

ENERGY OFFICE

3rd Floor, Smart Exchange, 5 Walnut Road, Durban, 4001

P O Box 1014, Durban 4000

Tel: +27 31 322 2622, Fax: +27 31 311 1089

Email: magash.naidoo@durban.gov.za

www.durban.gov.za

Final Summary Document: eThekweni Greenhouse Gas Emissions Inventory 2014

1 Synopsis

A Greenhouse Gas Emissions Inventory (GHGEI) for the eThekweni Municipality has been compiled for the 2014 calendar year. The inventory identifies the sources of Greenhouse Gas (GHG) emissions from both the local government and community sectors within the eThekweni Municipal Area. The eThekweni 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 eThekweni 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 eThekweni Municipality entity, whilst the community inventory includes GHG emissions from various sectors within the boundary of the eThekweni Municipal Area.

The total greenhouse emissions recorded for the entire eThekweni Municipal Area was 29,092,003tCO₂e¹ for the 2014 year. As with previous GHGEIs, the largest contribution to this footprint was transportation sector (39% of the total GHGs) followed closely by Industry emissions (31%). A graph showing the inventory by sector is shown in Figure 1.

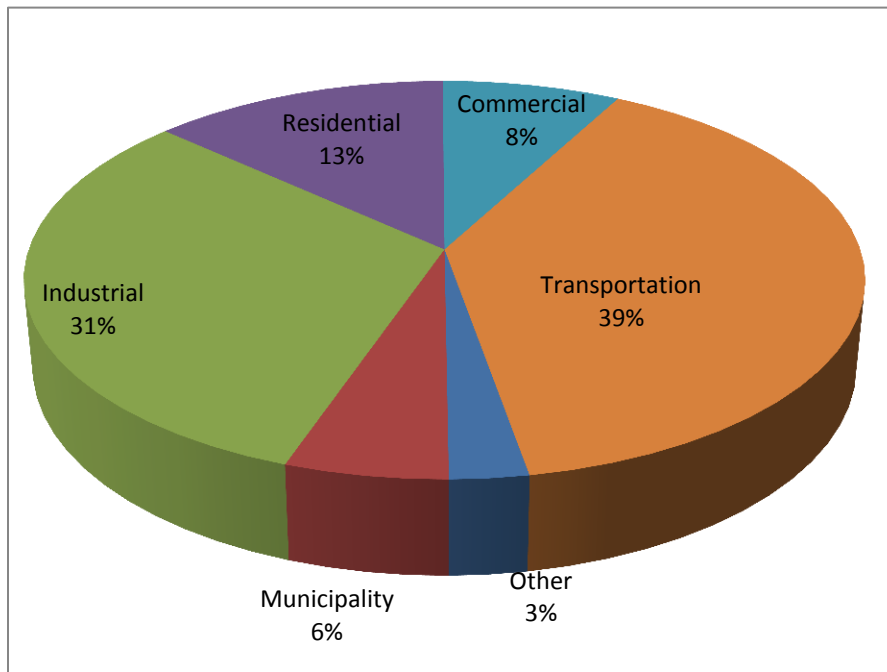


Figure 1: GHG emissions by sector

¹ Includes scope 1, 2 and selected scope 3 emissions

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 2014 emissions.

2 Background

In 2010 eThekwini 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 eThekwini 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 eThekwini 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 eThekwini 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.

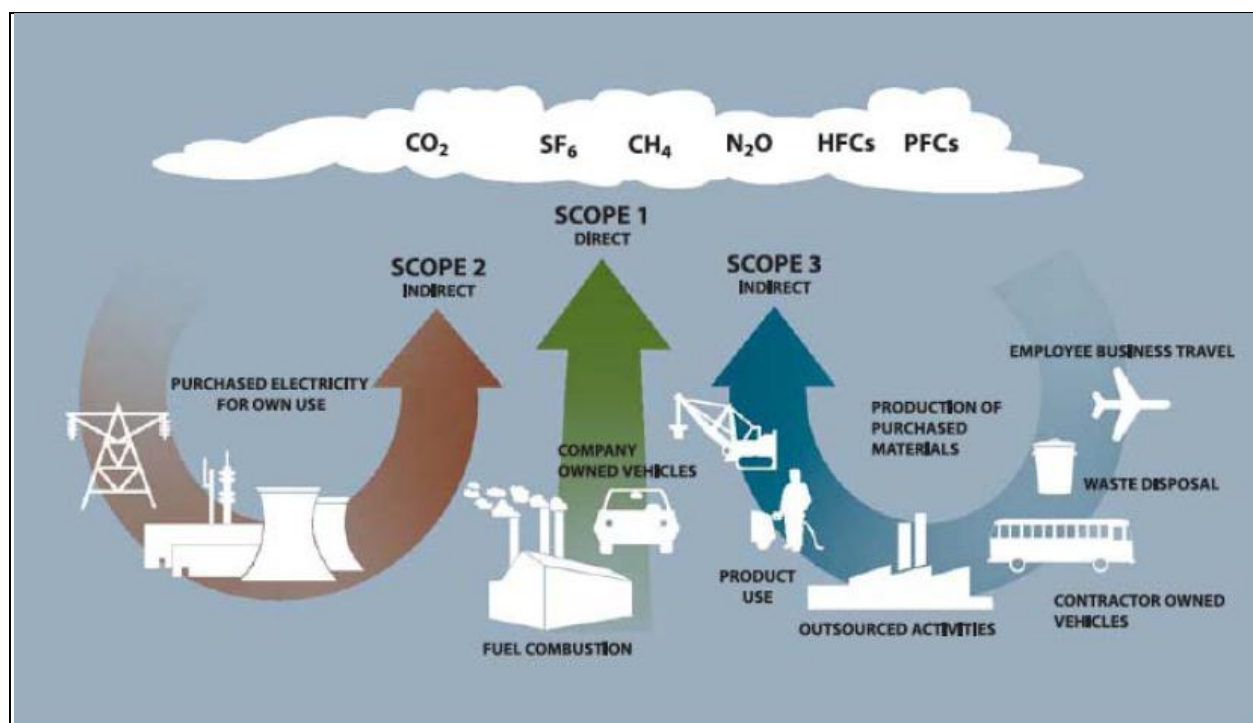


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

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 2014 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.

It should be noted that for the 2013 and 2014 GHGEIs the eThekwini Municipality has been reporting its GHG emissions according to the above methodologies/protocols and the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). However, for the 2015 GHGEI, and going forward, only the GPC will be utilised to guide GHG emission accounting and reporting. In addition, the GPC advises that the International Local Government GHG Emissions Analysis Protocol, developed by ICLEI, be utilised for the quantification of emissions from Local Government Operations, as a result the eThekwini Municipality will continue to utilise this protocol, in conjunction with the GPC.

4 Results

For 2014 the total carbon emissions recorded for the entire eThekwini Municipal Area was 29,092,003tCO₂e. 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 2014 period were 1,586,674tCO₂e. The government emissions sub-inventory included operations that are directly under the eThekwini Municipality's control and emissions arising from the use of all significant assets and services during 2014. 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	400,230 (25%)
Scope 2	Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses)	1,155,139 (73%)
Scope 3	Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights	31,305 (2%)

⁵ 1kWh = 1.03kg CO₂e

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2014. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 48 % to the Municipality's total 2014 emission inventory, was electrical transmission and distribution losses (scope 2).

The second highest municipal emission source was from the sale of Certified Emission Reductions (carbon credits), contributing 13% 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 Buildings and Facilities (11%); and Wastewater Facilities (8%), Streetlights and Traffic Signals (7%).

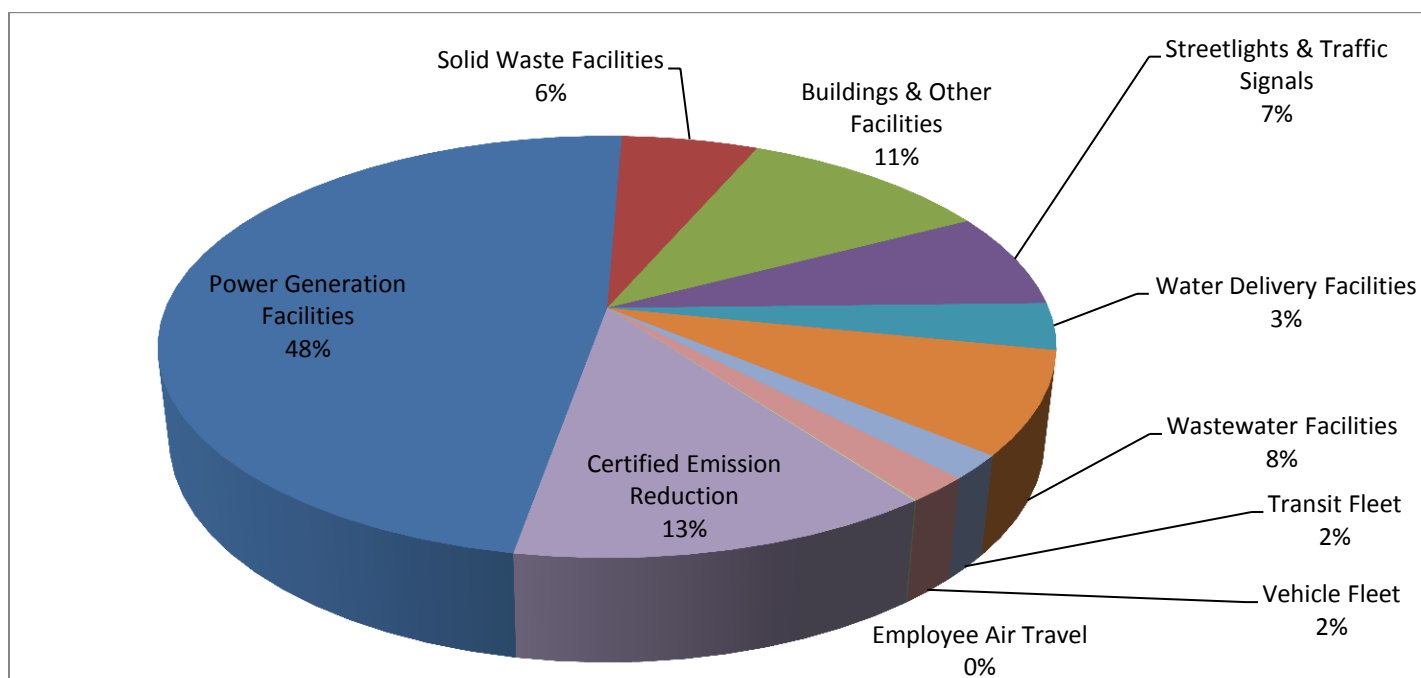


Figure 3: Total Government Emissions by Sector

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	19,316
	2	Purchased Electricity	152,565
Streetlights & Traffic Signals	2	Electricity consumption by municipal owned streetlights & traffic signals	114,257
	3	Electricity consumption by Eskom owned streetlights	1,140
Water Delivery Facilities	2	Purchased electricity	56,846
Wastewater Facilities	1	Stationary and process emissions	49,093
	2	Purchased electricity	75,316
Vehicle Fleet	1	Mobile fuel combustion	31,211
Transit Fleet	3	Mobile fuel combustion	29,292
Power Generation Facilities	1	Fugitive Emissions	3 552
Power Generation Facilities	2	Electrical distribution losses	755,639

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Solid Waste Facilities	1	Fugitive emissions	92,911
	1	Purchased electricity	517
	2		
Employee Air Travel	3	Mobile fuel combustion	873
Certified Emission Reduction	1	Certified Emission Reduction	204,146
Total Government Emissions			1,586,674

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 2014 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 2014 GHGEI reporting period, namely the *Durban Landfill-Gas-To-Electricity Project –La Mercy Landfills*⁶ and *Durban Landfill-Gas Bisasar Road*⁷. For the 2014 period, the eThekweni Municipality registered 204,146 CERs for this project (see table below).

Table 5: Municipal Intensity Figures

Source	Units	Total
Bisasar Road Landfill	tCO ₂ e	204,146.09

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 2014. 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	12,110,038 (44%)
Scope 2	Electricity Consumption	10,756,129 (39%)
Scope 3	Air Transport Systems, Marine Transport Systems	4,639,162 (17%)

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

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

⁸ Municipal and community emissions

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 25% 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 42%. The residential sector is also significant, at 14% or 3,842,648tCO₂e. Figure 4 below 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

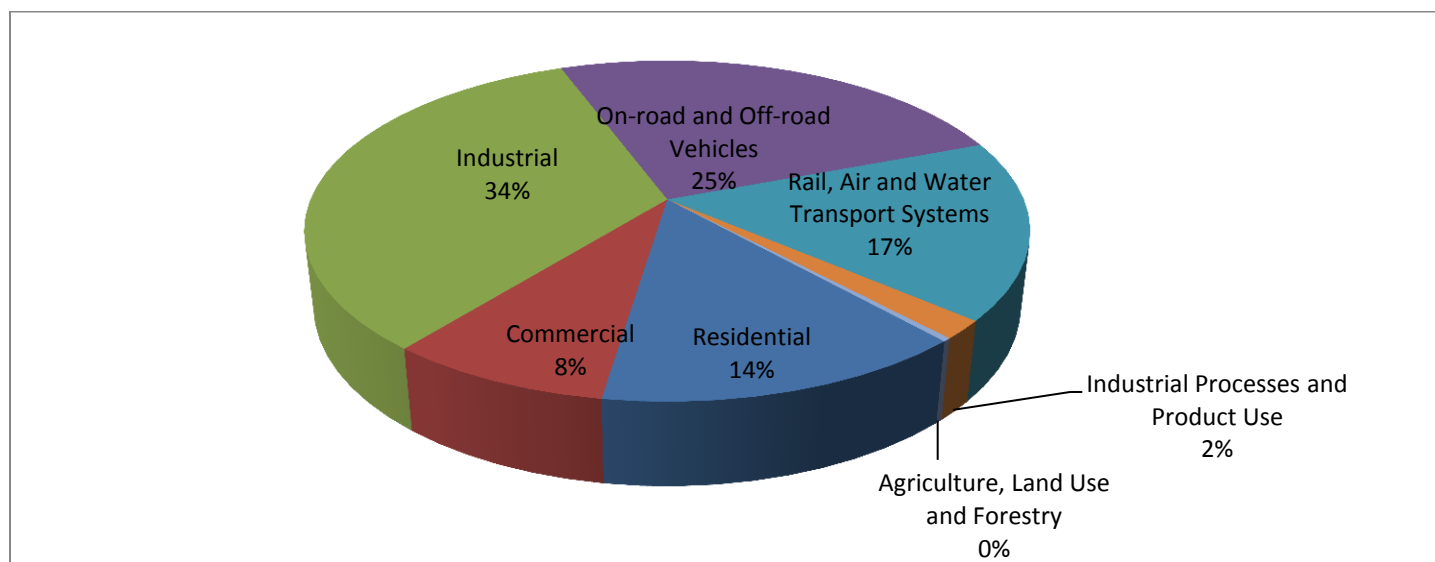


Table 7: Community Operation Emissions by Sector and Source

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Residential	1	Stationary Fuel Combustion	209,964
	2	Electricity Consumption	3,632,684
Commercial	2	Electricity Consumption	2,307,886
Industrial	1	Stationary Fuel Combustion	4,319,703
	2	Electricity Consumption	4,815,559
On-road and Off-road Vehicles	1	Mobile Fuel Combustion	6,813,121
Rail, Air and Water Transport Systems	3	Air Travel	4,639,162
Solid Waste	1	Fugitive Emissions	198,068
Industrial Process and Product Use	1	Pulp & Paper Production	436,980
	1	F-gases	44,333
Agriculture, Land Use and Forestry	1	Enteric Fermentation	87,868
Total Community Emissions			27,505,329

5 Analysis of the GHG Inventory

5.1 Total Emissions

For 2014 the total⁸ carbon emissions recorded for eThekweni Municipality was 29,092,003 tCO₂e. Local Government Emissions account for 6% of the total eThekweni emissions (Figure 5). Transportation (ground, air and water) and Industry contribute the highest to the total emissions (Figure 5), contributing 39% and 31% respectively. Emissions from the industry are significant due to the influential manufacturing and processing component of the city's economy.

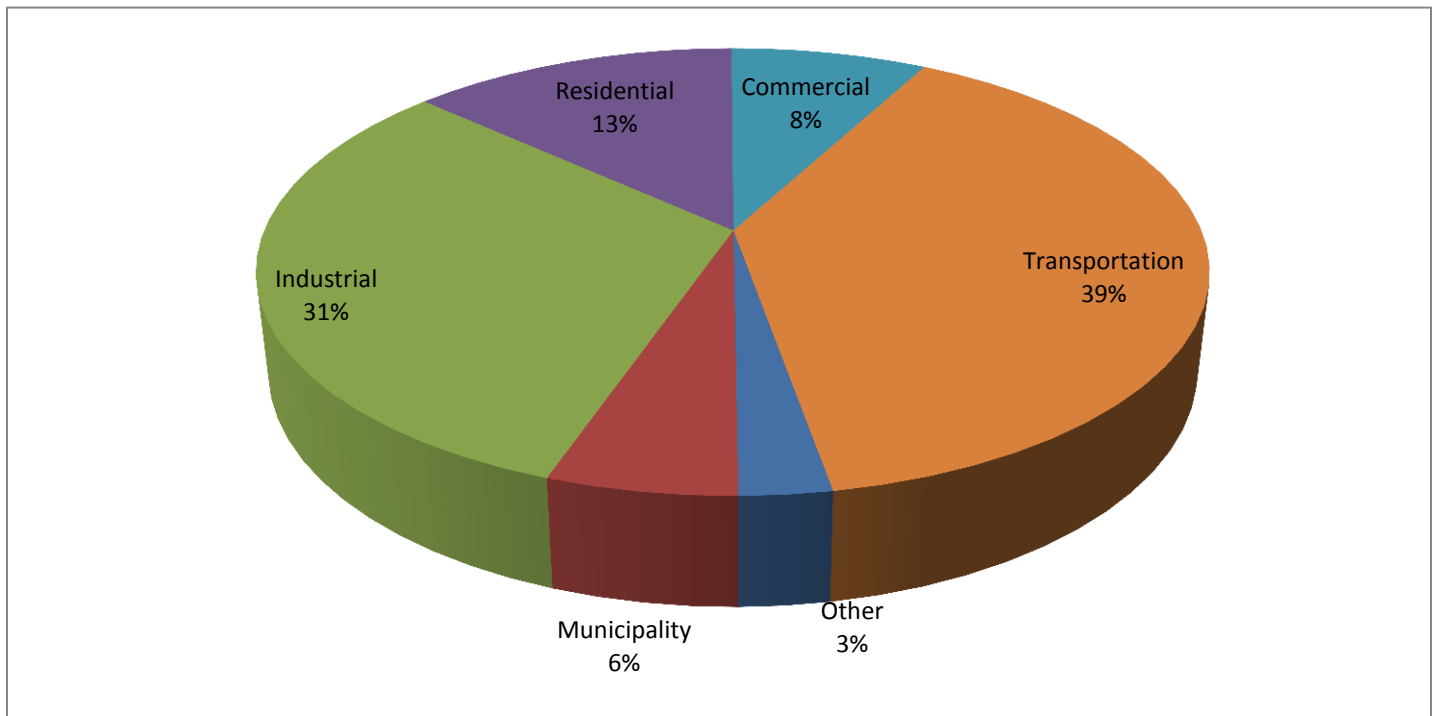


Figure 5: Carbon emissions by Sector

This “emission by sector” representation is largely an indication of the demand for energy in the city. Figure 5, above, illustrates that industry and transport have a large energy demand in comparison to residential and commercial activities. This sector comparison helps prioritize climate change mitigation interventions to sectors where there are large demands on energy.

The total emission value of 29,092,003 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 accounted for separately.

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

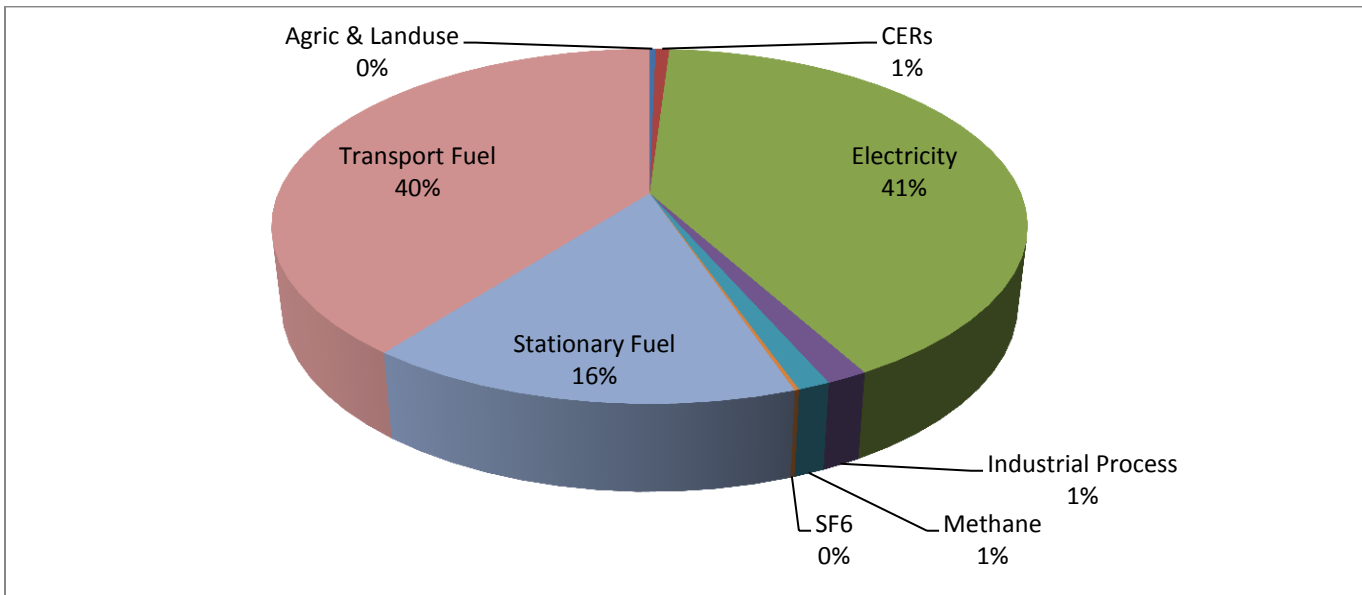


Figure 6: Carbon emissions by Source

The imported electricity supplied in the city was 11 295GWh (99.6%) compared to local generators of electricity at 42 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.

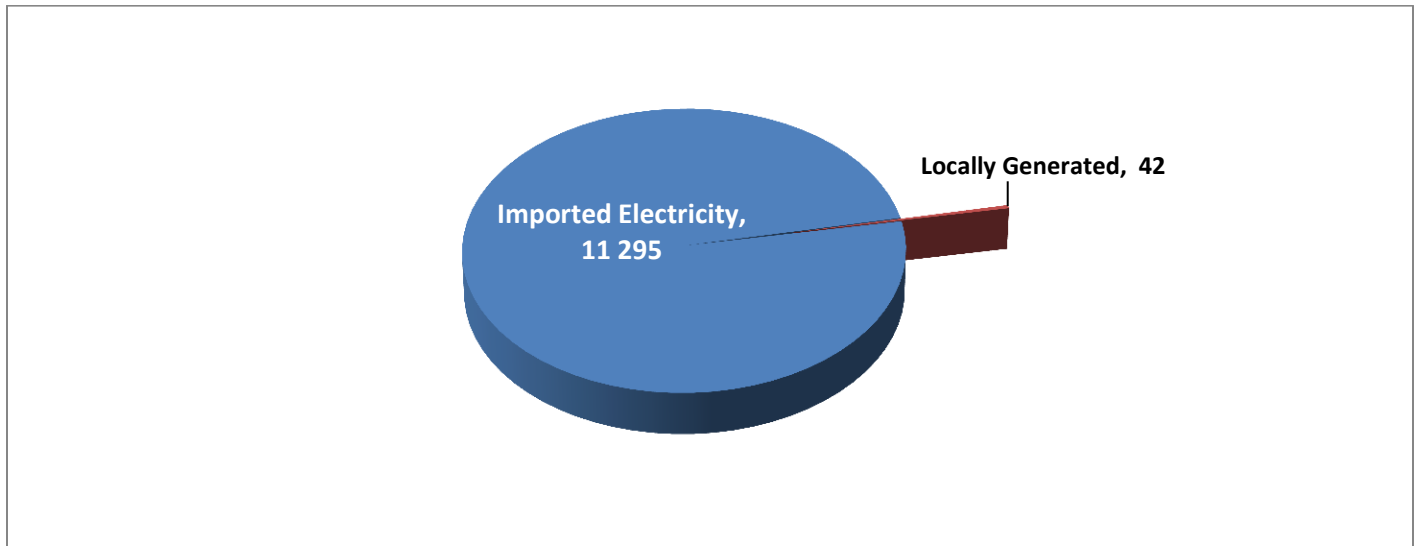


Figure 7: Electricity Supply by Source in the eThekweni Municipal Area (GWh)

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 8 below).

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

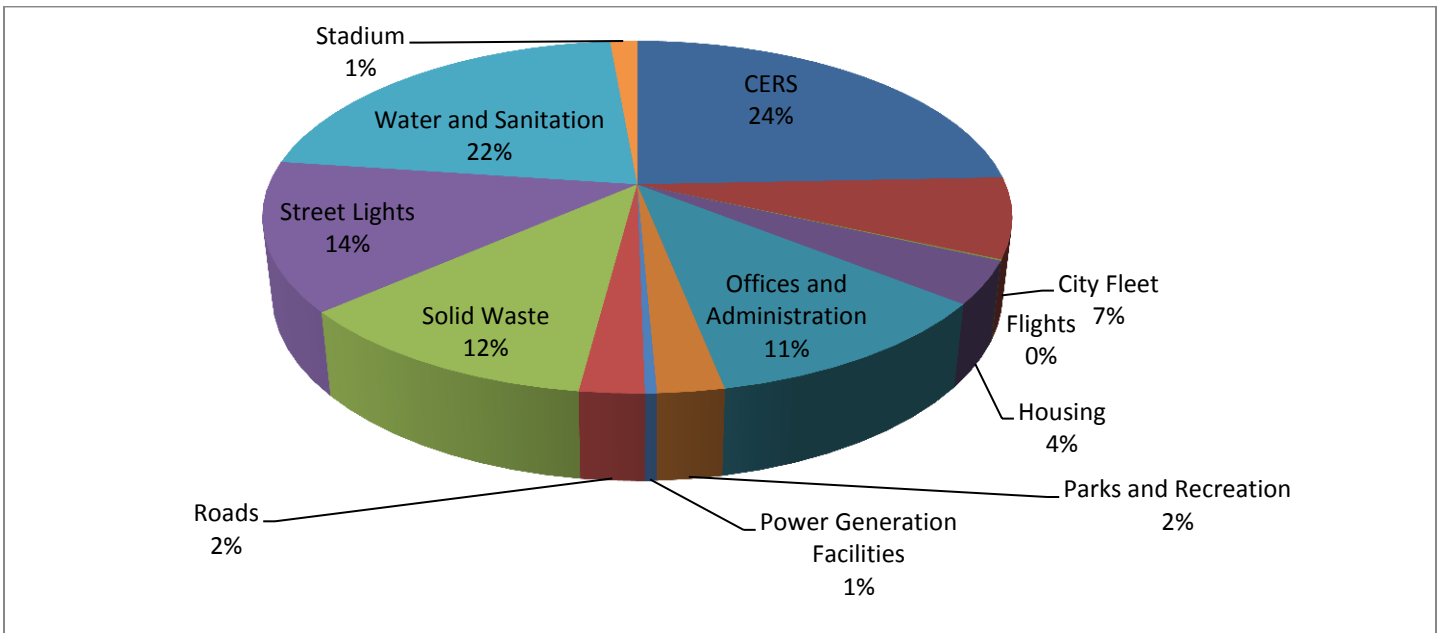


Figure 8: Municipal Emissions by Infrastructure Type tCO₂e (excluding electricity transmission losses)

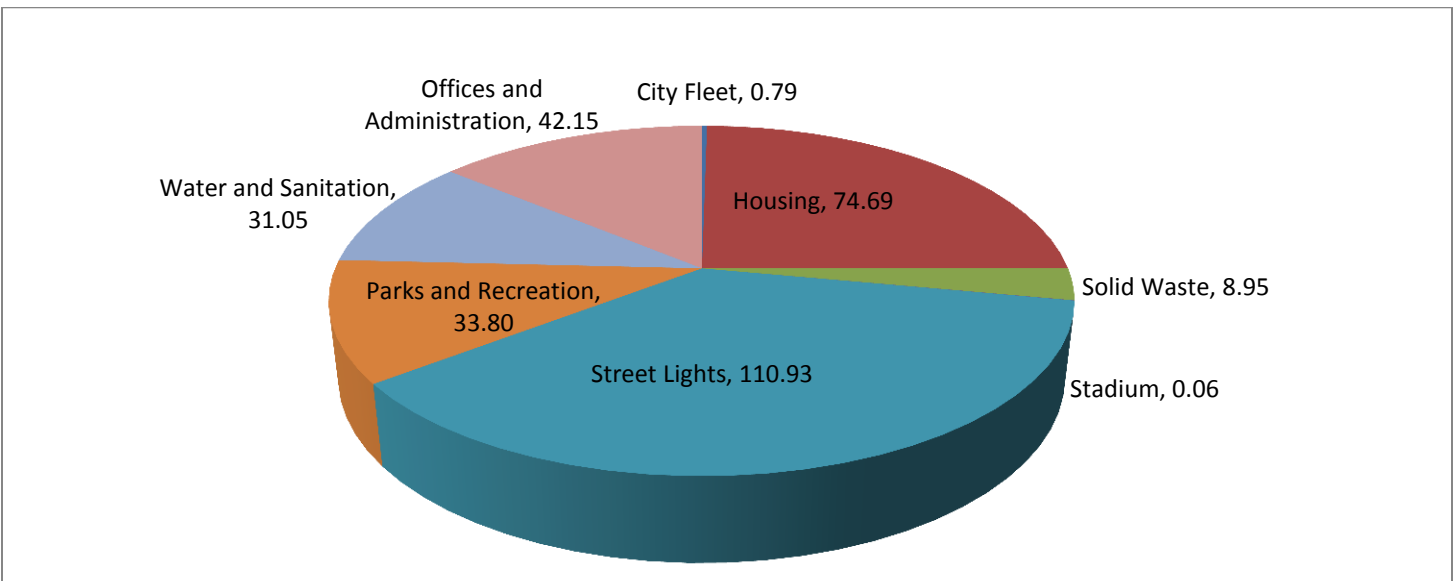


Figure 9: Municipal Electricity Consumption GWh (excluding electricity transmission losses)

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 51.67	tCO ₂ e / million Rand of operating budget	1 555 369	tCO ₂ e (Municipal Scope 1 & 2)	R 30 100.00 ¹²	Million Rand Operating Budget (2014/ 2015)
R 277.74	tCO ₂ e / million Rand of Capital budget	1 555 369	tCO ₂ e (Municipal Scope 1 & 2)	R 5 600.00 ¹³	Million Rand Capital Budget (2014/ 2015)
72.12	tCO ₂ e / Permanent employee	1 555 369	tCO ₂ e (Municipal Scope 1 & 2)	21 567 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
4.04	tCO ₂ e / household	3 842 648	tCO ₂ e (Residential Scope 1 & 2)	951 029 ¹⁵	Number of households within the EMA
R 38.72	tCO ₂ e / retail trade sales	2 307 886	tCO ₂ e (Commercial Scope 1 & 2)	R59 600.00 ¹⁶	2014 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
7.02	tCO ₂ e / Capita	24 421 536	tCO ₂ e (Scope 1 & 2)	3 481 147	Population within the EMA
8.26	tCO ₂ e / Capita	28,741,558	tCO ₂ e (Scope 1, 2 & 3)	3 481 147	Population within the EMA

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

¹²http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/Final%202014_15%20IDP.pdf

¹³http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/Final%202014_15%20IDP.pdf

¹⁴EThekweni Municipality, Human Resources

¹⁵Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development engineering

¹⁶Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development engineering

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%	6.2%
Yr 2014	1 586 674	27 505 329	29 092 003	1.2%	7.5%

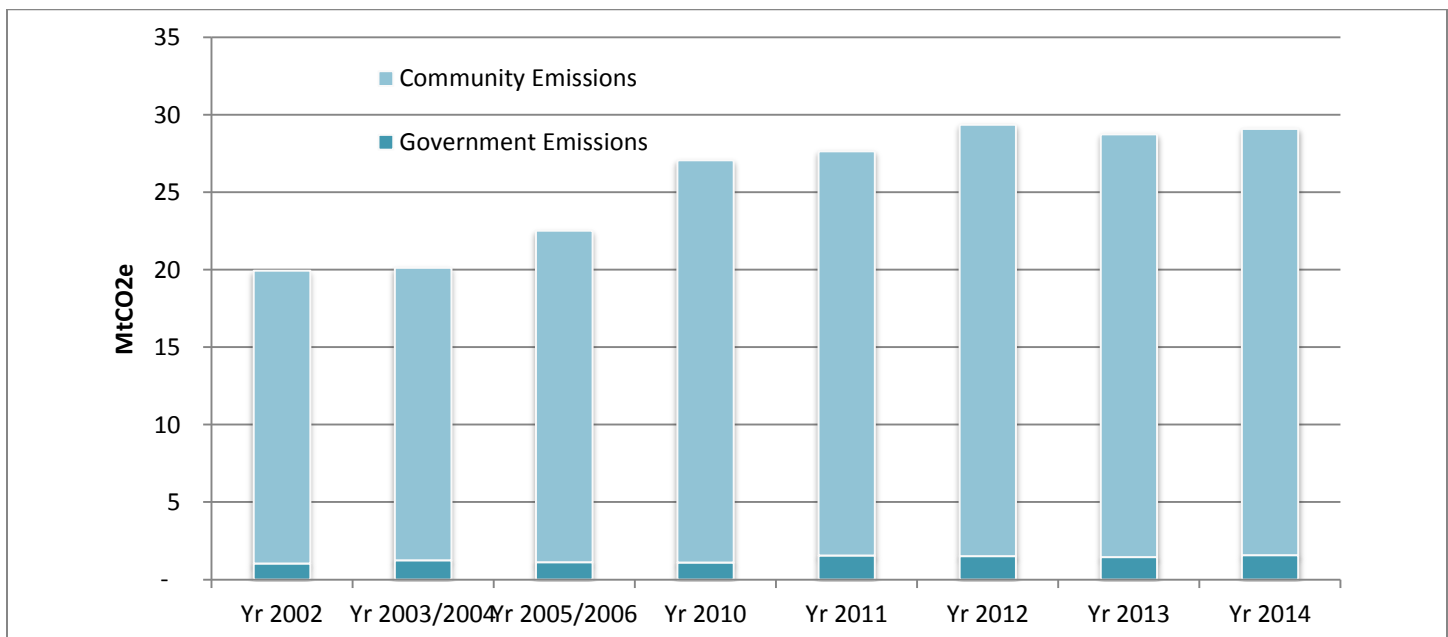


Figure 10: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Total emissions show an increase of 1.2% from year 2013 to 2014, which is equivalent to additional 350 445.3 tCO₂e emitted. The municipal and community sectors presents an increase of 135 745.8 tCO₂e and 214 699.5 tCO₂e respectively. Table 12 shows a detailed summary of the differences between 2013 and 2014.

Table 12: Data Comparison between 2013 and 2014 Reporting Periods

Scope	Type	Sub-Type	2013 (tCO ₂ e)	2014 (tCO ₂ e)	
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	5 883.8	19 315	228%
		Vehicle Fleet	37 313.9	31 211.3	-16%
	Solid Waste	Solid Waste (CH ₄)	92 768.0	92 911.3	0%
	Power Generation Facilities	Fugitive Emissions	3 552.0	3 552.0	0%
	Wastewater Treatment	Wastewater (CH ₄)	46 528.4	49 093.1	6%
	CERs	Certified Emission Reduction	202 601.1	204 146.4	1%
Municipal Scope 2	Electricity Consumption	Buildings	171 108.2	152 564.9	-11%
		Streetlights & Traffic Signals	112 287.5	114 256.9	2%
		Water Delivery Facilities	44 903.0	56 845.8	27%
		Transmission and Distribution Losses	627 171.8	755 638.9	20%
		Solid Waste Facilities	512.4	516.5	1%
		Wastewater Facilities	74 987.2	75 316.1	0%
Municipal Scope 3	Transport Systems	Streetlights	1 042.7	1 140.0	0%
		Transit Fleet	29 291.8	29 291.8	0%
		Flights	976.2	872.9	-11%
Subtotal Municipal			1 450 927.9	1 586 673.7	9%
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	4 596 899.3	4 529 667.1	-1%
		Mobile Fuel Combustion	6 383 880.9	6 813 121.2	7%
	Solid Waste	Solid Waste	205 740.0	198 068.0	-4%
	Industrial Processes & Product Use	IPPU	297 174.1	436 980.0	47%
	Industrial Processes & Product Use	IPPU	44 333.4	44 333.4	0%
	Agric & Landuse	Agric & Landuse	92 633.5	87 868.4	-5%
Community Scope 2	Electricity Consumption	Residential	3 645 811.7	3 632 683.8	0%
		Commercial	2 577 588.9	2 307 886.0	-10%
		Industrial	4 812 446.7	4 815 559.0	0%
Community Scope 3	Transport Systems	Air Transport Systems	206 364.8	211 406.0	2%
		Water Transport Systems	4 427 756.4	4 427 756.4	0%
Subtotal Community			27 290 629.7	27 505 329.2	1%
Total			28 741 557.6	29 092 002.9	1%

6 Conclusion and Way Forward

The compilation of the eThekwini GHG Emission Inventory is an important step in documenting the eThekwini Municipality's government and community emissions that are contributing to human induced climate change. The current inventory is the fifth iteration using the Local Government GHG Emissions Analysis Protocols. The 2014 total GHG emissions has increased from 28 741 558 tCO₂e in 2013 to 29 092 003 tCO₂e.

CERs are emissions that are captured from being released to the environment by destroying the methane. These emissions are traded and as such they will not be reported under any scope. Previously they were wrongly reported under scope 1. Going forward starting from the 2015 eThekwini Municipality Inventory the CERs will be reported separately from the total emissions in the GHGEI.

The way forward to improving the inventory is to close the data gaps by:

- Developing Methods for collecting unavailable data
- Working closely with departments or stakeholders that are providing data to benchmark and set target reduction goals where there are none; and
- Assist departments or stakeholders to identify GHG emissions reduction strategies.