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Final Summary Document: eThekweni Greenhouse Gas Emissions Inventory 2017

1 Synopsis

A Greenhouse Gas Emissions Inventory (GHGEI) for the eThekweni Municipality has been compiled for the 2017 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

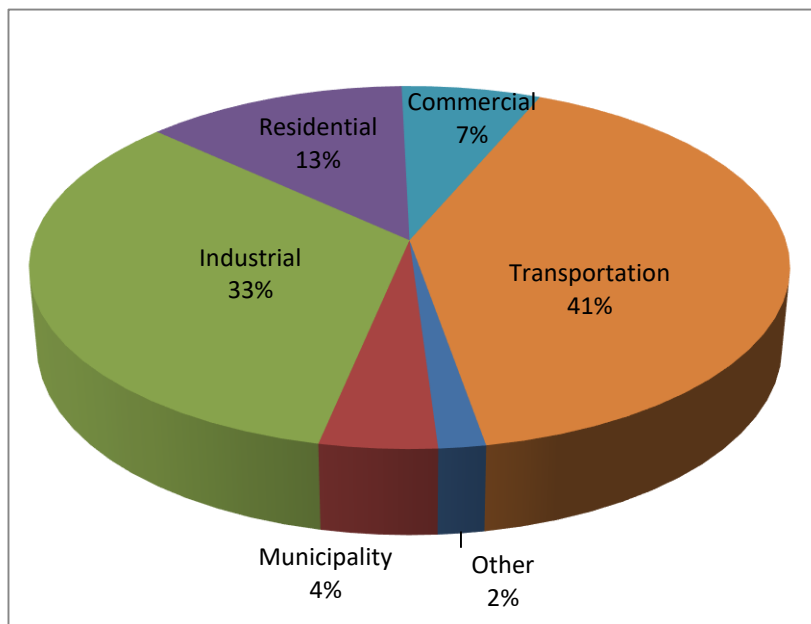


Figure 1: GHG emissions by sector

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 29,025,638 tCO₂e¹ for the 2017 year. As with previous GHGEIs, the largest contribution to this footprint was transportation sector (41% of the total GHGs) followed closely by Industry emissions (33%). 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.

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 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.

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.

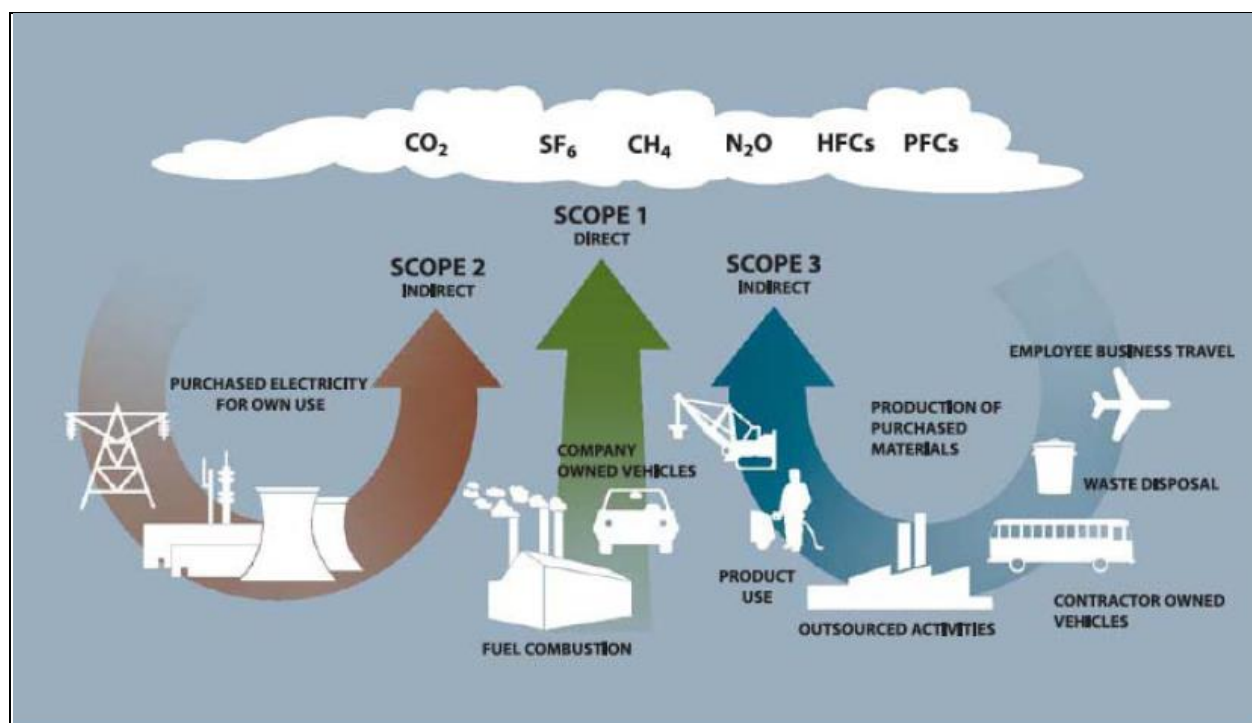


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

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 2017 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. Table 1 and table 2 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 2017 the total carbon emissions recorded for the entire eThekweni Municipal Area was 29,025,638 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 2017 period were 1,261,219 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 2017. Table 3 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	157,544 (12%)
Scope 2	Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses)	1,066,535 (85%)
Scope 3	Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights	37,140 (3%)

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2017. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 63% to the Municipality's total 2017 emission inventory, was electrical transmission and distribution losses (scope 2) and was followed by streetlights and traffic signals at 11%.

⁵ 1kWh = 1.03kg CO₂

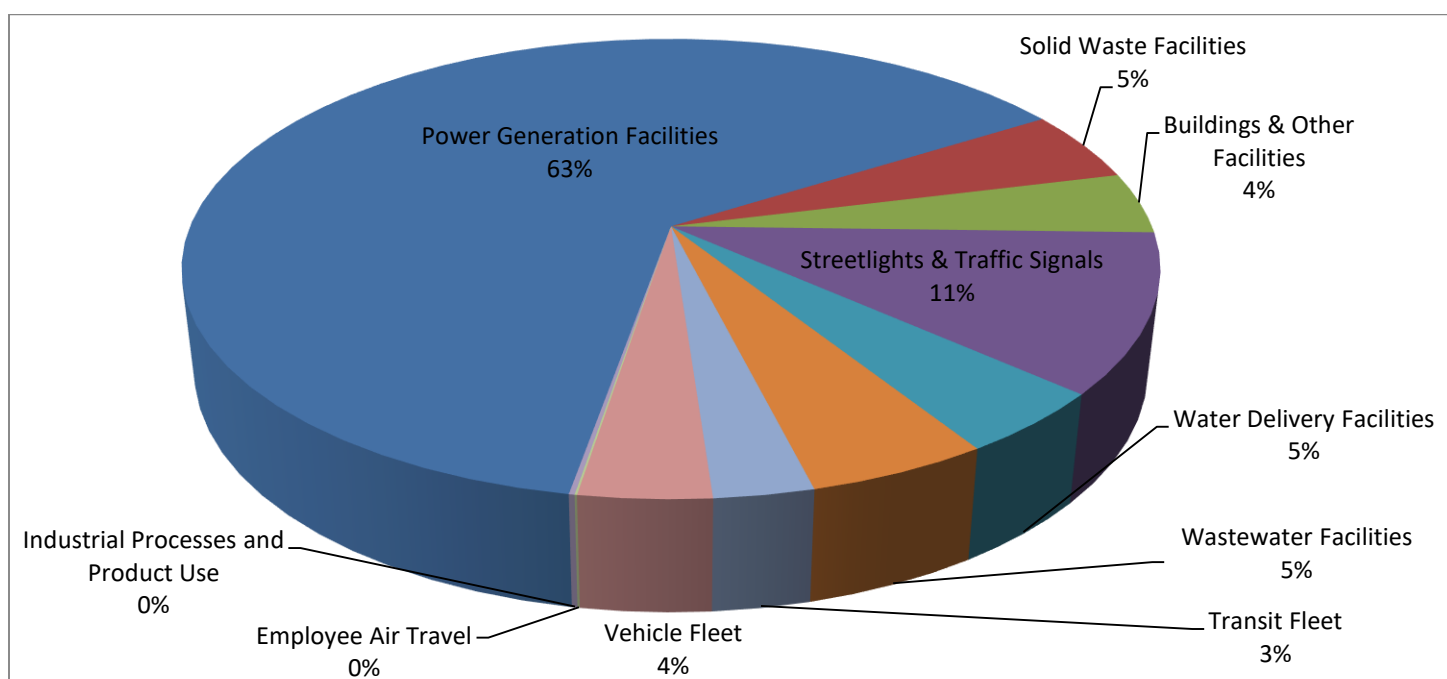


Figure 3: Total Government Emissions by Sector

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	2,961
	2	Purchased Electricity	51,286
Streetlights & Traffic Signals	2	Electricity consumption by municipal owned	139,072
	3	Streetlights	1,092
Water Delivery Facilities	2	Purchased electricity	55,951
Wastewater Facilities	1	Stationary and process emissions	43,273
	2	Purchased electricity	20,948
Vehicle Fleet	1	Mobile fuel combustion	46,543
Transit Fleet	3	Mobile fuel combustion	35,236
Power Generation Facilities	2	Electrical distribution losses	798,765
Solid Waste Facilities	1	Fugitive emissions	62,740
	2	Purchased electricity	514
Industrial Process and Product Use	1	Bitumen	2,027
Employee Air Travel	3	Mobile fuel combustion	812

4.2 Community Emissions

Total community emissions were equated to 27,764,419 tCO₂e. The community emissions inventory includes GHG emissions associated with activities occurring within the eThekweni Municipality's geopolitical boundary generated during 2017. The table below shows community emissions by scope.

Table 5: 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	12,838,995 (46%)
Scope 2	Electricity Consumption	11,328,001 (37%)
Scope 3	Air Transport Systems, Marine Transport Systems	4,701,083 (17%)

The largest sector contributing 35% 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 26% 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 at 43%. 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

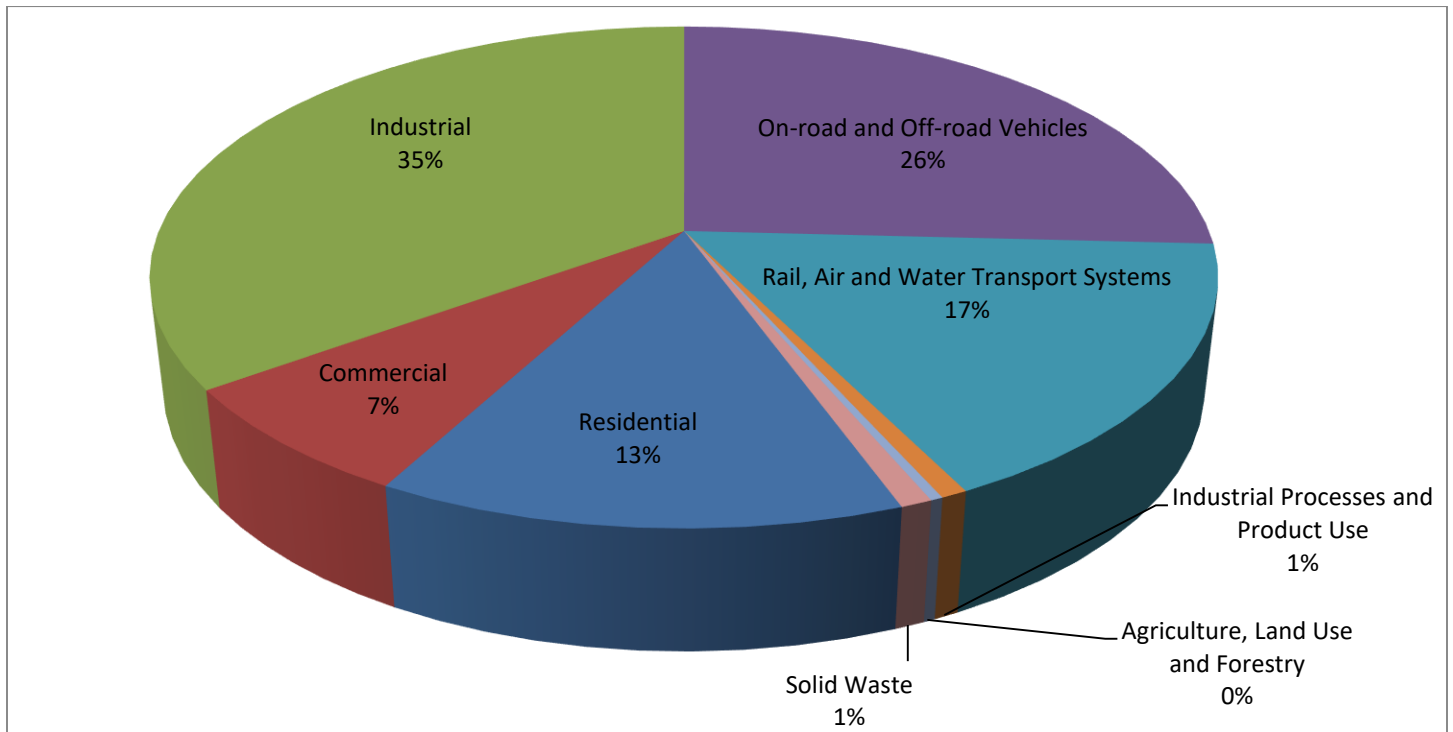


Table 6: Community Operation Emissions by Sector and Source

Sector	Scope	Emission Sources	Emissions (tonnes CO ₂ e)
Residential	1	Stationary Fuel Combustion	281,258
	2	Electricity Consumption	3,450,318
Commercial	2	Electricity Consumption	1,985,963
Industrial	1	Stationary Fuel Combustion	4,883,050
	2	Electricity Consumption	4,825,185
On-road and Off-road Vehicles	1	Mobile Fuel Combustion	7,168,511
Rail, Air and Water Transport Systems	3	Air Travel	4,663,943
Solid Waste	1	Fugitive Emissions	227,526
Industrial Process and Product Use	1	Pulp & Paper Production	146,467
	1	F-gases	44,330
Agriculture, Land Use and Forestry	1	Enteric Fermentation	87,868
Total Community Emissions			27,764,419

5 Analysis of the GHG Inventory

5.1 Total Emissions

For 2017 the total carbon emissions recorded for eThekweni Municipality was 29,025,638 tCO₂e. Municipal activities accounts for 4% of the total emissions; highest emitters, transportation and industry are at 43% and 31%, respectively (Figure 1).

Below is Figure 5it indicates that most of the emissions in the city come from liquid fuels (41%) used for transport. Electricity however is the second largest source of emissions at 39%. Stationary Combustion also contributes to the overall GHG footprint with 18% of the total emissions.

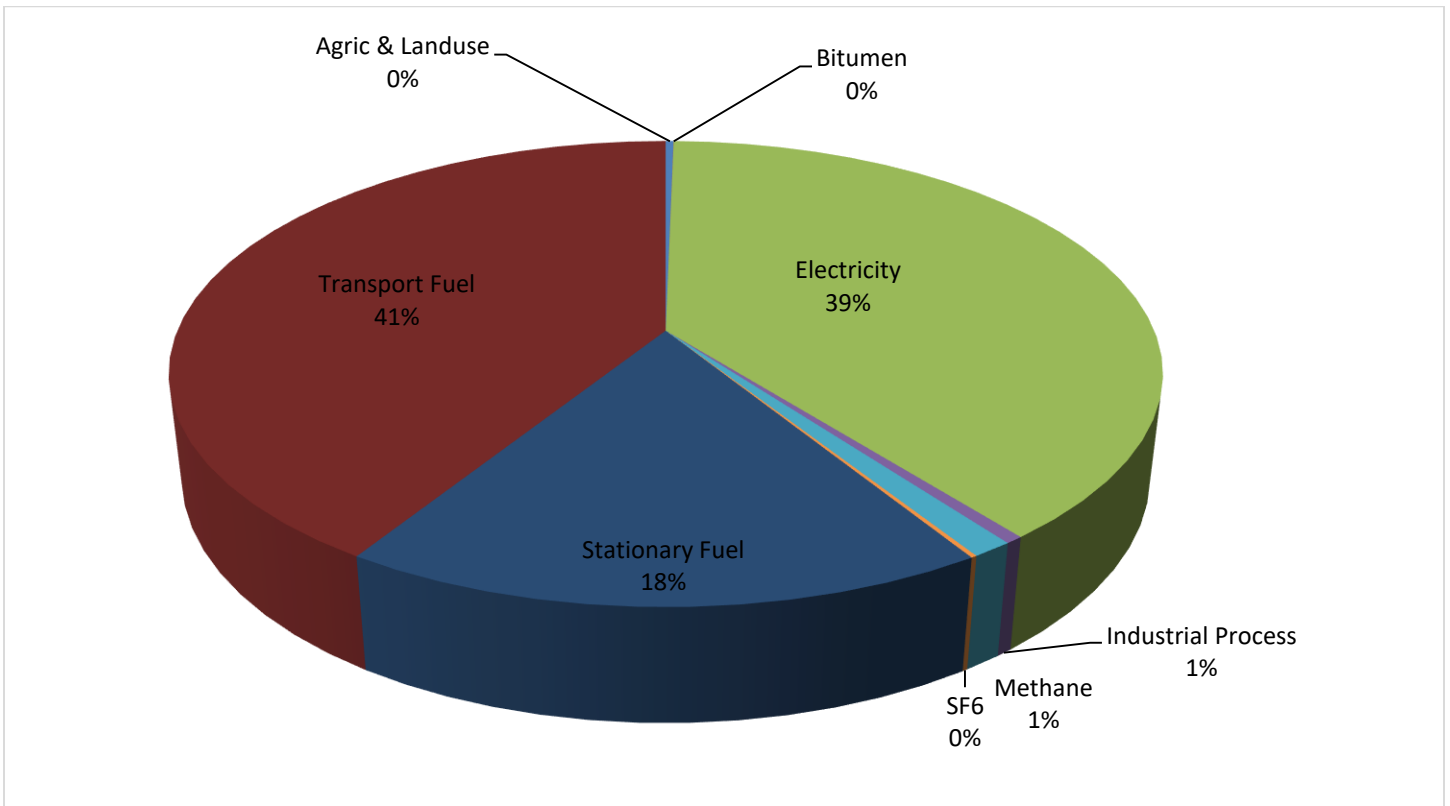


Figure 5: Carbon emissions by Source

The imported electricity supplied in the city was 11,276 GWh (99.65%) compared to local generators of electricity at 40 GWh (0.35%) (See Figure 6 below). This local generation is predominantly from the Municipal Landfill Gas and renewable energy embedded generators.

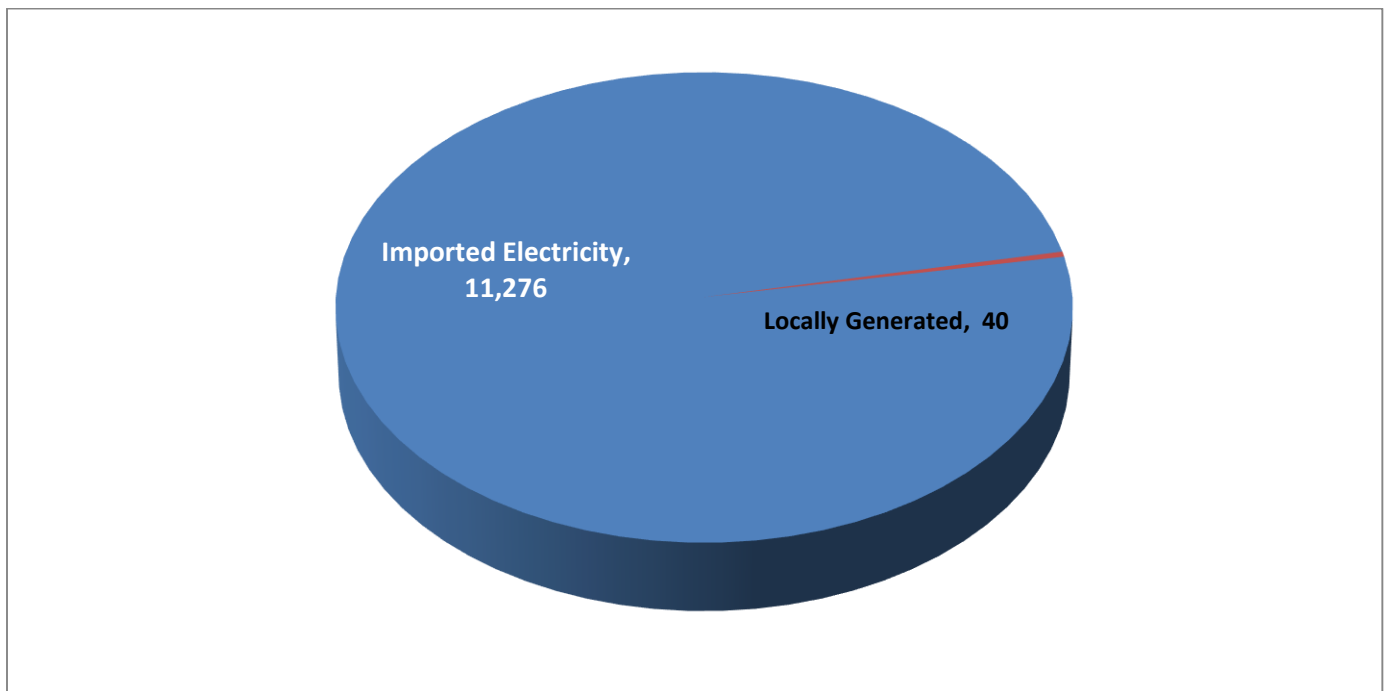


Figure 6: Electricity Supply by Source in the eThekweni Municipal Area (GWh)

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. Street lights operations were responsible for the largest component of the municipal footprint followed by Water and Sanitation, City Fleet and Solid Waste. The bulk of the infrastructure emissions are from electricity usage, Solid Waste emissions are predominantly from methane and Water and Sanitation facilities also contributes to the methane (Figure 7 below).

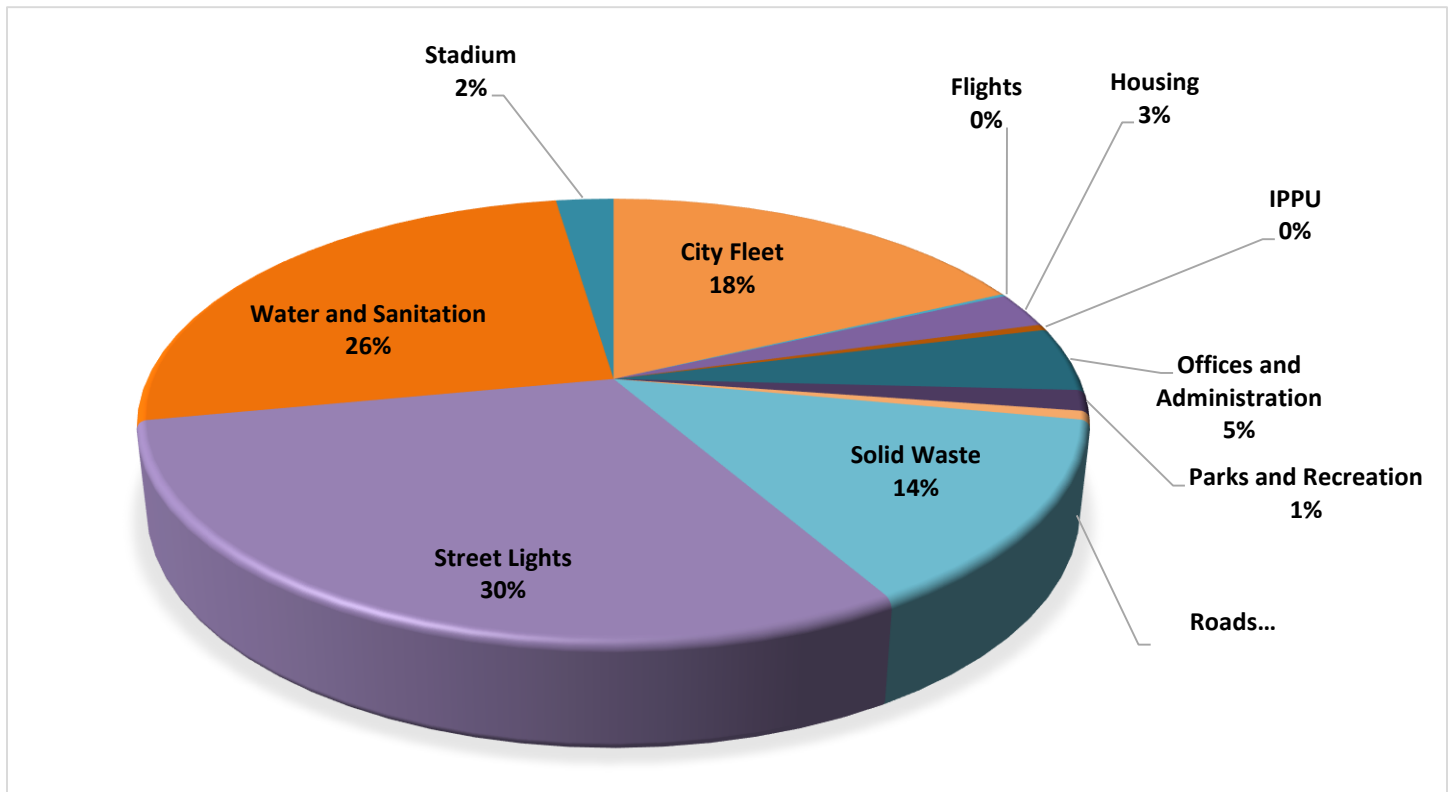


Figure 7: Municipal Emissions by Infrastructure Type tCO₂e (excluding electricity transmission losses)

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 7: Municipal Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
R32.82	tCO ₂ e / million Rand of operating budget	1,224,079	tCO ₂ e (Municipal Scope 1 & 2)	R 37,200.00 ⁶	Million Rand Operating Budget (2017/ 2018)
R167.68	tCO ₂ e / million Rand of Capital budget	1,224,079	tCO ₂ e (Municipal Scope 1 & 2)	R7,300.00 ⁷	Million Rand Capital Budget (2017/ 2018)
52.07	tCO ₂ e / Permanent employee	1,224,079	tCO ₂ e (Municipal Scope 1 & 2)	23,510 ⁸	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 8: Community Emissions Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
3.37	tCO ₂ e / household	3,731,576	tCO ₂ e (Residential Scope 1 & 2)	1,108,583 ⁹	Number of households within the EMA
R 25.11	tCO ₂ e / retail trade sales	1,985,963	tCO ₂ e (Commercial Scope 1 & 2)	R79,100.00 ¹⁰	2017 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 9: Total Emissions Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
6.29	tCO ₂ e / Capita	24,324,540	tCO ₂ e (Scope 1 & 2)	3,866,505	Population within the EMA
7.36	tCO ₂ e / Capita	28,464,675	tCO ₂ e (Scope 1, 2 & 3)	3,866,505	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

⁶Global Insight 2019, EThekweni Treasury Unit, Planning Unit. PSIR Dept.

⁷Global Insight 2019, EThekweni Treasury Unit, Planning Unit. PSIR Dept.

⁸EThekweni Municipality, Human Resources

⁹Global Insight 2019, EThekweni Treasury Unit, Planning Unit. PSIR Dept.

¹⁰Global Insight 2019, EThekweni Treasury Unit, Planning Unit. PSIR Dept.

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

Year	Government Emissions	Community Emissions	Total Emissions	% Change
Year 2010	1,104,212	25,962,074	27,066,285	
Year 2011	1,551,420	26,097,979	27,649,400	2.2%
Year 2012	1,526,431	27,833,965	29,360,395	6.2%
Year 2013	1,450,928	27,290,630	28,741,558	-2.1%
Year 2014	1,586,674	27,505,329	29,092,003	1.2%
Year 2015	1,715,259	25,352,653	27,067,912	-7.0%
Year 2016	1,817,486	26,647,189	28,464,675	5.2%
Year 2017	1,261,219	27,764,419	29,025,638	2.0%

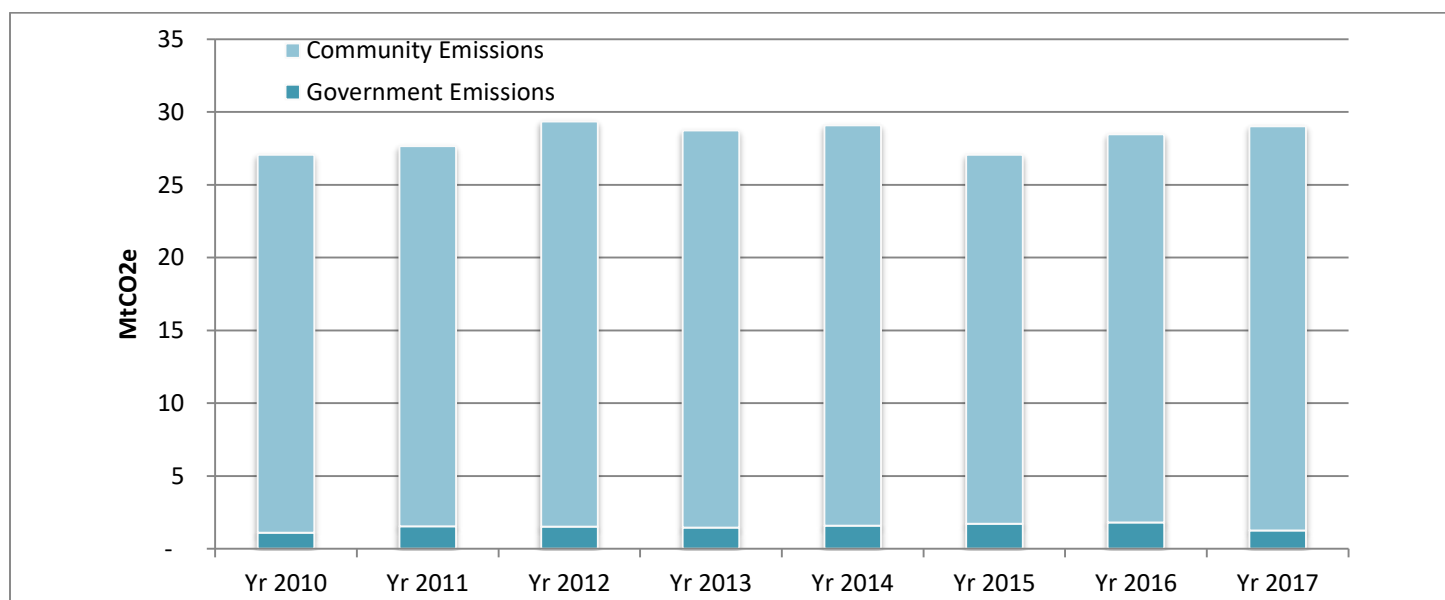


Figure 8: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Total emissions have increased by 559,871 tCO₂e in 2017. The emission for municipal sector have decreased from 1,817,467 tCO₂e to 1,261,219 tCO₂e and the community sector have increased by 1,117,230 tCO₂e. Table 12 shows a detailed summary of the differences between 2015 and 2017 emissions.

Table 11: Data Comparison between 2016 and 2017 Reporting Periods

Scope	Type	Sub-Type	2016 (tCO ₂ e)	2017 (tCO ₂ e)
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	2,909.5	2,960.7
		Vehicle Fleet	42,933.4	46,543.2
	Solid Waste	Solid Waste (CH ₄)	82,066.0	62,740.3
	Industrial Processes & Product Use	IPPU	3,417.9	2,026.9
	Wastewater Treatment	Wastewater (CH ₄)	50,584.2	43,272.7
Municipal Scope 2	Electricity Consumption	Buildings	134,822.0	51,285.6
		Streetlights & Traffic Signals	120,054.8	139,071.9
		Water Delivery Facilities	77,567.7	55,950.9
		Transmission and Distribution Losses	1,226,866.9	798,764.9
		Solid Waste Facilities	2,149.5	514.3
		Wastewater Facilities	41,842.4	20,947.8
Municipal Scope 3	Transport Systems	Streetlights	1,095.0	1,091.6
		Transit Fleet	31,115.0	35,235.8
		Flights	1,157.2	812.4
Subtotal Municipal			1,817,486.5	1,261,219.0
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	4,577,351.8	5,164,307.9
		Mobile Fuel Combustion	6,450,835.2	7,168,510.8
	Solid Waste	Solid Waste	183,574.0	227,526.3
	Industrial Processes & Product Use	IPPU	156,422.0	146,466.6
	Industrial Processes & Product Use	IPPU	47,885.4	44,330.0
	Agric & Landuse	Agric & Landuse	87,868.4	87,868.4
Community Scope 2	Electricity Consumption	Residential	3,399,158.3	3,450,317.6
		Commercial	2,072,205.3	1,985,963.3
		Industrial	4,980,061.9	4,825,184.8
Community Scope 3	Transport Systems	Air Transport Systems	264,070.2	236,186.6
		Water Transport Systems	4,427,756.4	4,427,756.4
Subtotal Community			26,647,188.8	27,764,418.7
Total			28,464,675.3	29,025,637.6

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 human induced climate change. The 2017 total GHG emissions have increased from 28,464,675.3 tCO₂e in 2016 to 29,025,637.6 tCO₂e.