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Final Summary Document: eThekweni Greenhouse Gas Emissions Inventory 2015

1 Synopsis

A Greenhouse Gas Emissions Inventory (GHGEI) for the eThekweni Municipality has been compiled for the 2015 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.

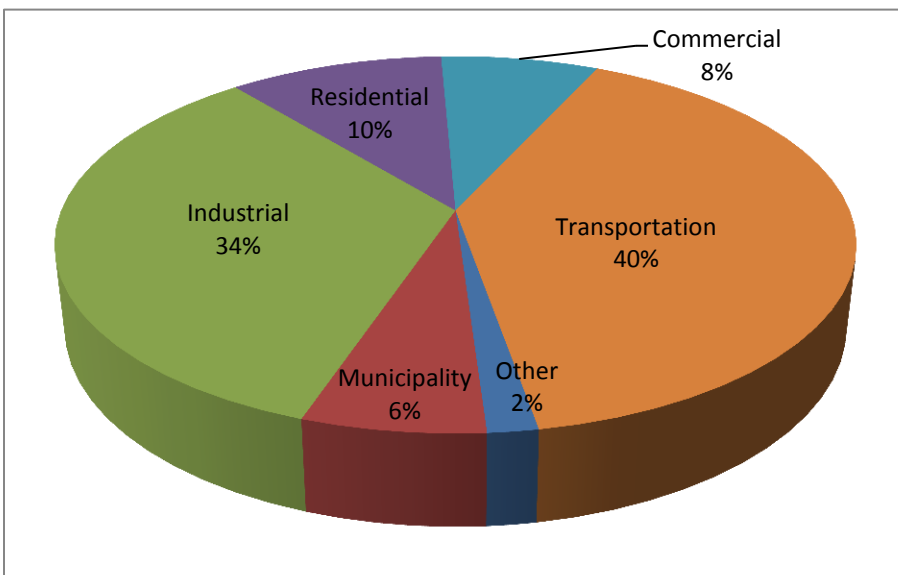


Figure 1: GHG emissions by sector

The total greenhouse emissions recorded for the entire eThekweni Municipal Area was 27 067 912 tCO₂e¹ for the 2015 year. As with previous GHGEIs, the largest contribution to this footprint was transportation sector (40% of the total GHGs) followed closely by Industry emissions (34%). A graph showing the inventory by sector is shown in Figure 1.

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 2015 emissions.

¹ Includes scope 1, 2 and selected scope 3 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 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.

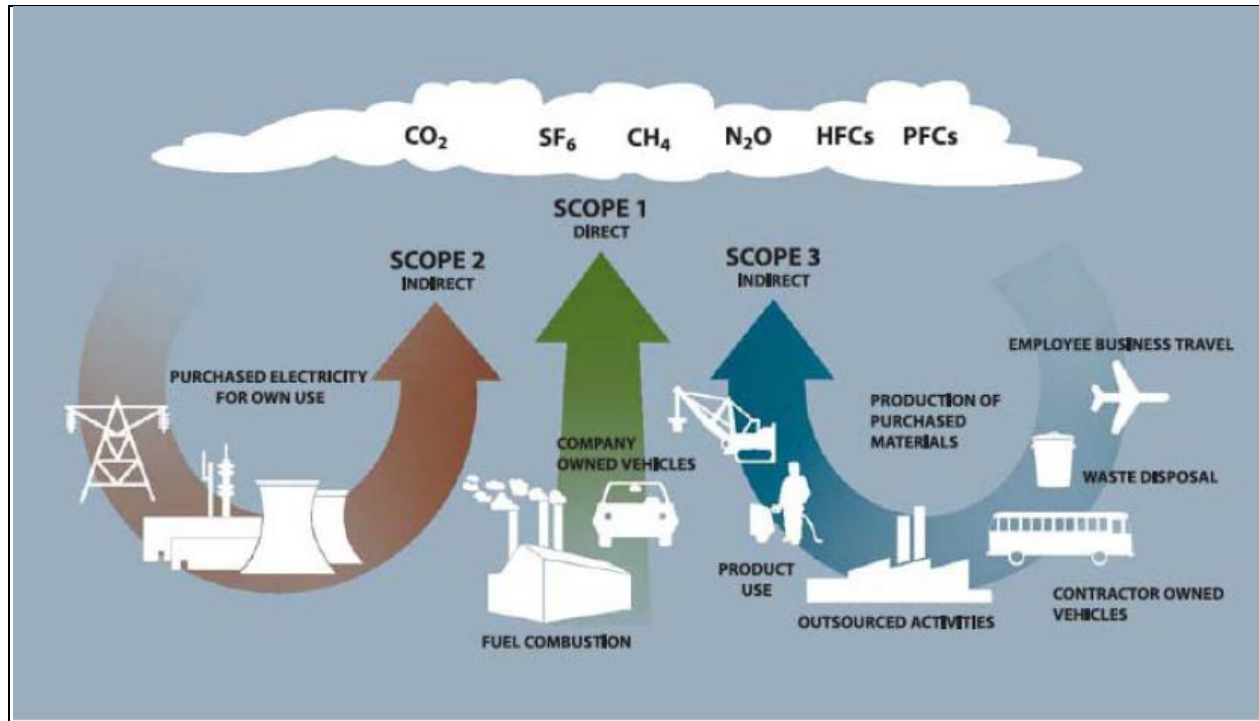


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

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 2015 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 2015 the total carbon emissions recorded for the entire eThekweni Municipal Area was 27 067 912 tCO₂e. 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 2015 period were 1 715 259 tCO₂e. 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 2015. 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	203 461 (12%)
Scope 2	Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses)	1 478 424 (86%)
Scope 3	Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights	33 374 (2%)

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2015. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 62% to the Municipality's total 2015 emission inventory, was electrical transmission and distribution losses (scope 2). The second highest municipal emission source was from the Municipal Buildings and Facilities at 11% followed by Streetlights and Traffic Signals at 7%.

⁵ 1kWh = 1.03kg CO₂

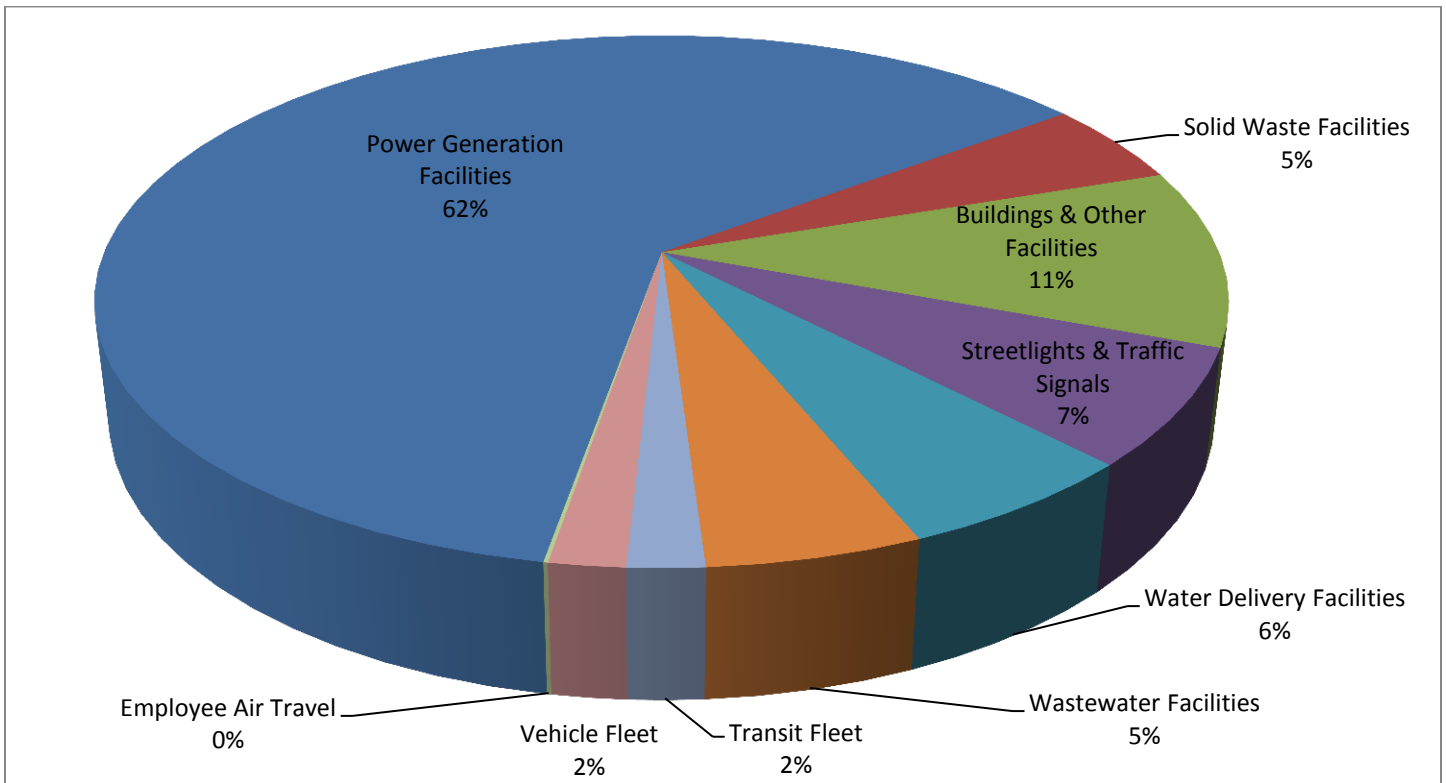


Figure 3: Total Government Emissions by Sector

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	18 847
	2	Purchased Electricity	164 888
Streetlights & Traffic Signals	2	Electricity consumption by municipal owned	120 162
Water Delivery Facilities	2	Purchased electricity	102 104
Wastewater Facilities	1	Stationary and process emissions	49 711
	2	Purchased electricity	38 921
Vehicle Fleet	1	Mobile fuel combustion	31 217
Transit Fleet	3	Mobile fuel combustion	31 492
Power Generation Facilities	1	Fugitive Emissions	3 552
Power Generation Facilities	2	Electrical distribution losses	1 049 239
Solid Waste Facilities	1	Fugitive emissions	82 700
	2	Purchased electricity	3 109
Industrial Process and Product Use	1	Bitumen	17 435
Employee Air Travel	3	Mobile fuel combustion	1 882

4.2 Community Emissions

Total community (excluding local government) emissions equated to 25 352 653 tCO₂e. The community emissions inventory includes GHG emissions associated with activities occurring within the eThekweni Municipality’s geopolitical boundary generated during 2015. The table below shows community emissions by scope.

Table 5: Community Emissions by Scope

Emissions Scope	GHG Sources	Community Emissions (CO ₂ e)
Scope 1	Stationary Fuel Combustion, Mobile Fuel Combustion, Solid Waste Disposal, Enteric Fermentation, Pre-harvest Cane Burning	11 300 993 (45%)
Scope 2	Electricity Consumption	9 350 121 (37%)
Scope 3	Air Transport Systems, Marine Transport Systems	4 734 913 (19%)

The largest sector contributing 36% 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 19%. Collectively (ground, air and water), transport sector emissions contribute the most significant proportion of the community emissions, at 44%. The residential sector is also significant, at 11%. 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 6.

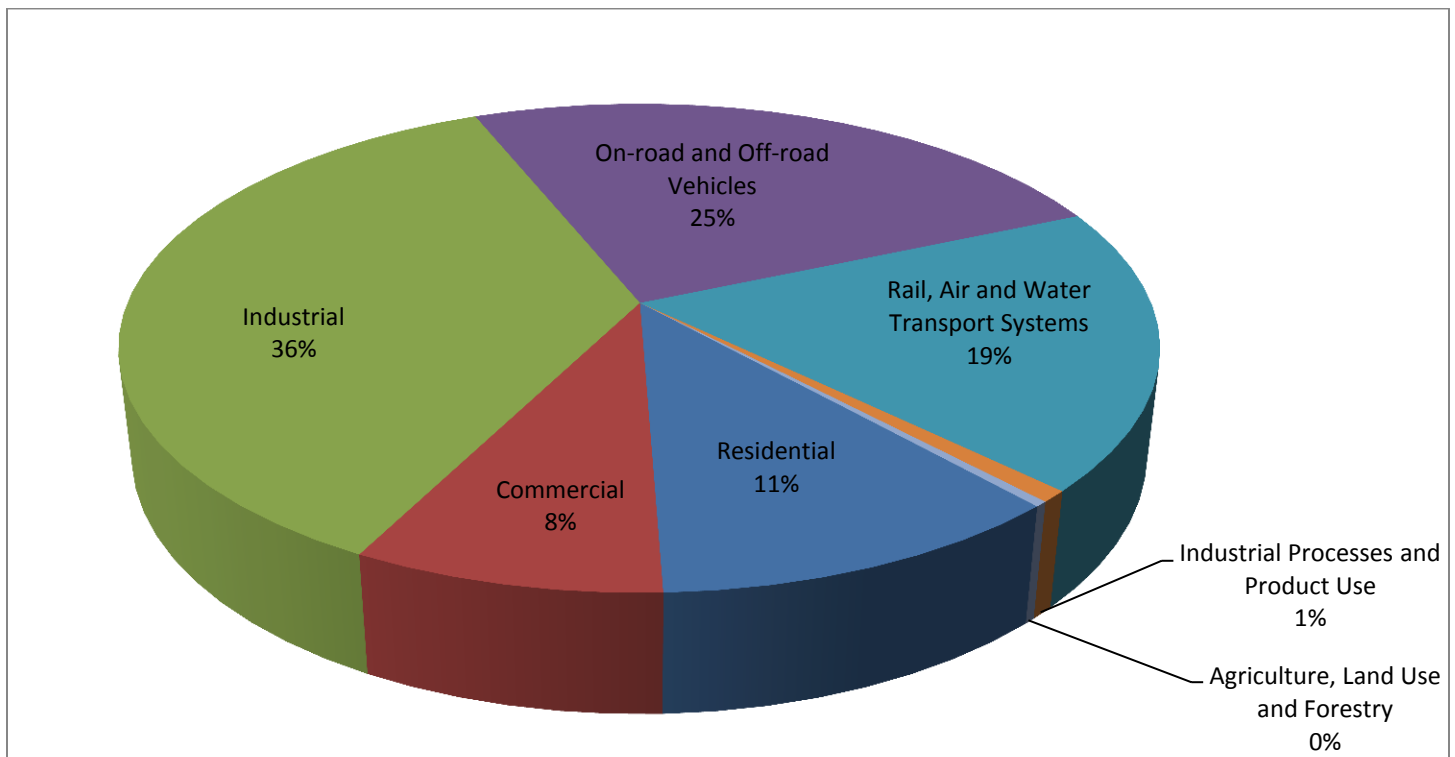


Figure 4: Total Community Emissions by Sector

Table 6: Community Operation Emissions by Sector and Source

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Residential	1	Stationary Fuel Combustion	218 160
	2	Electricity Consumption	2 568 723
Commercial	2	Electricity Consumption	2 048 861
Industrial	1	Stationary Fuel Combustion	4 401 865
	2	Electricity Consumption	4 732 537
On-road and Off-road Vehicles	1	Mobile Fuel Combustion	6 211 788
Rail, Air and Water Transport Systems	3	Air Travel	4 701 539
Solid Waste	1	Fugitive Emissions	190 683
Industrial Process and Product Use	1	Pulp & Paper Production	146 295
	1	F-gases	44 333
Agriculture, Land Use and Forestry	1	Enteric Fermentation	87 868
Total Community Emissions			25 352 653

5 Analysis of the GHG Inventory

5.1 Total Emissions

For 2015 the total⁶ carbon emissions recorded for eThekweni Municipality was 27 067 912 tCO₂e. Local Government Emissions account for 6% of the total eThekweni emissions (Figure 1). Transportation (ground, air and water) and Industry contribute the highest to the total emissions (Figure 1), contributing 40% and 34% respectively. The total emission value of 27 067 912 tCO₂e can also be assessed by “source” or *supply*.

The graph below, Figure 5, is an indication of where the greenhouse gasses in the city come from. As to be expected Transport Fuels⁷ are responsible for 41% of total GHG footprint (figure 1), which is close to 41% allocation in the transport sector (Figure 5). Electricity however is the second largest source of Greenhouse Gasses, responsible for 40% of the total footprint. Stationary Combustion⁸ also contributes to the overall GHG footprint with 17% of the total emissions.

⁶ Municipal and community emissions

⁷Including: Petrol, Diesel, Jet Fuel, Marine Diesel and Fuel Oil

⁸Including: Heavy Furnace Oil; Bitumen; Natural Gas; LPG; Coal; Coke; Illuminating Paraffin; Paraffin Wax; Refinery Gas

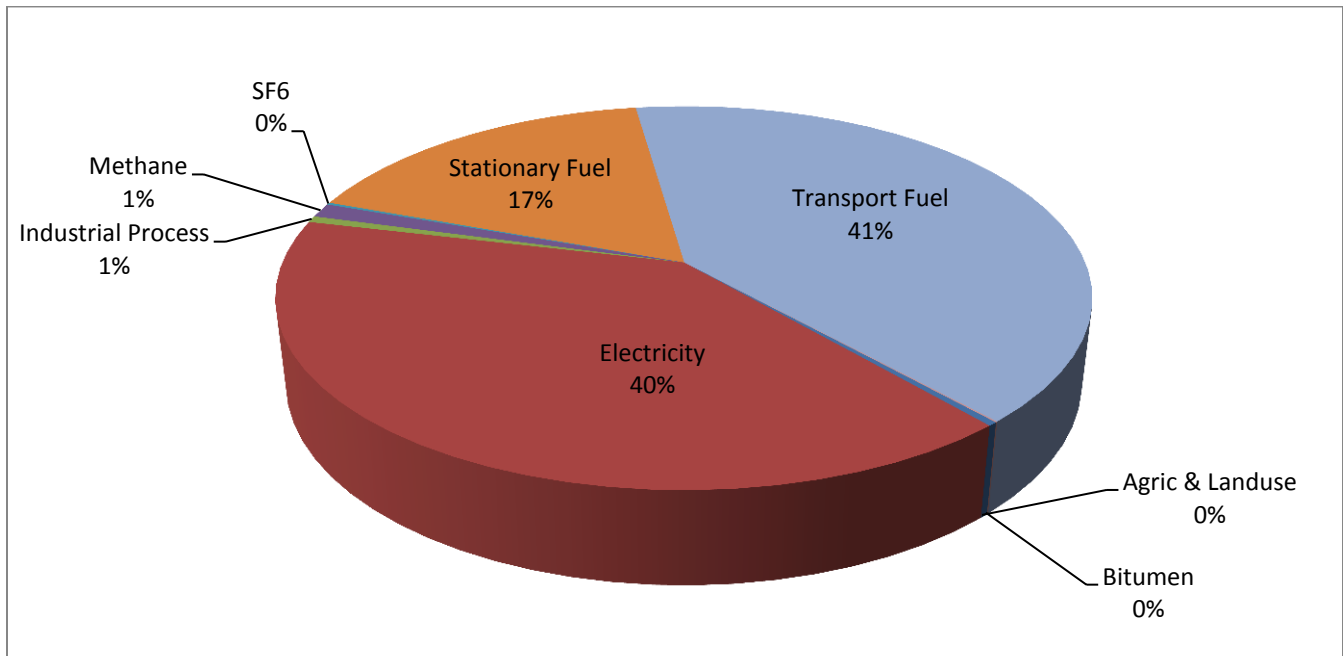


Figure 5: Carbon emissions by Source

The imported electricity supplied in the city was 11 015GWh (99.6%) compared to local generators of electricity at 47 GWh (See Figure 6 below). This local generation is predominantly from the Municipal Landfill Gas to Electricity Project⁹ and embedded generators.

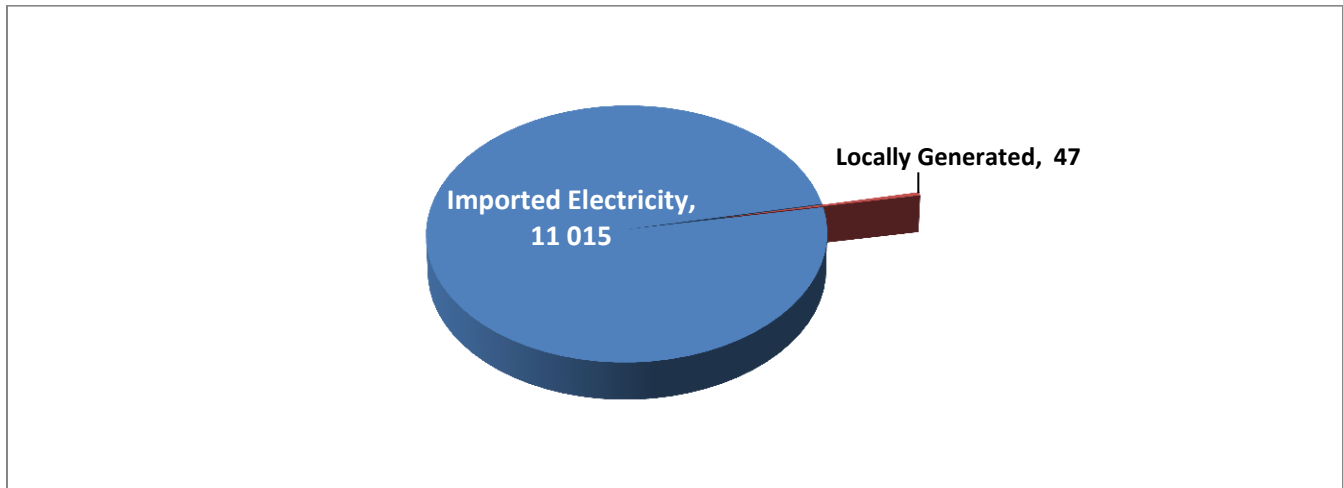


Figure 6: Electricity Supply by Source in the eThekweni Municipal Area (GWh)

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. Water and Sanitation operations were responsible for the largest component of the municipal footprint followed by Street Lights. 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 7 below).

⁹<http://www.kznenergy.org.za/durban-landfill-gas-to-electricity-project/>

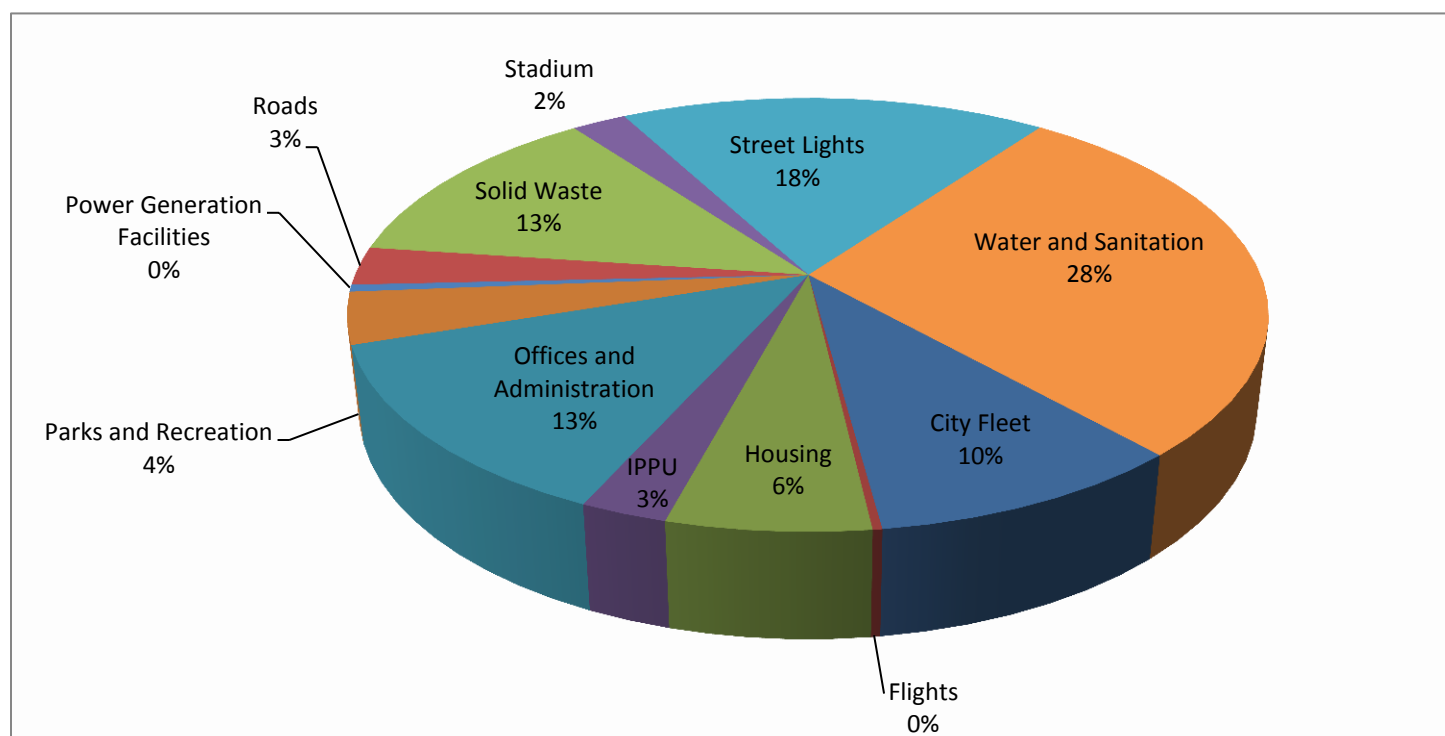


Figure 7: Municipal Emissions by Infrastructure Type tCO₂e (excluding electricity transmission losses)

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 5: Municipal Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
R 50.81	tCO ₂ e / million Rand of operating budget	1 681 885	tCO ₂ e (Municipal Scope 1 & 2)	R 33 100.00 ¹⁰	Million Rand Operating Budget (2015/ 2016)
R 275.72	tCO ₂ e / million Rand of Capital budget	1 681 885	tCO ₂ e (Municipal Scope 1 & 2)	R 6 100.00 ¹¹	Million Rand Capital Budget (2015/ 2016)
75.02	tCO ₂ e / Permanent employee	1 681 885	tCO ₂ e (Municipal Scope 1 & 2)	22 420 ¹²	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.

¹⁰http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/Final%202015_15%20IDP.pdf

¹¹http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/Final%202015_15%20IDP.pdf

¹²EThekweni Municipality, Human Resources

Table 6: Community Emissions Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
2.62	tCO ₂ e / household	2 786 883	tCO ₂ e (Residential Scope 1 & 2)	1 063 243 ¹³	Number of households within the EMA
R 34.55	tCO ₂ e / retail trade sales	2 048 861	tCO ₂ e (Commercial Scope 1 & 2)	R59 300.00 ¹⁴	2015 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 7: Total Emissions Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
6.28	tCO ₂ e / Capita	22 332 999	tCO ₂ e (Scope 1 & 2)	3 555 868	Population within the EMA
8.08	tCO ₂ e / Capita	28 741 558	tCO ₂ e (Scope 1, 2 & 3)	3 555 868	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 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 8: 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	1 586 673	27 505 329	29 092 002	1.2%	6.2%
Yr 2015	1 715 259	25 352 653	27 067 912	-7.0%	-0.8%

¹³ Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development engineering

¹⁴ Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development engineering

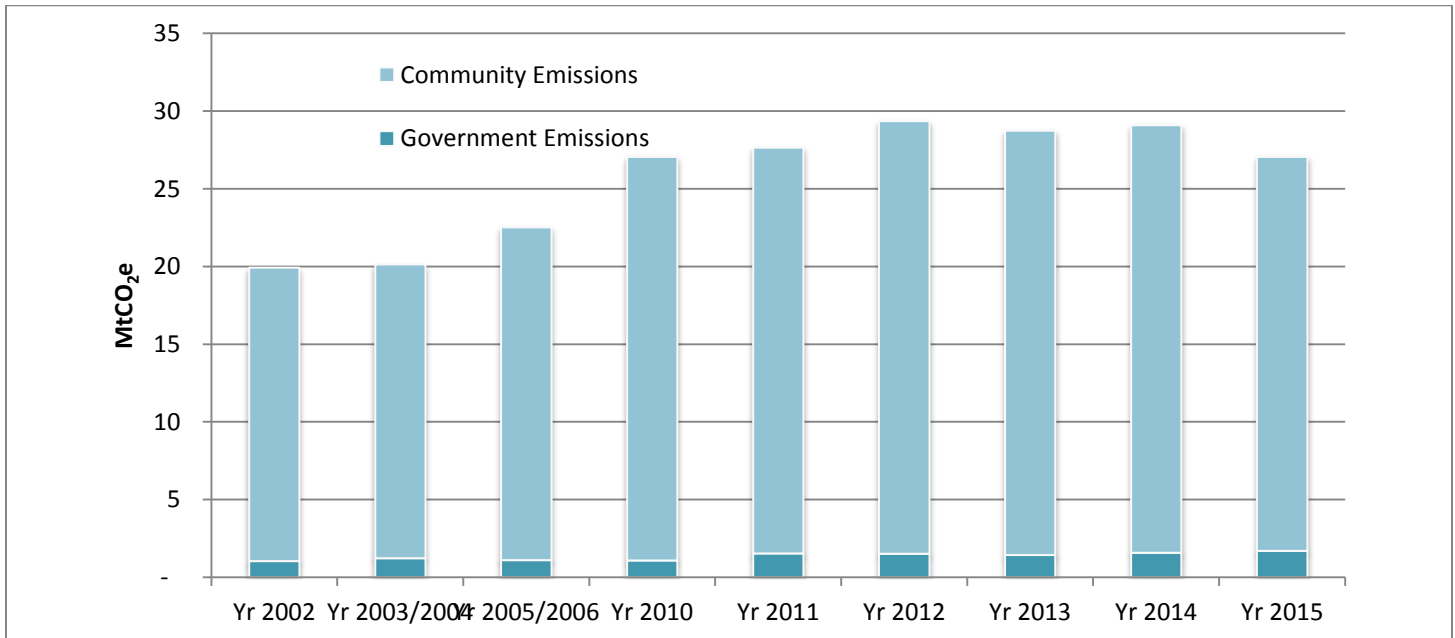


Figure 8: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Total emissions show a decrease of 7% for 2015, which is equivalent to 1 819 944 tCO₂e. However, the municipal sector presented an increase of 332 732.0 tCO₂e whilst the community sector present a decrease of 2 152 653.0 tCO₂e. Table 12 gives a detailed summary of the differences between 2014 and 2015.

Table 9: Data Comparison between 2014 and 2015 Reporting Periods

Scope	Type	Sub-Type	Sub-Type	2014 (tCO ₂ e)	2015 (tCO ₂ e)
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	Stationary Fuel	19 315.8	18 846.7
		Vehicle Fleet	Transport Fuel	31 211.3	31 216.6
	Solid Waste	Solid Waste (CH ₄)	Methane	92 911.3	82 700.2
	Power Generation Facilities	Fugitive Emissions	SF ₆	3 552.0	3 552.0
	Industrial Processes & Product Use	IPPU	Bitumen	-	17 435.0
	Wastewater Treatment	Wastewater (CH ₄)	Methane	49 093.1	49 711.1
	CERs	Certified Emissions Reduction	CERs	204 146.	
Municipal Scope 2	Electricity Consumption	Buildings	Electricity	152 564.9	164 888.4
		Streetlights & Traffic Signals	Electricity	114 256.9	120 161.7
		Water Delivery Facilities	Electricity	56 845.8	102 104.2
		Transmission and Distribution Losses	Electricity	755 638.9	1 049 239.5
		Solid Waste Facilities	Electricity	516.5	3 108.6
		Wastewater Facilities	Electricity	75 316.1	38 921.3
Municipal Scope 3	Transport Systems	Streetlights	Electricity	1 140.0	-
		Transit Fleet	Transport Fuel	29 291.8	31 491.8
		Flights	Transport Fuel	872.9	1 882.4
Subtotal Municipal				1 586 673.7	1 715 259.3
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	Stationary Fuel	4 529 667.1	4 620 025.2
		Mobile Fuel Combustion	Transport Fuel	6 813 121.2	6 211 787.7
	Solid Waste	Solid Waste	Methane	198 068.0	190 683.0
	Industrial Processes & Product Use	IPPU	Industrial Process	436 980.0	146 295.0
	Industrial Processes & Product Use	IPPU	SF ₆	44 333.4	44 333.4
Agric & Landuse	Agric & Landuse	Agric & Landuse	87 868.4	87 868.4	
Community Scope 2	Electricity Consumption	Residential	Electricity	3 632 683.8	2 568 723.2
		Commercial	Electricity	2 307 886.0	2 048 861.0
		Industrial	Electricity	4 815 559.0	4 732 537.2
Community Scope 3	Transport Systems	Air Transport Systems	Transport Fuel	211 406.0	273 782.6
		Water Transport Systems	Transport Fuel	4 427 756.4	4 427 756.4
Subtotal Community				27 505 329.2	25 352 653.0
Total				29 092 002.9	27 067 912.3

6 Conclusion and Way Forward

The 2015 total GHG emissions have decreased from 29 092 003 tCO₂e in 2014 to 27 067 912 tCO₂e.

Many changes and moves in departments within municipal buildings affect electricity consumption impacting on the emissions from electricity. In some instances City buildings and facilities that are rented out whose accounts are not being paid, the city is accountable for the consumption. This is impacting to an increase to the electricity consumption by the council. Unaccounted electrical losses contribute most to the increase of the overall emissions for the city.

Recommendations

- Baseline year should be revisited as there are changes in the data sets.
- Energy audits and retrofits should be done for all municipal buildings and facilities.
- Reduce fleet size, improve scheduling and route efficiency.
- Increase office recycling, encourage municipal composting program.