be expected Transport Fuels⁹ are responsible for 39% of total GHG footprint, which closely matches the 38% allocation in the transport sector (Figure 5 above). Electricity however is the largest source of Greenhouse Gasses, responsible for 42% of the total footprint. Stationary Combustion¹⁰ also contributes to the overall GHG footprint with 16% of the total emissions. However there are data gaps in this particular category and research needs to be conducted to better understand the emissions from different stationary combustion sources. For the purposes of this Graph CERs are classified as a separate source of emissions.

⁸ Municipal and community emissions

⁹Including: Petrol, Diesel, Jet Fuel, Marine Diesel and Fuel Oil

¹⁰Including: Heavy Furnace Oil; Bitumen; Natural Gas; LPG; Coal; Coke; Illuminating Paraffin; Paraffin Wax; Refinery Gas

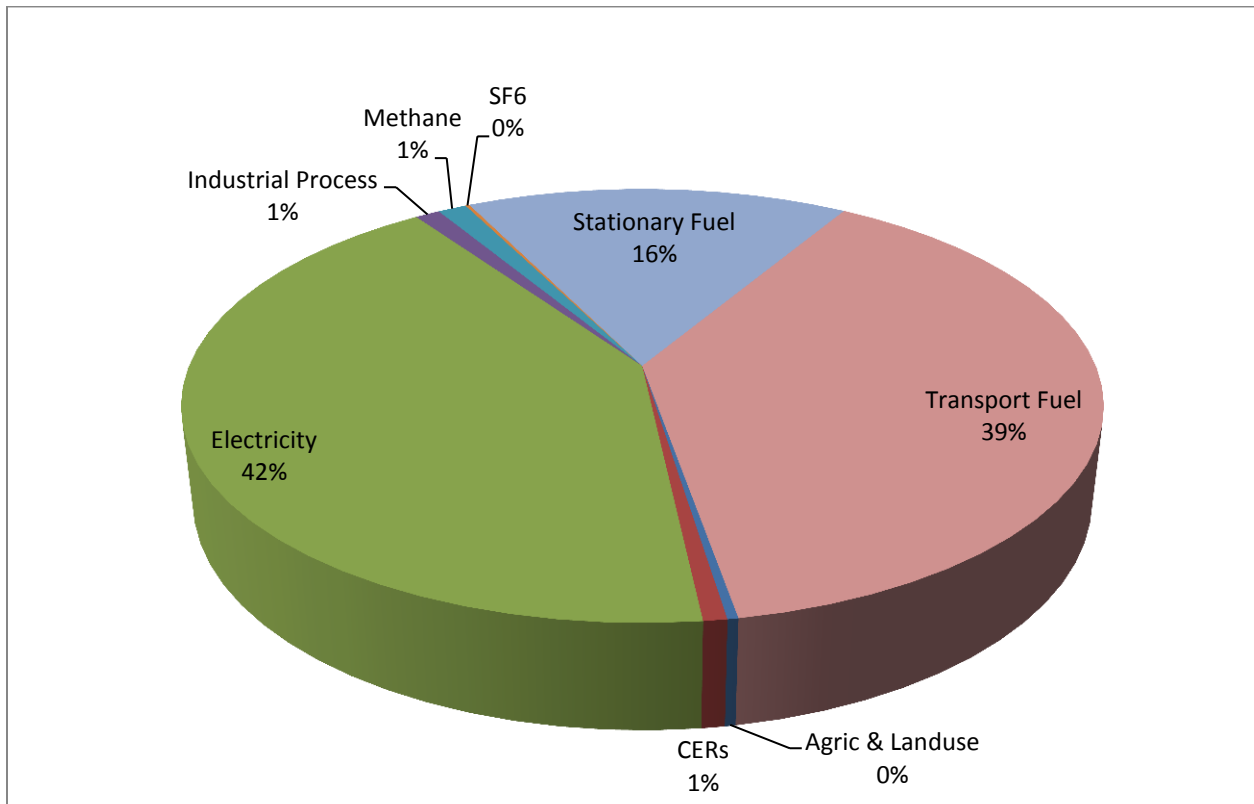


Figure 6: Carbon emissions by Source

The imported electricity supplied in the city was 11 402GWh (99.6%) compared to local generators of electricity at 45 GWh (See Figure 7 below). This local generation is predominantly from the Municipal Landfill Gas to Electricity Project¹¹ and 3.5 GWh of renewable energy embedded generators.

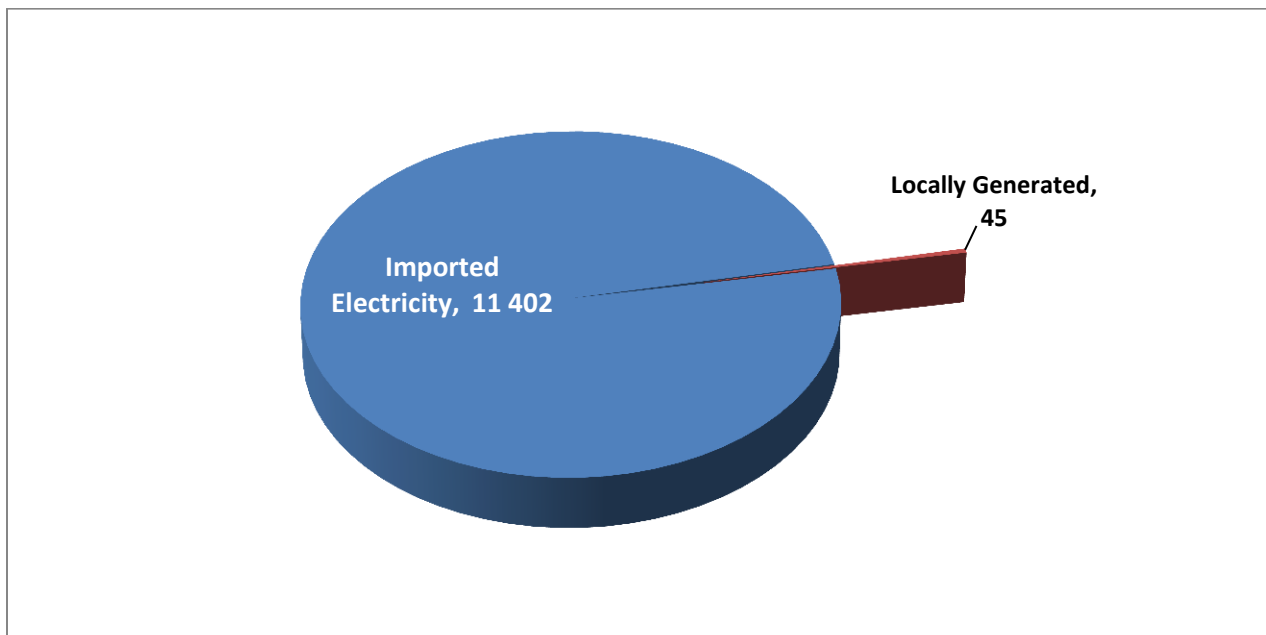


Figure 7: Electricity Supply by Source in the eThekweni Municipal Area (GWh)

¹¹<http://www.kznenergy.org.za/durban-landfill-gas-to-electricity-project/>

5.2 Municipal Emissions

The spread of municipal emissions by infrastructure type is provided in the graph below. This graph excludes electricity transmission losses to more clearly identify area of operations within the municipality that have high carbon outputs. Certified Emission Reductions were responsible for the largest component of the municipal footprint (excluding transmission losses) followed by Water and Sanitation and Solid Waste Operations. The Solid Waste emissions are predominantly from methane while Water and Sanitation are from electricity usage and some methane. The bulk of the remaining infrastructure emissions are from the use of electricity (Figure 9 below).

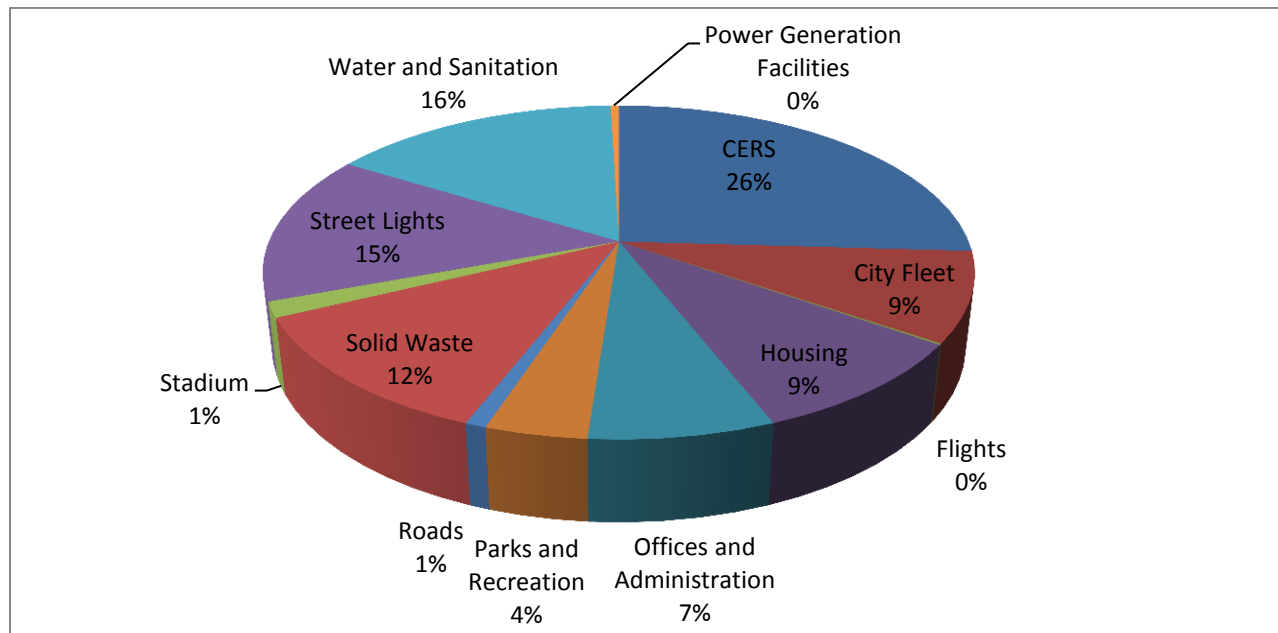


Figure 8: Municipal Emissions by Infrastructure Type tCO₂e (excluding electricity transmission losses)

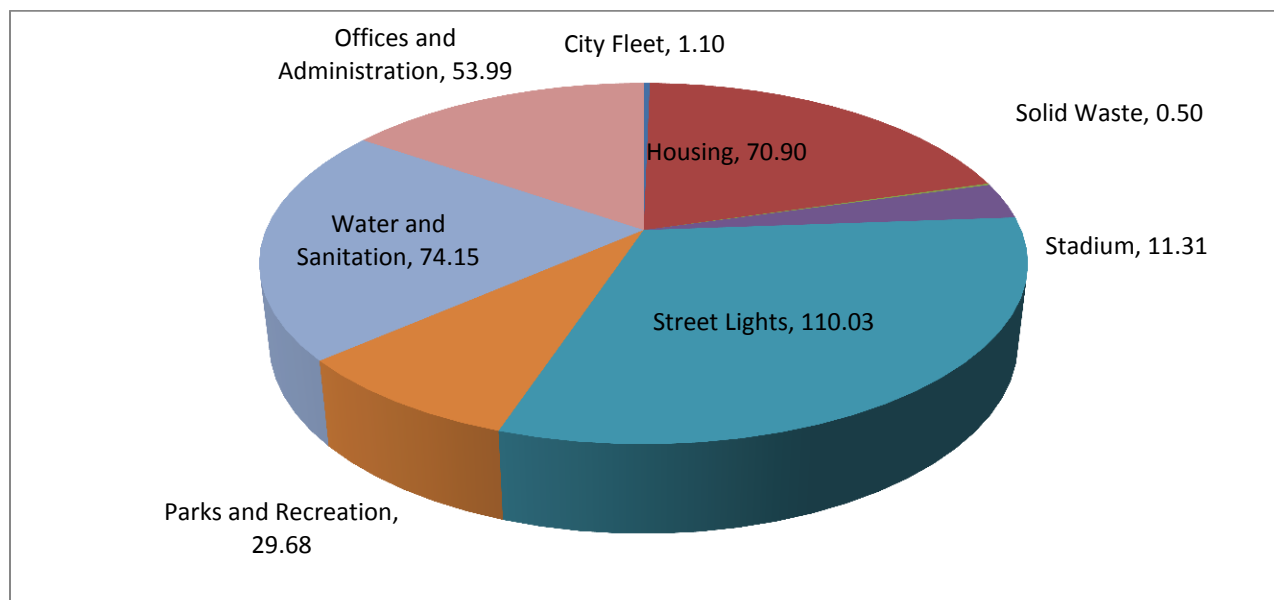


Figure 9: Municipal Electricity Consumption GWh (excluding electricity transmission losses)

5.3 Intensity of Emissions

5.3.1 Government Intensity Figures

Emission intensity figures for the Municipality are recorded below in Table 8. These figures were calculated by combining all municipal scope 1 and 2 emissions and dividing them by the relevant indicator.

Table 8: Municipal Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
R 50.16	tCO ₂ e / million Rand of operating budget	1 419 617	tCO ₂ e (Municipal Scope 1 & 2)	R 28 300.00 ¹²	Million Rand Operating Budget (2013/ 2014)
R 262.85	tCO ₂ e / million Rand of Capital budget	1 419 617	tCO ₂ e (Municipal Scope 1 & 2)	R 5 400.00 ¹³	Million Rand Capital Budget (2013/ 2014)
66.12	tCO ₂ e / Permanent employee	1 419 617	tCO ₂ e (Municipal Scope 1 & 2)	21 469 ¹⁴	Permanent Employees

5.3.2 Community Intensity Figures

Community intensity figures are recorded below. These emissions were calculated by combining relevant sector scope emissions and dividing them by the relevant indicators.

Table 9: Community Emissions Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
3.92	tCO ₂ e / household	3,877,995	tCO ₂ e (Residential Scope 1 & 2)	989 936 ¹⁵	Number of households within the EMA
R 39.05	tCO ₂ e / retail trade sales	2,577,589	tCO ₂ e (Commercial Scope 1 & 2)	R 66 000.00 ¹⁶	2013 Annual retail trade sales

5.3.3 Total Emissions Intensity Figures

Total emission intensity figures (for the municipality and the community) are recorded below in Table 8. These emissions were calculated by combining relevant sector scope emissions and dividing them by the relevant indicators. A per capita figure has been calculated using total scope 1 and 2 emissions, and separately using emissions from all three scopes to account for different methodologies of calculating this figure.

Table 10: Total Emissions Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
6.99	tCO ₂ e / Capita	24,076,126	tCO ₂ e (Scope 1 & 2)	3,442,361 ¹⁷	Population within the EMA
8.35	tCO ₂ e / Capita	28,741,558	tCO ₂ e (Scope 1, 2 & 3)	3,442,361	Population within the EMA

¹²http://www.durban.gov.za/media_publications/Press_Releases/Pages/201314BudgetAdopted.aspx

¹³http://www.durban.gov.za/media_publications/Press_Releases/Pages/201314BudgetAdopted.aspx

¹⁴EThekweni Municipality, Human Resources

¹⁵http://www.durban.gov.za/Resource_Centre/edge/Documents/EDGE%2010th%20Edition.pdf

¹⁶http://www.durban.gov.za/Resource_Centre/edge/Documents/EDGE%2010th%20Edition.pdf

¹⁷STATSSA: Census 2011: Municipal Fact sheet

5.4 Comparison with previous GHGIE

The 2010 eThekweni GHG Inventory serves as the baseline inventory because the methodology for collecting and reporting data was clearly defined for this period. However data for Greenhouse Gas Emissions Inventories in the eThekweni Municipality dates back to 2002. This emerging emissions trend is summarised in the table and graph below. As is evident from these data sets, there is a continued and steady increase in greenhouse gas emissions over time in the city. This trend is primarily a result of improved data collection methodologies but also due to increased uses of energy and carbon intensive processes in the city.

Table 11: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Year	Government Emissions	Community Emissions	Total Emissions	% Change	% Change from 2010 Baseline
Yr 2002	1 047 000	18 890 000	19 937 000		
Yr 2003/2004	1 247 000	18 890 000	20 137 000	1.0%	
Yr 2005/2006	1 118 061	21 413 906	22 531 967	11.9%	
Yr 2010	1 104 212	25 962 074	27 066 285	20.1%	
Yr 2011	1 551 420	26 097 979	27 649 400	2.2%	2.2%
Yr 2012	1 526 431	27 833 965	29 360 395	6.2%	8.3%
Yr 2013	1 450 928	27 290 630	28 741 558	-2.1%	4.1%

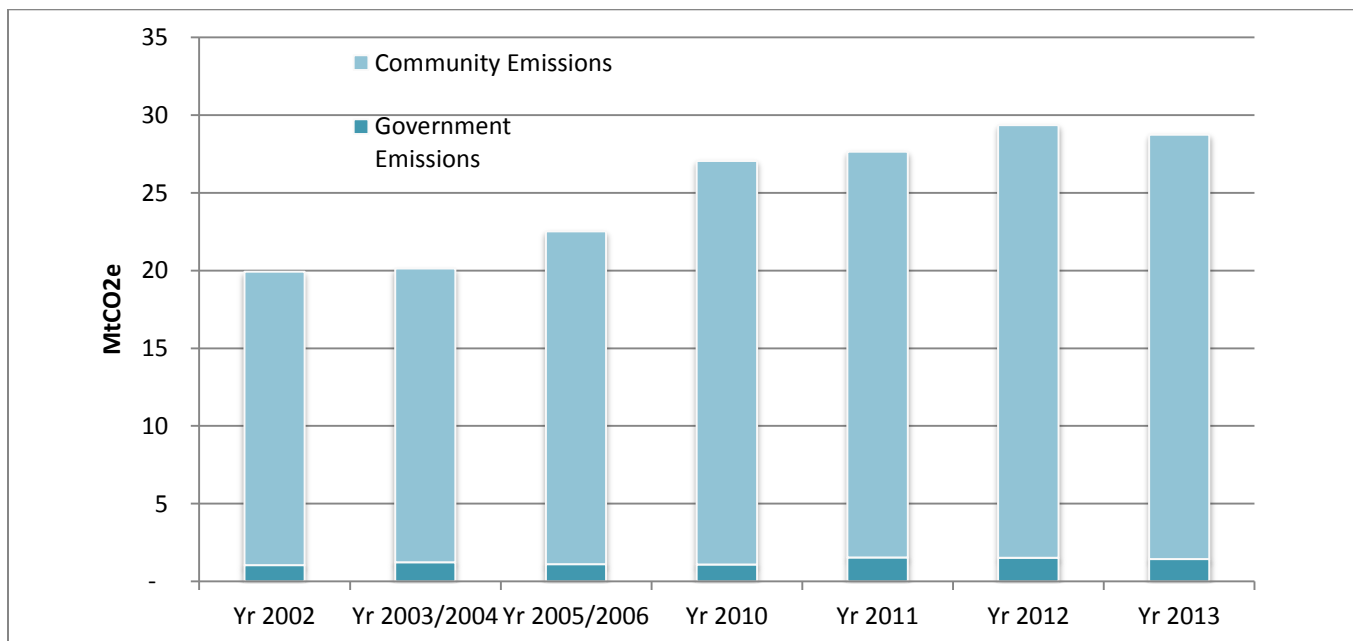


Figure 10: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Total emissions show a decrease of 2.1% from year 2012 to 2013, which is equivalent to 618 838.1 tCO₂e of emissions less emitted. The municipal and community sectors presents a decrease of -75 503.0 tCO₂e and -543 335.0 tCO₂e respectively. Table 12 shows a detailed summary of the differences between 2012 and 2013.

Table 12: Data Comparison between 2012 and 2013 Reporting Periods

Scope	Type	Sub-Type	2012 (tCO ₂ e)	2013 (tCO ₂ e)	
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	15 082.2	5 883.8	-61%
		Vehicle Fleet	46 654.1	37 313.9	-20%
	Solid Waste	Solid Waste (CH ₄)	71 370.0	92 768.0	30%
	Power Generation Facilities	Fugitive Emissions	3 552.0	3 552.0	100%
	Wastewater Treatment	Wastewater (CH ₄)	35 978.8	46 528.4	29%
	CERs	Certified Emission Reduction	219 173.3	202 601.1	-8%
Municipal Scope 2	Electricity Consumption	Buildings	164 935.4	171 108.2	4%
		Streetlights & Traffic Signals	108 100.8	112 287.5	4%
		Water Delivery Facilities	64 048.2	44 903.0	-30%
		Transmission and Distribution Losses	705 364.5	627 171.8	-11%
		Solid Waste Facilities	1 849.9	512.4	-72%
		Wastewater Facilities	57 099.7	74 987.2	31%
Municipal Scope 3	Transport Systems	Streetlights	1 079.1	1 042.7	-3%
		Transit Fleet	31 951.4	29 291.8	-8%
		Flights	191.5	976.2	410%
Subtotal Municipal			1 526 430.9	1 450 927.9	-4.9%
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	4 719 185.8	4 596 899.3	-3%
		Mobile Fuel Combustion	6 183 253.3	6 383 880.9	3%
	Solid Waste	Solid Waste	212 230.0	205 740.0	-3%
	Industrial Processes & Product Use	IPPU	331 517.2	297 174.1	-10%
	Industrial Processes & Product Use	IPPU	44 333.4	44 333.4	100%
	Agric & Landuse	Agric & Landuse	90 263.6	92 633.5	2.6%
Community Scope 2	Electricity Consumption	Residential	3 587 449.7	3 645 811.7	2%
		Commercial	3 142 390.7	2 577 588.9	-18%
		Industrial	4 843 556.5	4 812 446.7	-1%
Community Scope 3	Transport Systems	Air Transport Systems	252 028.2	206 364.8	-18%
		Water Transport Systems	4 427 756.4	4 427 756.4	0%
Subtotal Community			27 833 964.8	27 290 629.7	-2%
Total			29 360 395.7	28 741 557.7	-2.1%

6 Conclusion and Way Forward

The compilation of the eThekweni GHG Emission Inventory is an important step in documenting the eThekweni Municipality's government and community emissions that are contributing to climate change. The current inventory is the fourth iteration using the Local Government GHG Emissions Analysis Protocols. There has been an upward trend in the total GHG emissions in the eThekweni Municipality from 27 066 285 tCO₂e in 2010 to 29 360 395 tCO₂e in 2012. However a decrease from 29 360 396 tCO₂e in 2012 to 28 741 558 tCO₂e in 2013 was observed.