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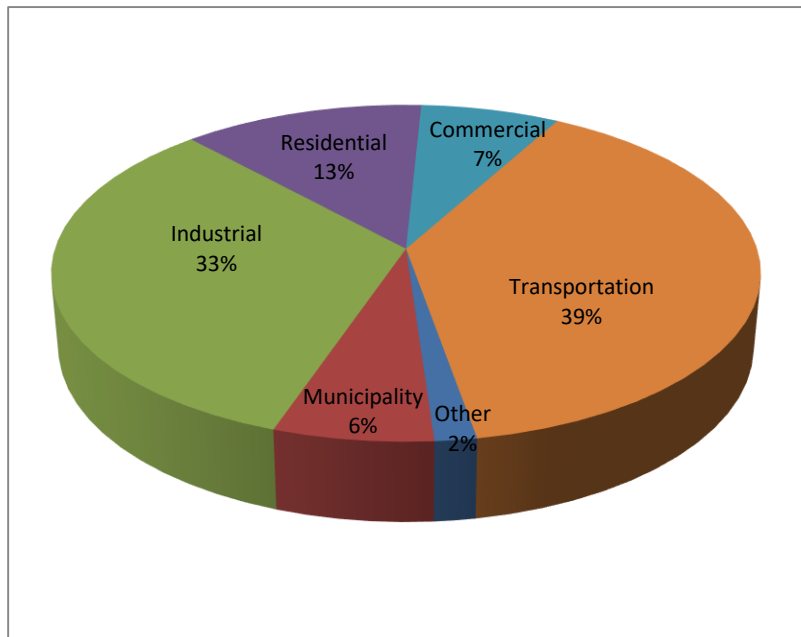
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Final Summary Document: eThekweni Greenhouse Gas Emissions Inventory 2016

1 Synopsis

A Greenhouse Gas Emissions Inventory (GHGEI) for the eThekweni Municipality has been compiled for the 2016 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 28,417,885tCO₂e¹ for the 2016 year. As with previous GHGEIs, the largest contribution to this footprint was transportation sector (39% of the total GHGs) followed closely by Industry emissions (33%). 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.

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.

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.

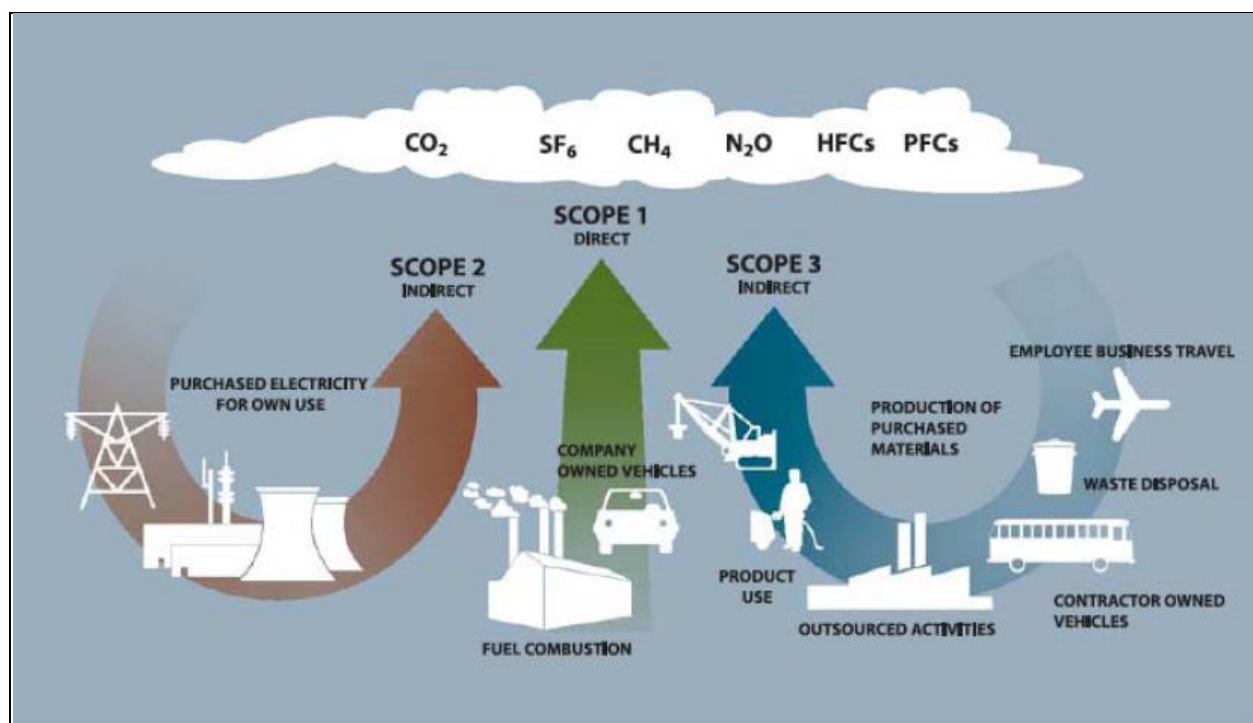


Figure 2: Total Government Emissions by Sector (Image Source: www.ghgprotocol.org)

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 2016 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 2016 the total carbon emissions recorded for the entire eThekweni Municipal Area was 28,417,885tCO₂e. 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 2016 period were 1,818,581tCO₂e. 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 2016. 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 | 181,911 (10%) |
| Scope 2 | Electricity Consumption, Electricity Transmission & Distribution (Technical and Non-technical losses) | 1,603,303 (88%) |
| Scope 3 | Employee Air Travel, Transit vehicles operated by contractor, Electricity consumption by Eskom owned streetlights | 33,367 (2%) |

The graph below (Figure 3) shows the distribution of emissions by sector for the government emissions for 2016. A breakdown of the sectors by emission source is provided in Table 4. The highest municipal emission source, contributing 67% to the Municipality's total 2016 emission inventory, was electrical transmission and distribution losses (scope 2). This was followed by buildings and other facilities at 8%, and streetlights and traffic signals at 7%.

⁵ 1kWh = 1.03kg CO₂

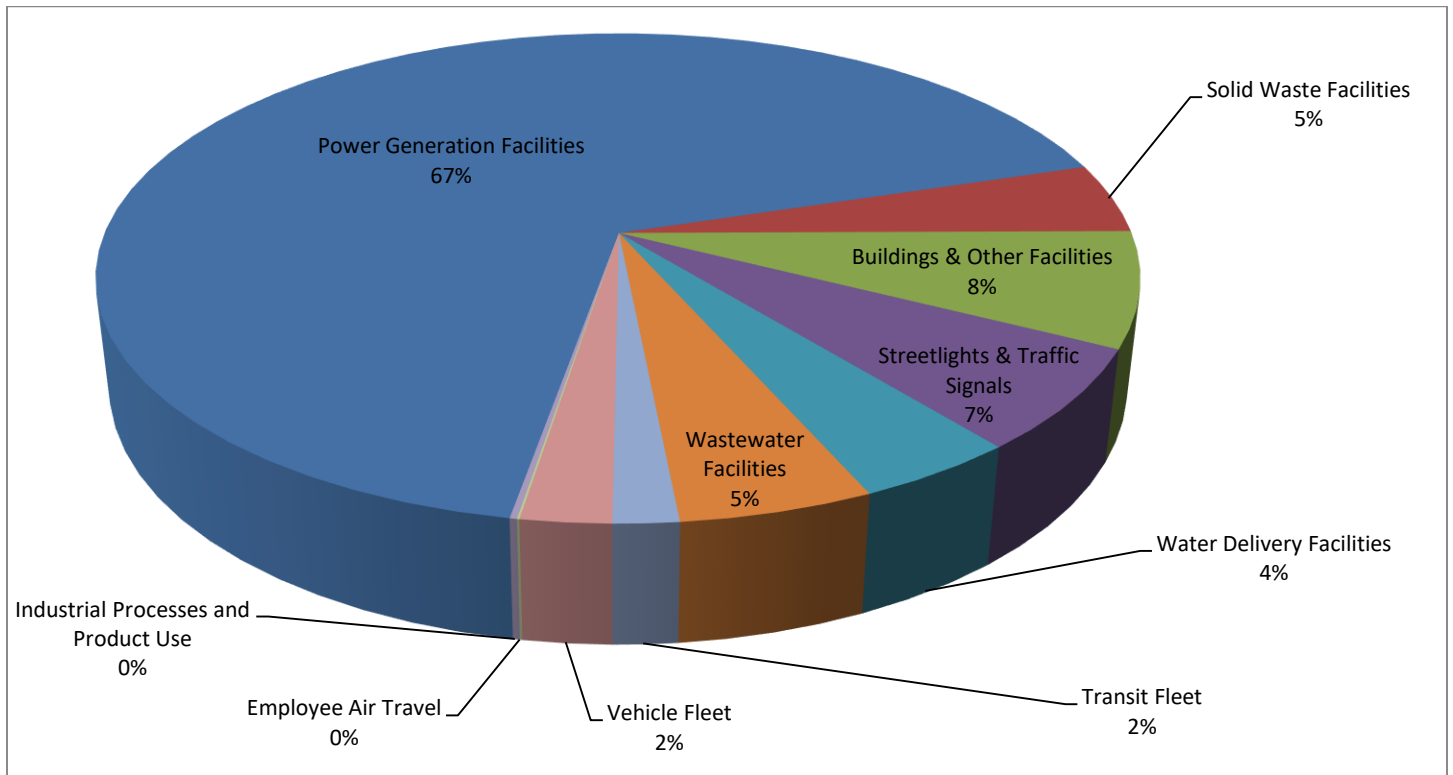


Figure 3: Total Government Emissions by Sector

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 | 2,909 |
| | 2 | Purchased Electricity | 134,822 |
| Streetlights & Traffic Signals | 2 | Electricity consumption by municipal owned | 120,055 |
| Water Delivery Facilities | 2 | Purchased electricity | 77,568 |
| Wastewater Facilities | 1 | Stationary and process emissions | 50,584 |
| | 2 | Purchased electricity | 41,842 |
| Vehicle Fleet | 1 | Mobile fuel combustion | 42,933 |
| Transit Fleet | 3 | Mobile fuel combustion | 31,115 |
| Power Generation Facilities | 2 | Electrical distribution losses | 1,226,867 |
| Solid Waste Facilities | 1 | Fugitive emissions | 82,066 |
| | 2 | Purchased electricity | 2,149 |
| Industrial Process and Product Use | 1 | Bitumen | 3,418 |
| Employee Air Travel | 3 | Mobile fuel combustion | 1,157 |

4.2 Community Emissions

Total community (excluding local government) emissions equated to 26,599,303 tCO₂e. The community emissions inventory includes GHG emissions associated with activities occurring within the eThekweni Municipality’s geopolitical boundary generated during 2016. 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 | 11,456,051 (43%) |
| Scope 2 | Electricity Consumption | 10,451,425 (39%) |
| Scope 3 | Air Transport Systems, Marine Transport Systems | 4,691,827 (18%) |

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 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 18%. Collectively (ground, air and water), transport sector emissions contribute the most significant proportion of the community emissions, at 42%. tCO₂e. 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

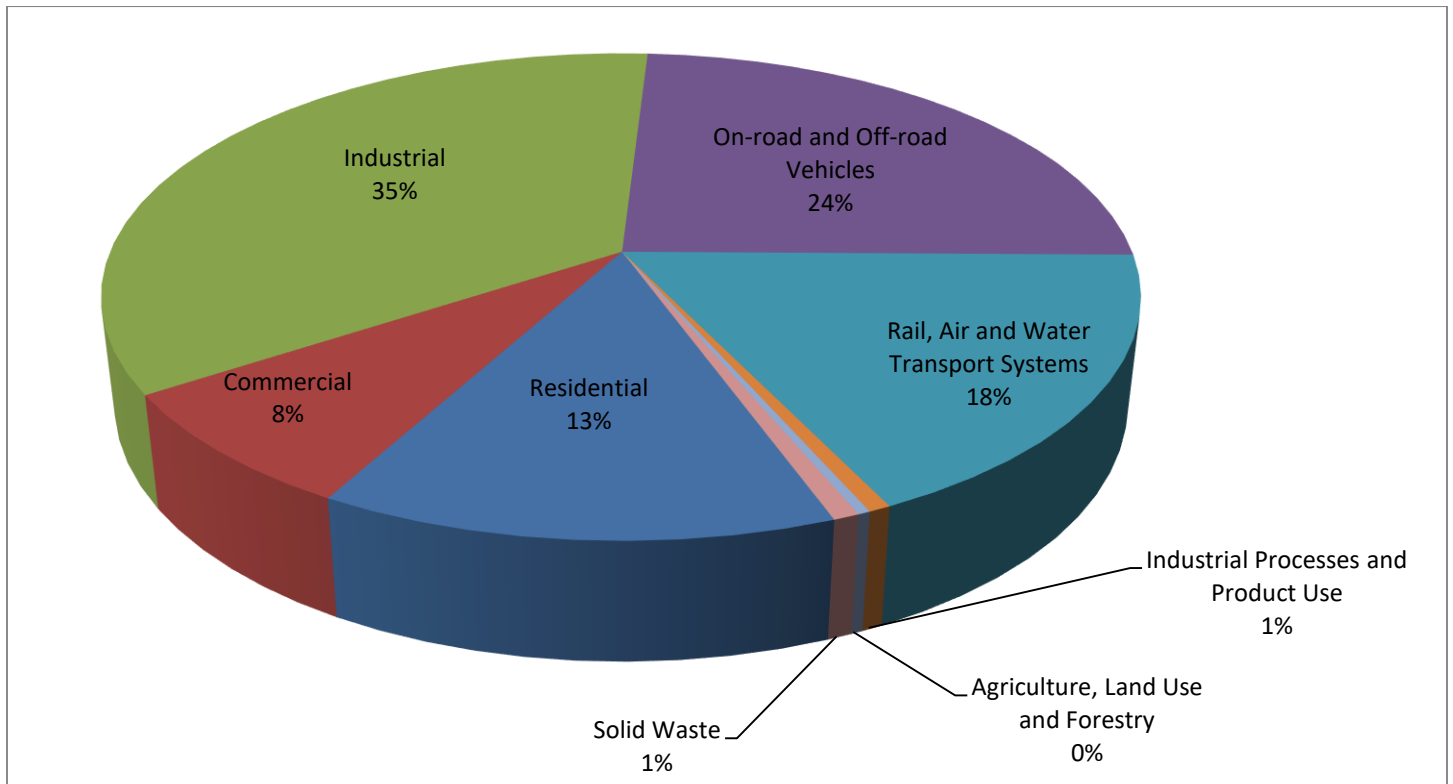


Table 6: Community Operation Emissions by Sector and Source

| Sector | Scope | Emission Sources | Emissions (tonnes CO ₂ e) |
|---------------------------------------|-------|----------------------------|--------------------------------------|
| Residential | 1 | Stationary Fuel Combustion | 201,951 |
| | 2 | Electricity Consumption | 3,399,158 |
| Commercial | 2 | Electricity Consumption | 2,072,205 |
| Industrial | 1 | Stationary Fuel Combustion | 4,375,401 |
| | 2 | Electricity Consumption | 4,980,062 |
| On-road and Off-road Vehicles | 1 | Mobile Fuel Combustion | 6,450,835 |
| Rail, Air and Water Transport Systems | 3 | Air Travel | 4,691,827 |
| Solid Waste | 1 | Fugitive Emissions | 183,574 |
| Industrial Process and Product Use | 1 | Pulp & Paper Production | 156,422 |
| | 1 | F-gases | 44,33 |
| Agriculture, Land Use and Forestry | 1 | Enteric Fermentation | 87,868 |
| Total Community Emissions | | | 26,599,30 |

5 Analysis of the GHG Inventory

5.1 Total Emissions

For 2016 the total⁶ carbon emissions recorded for eThekweni Municipality was 28,417,885tCO₂e. Municipal activities accounts for 6% of the total emissions; highest emitters, transportation and industry are at 39% and 33% respectively (Figure 1).

Figure 5, is an indication that most of the emissions in the city come from transport fuels⁷ (49%). Electricity however is the second largest source of emissions at 29%. Stationary Combustion⁸ also contributes to the overall GHG footprint with 20% 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

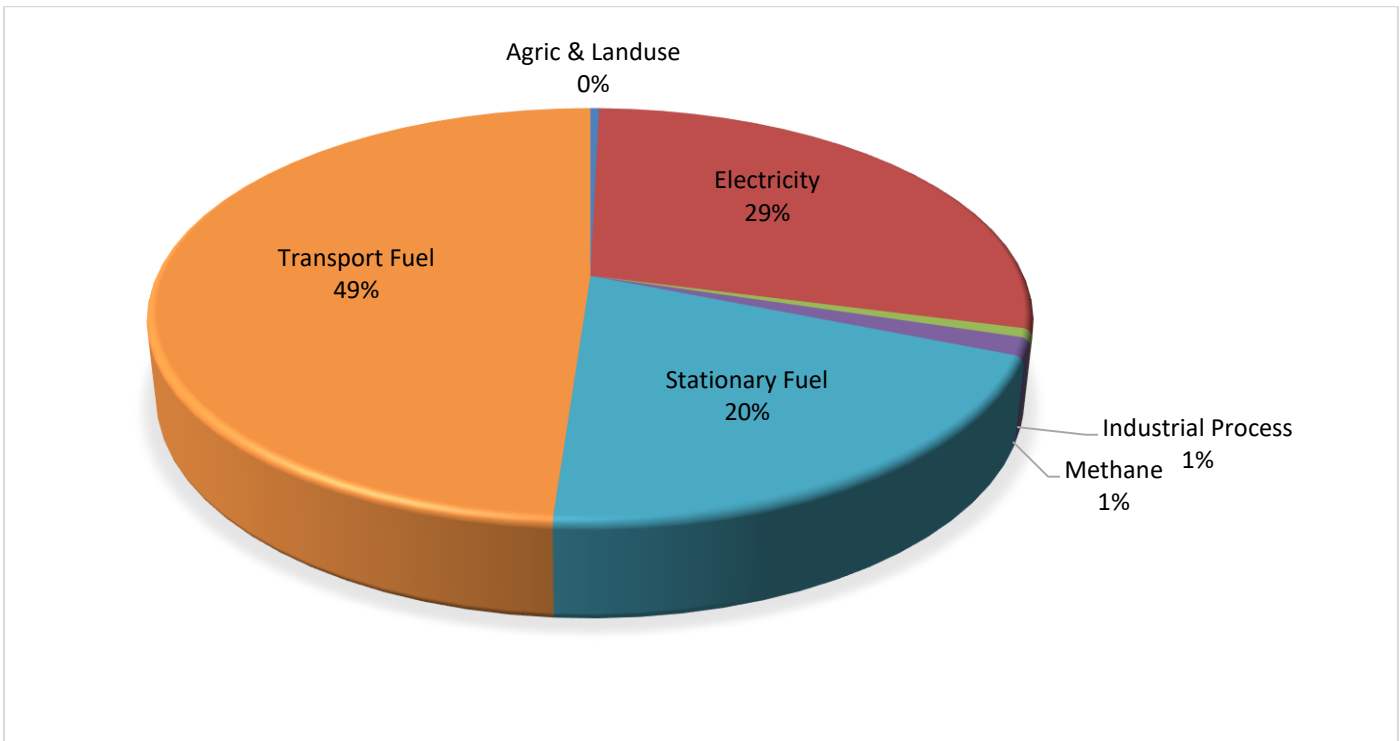


Figure 5: Carbon emissions by Source

The imported electricity supplied in the city was 11,341 GWh (99.59%) compared to local generators of electricity at 4,7 GWh (0.4%) (See Figure 6 below). This local generation is predominantly from the Municipal Landfill Gas and renewable energy embedded generators.

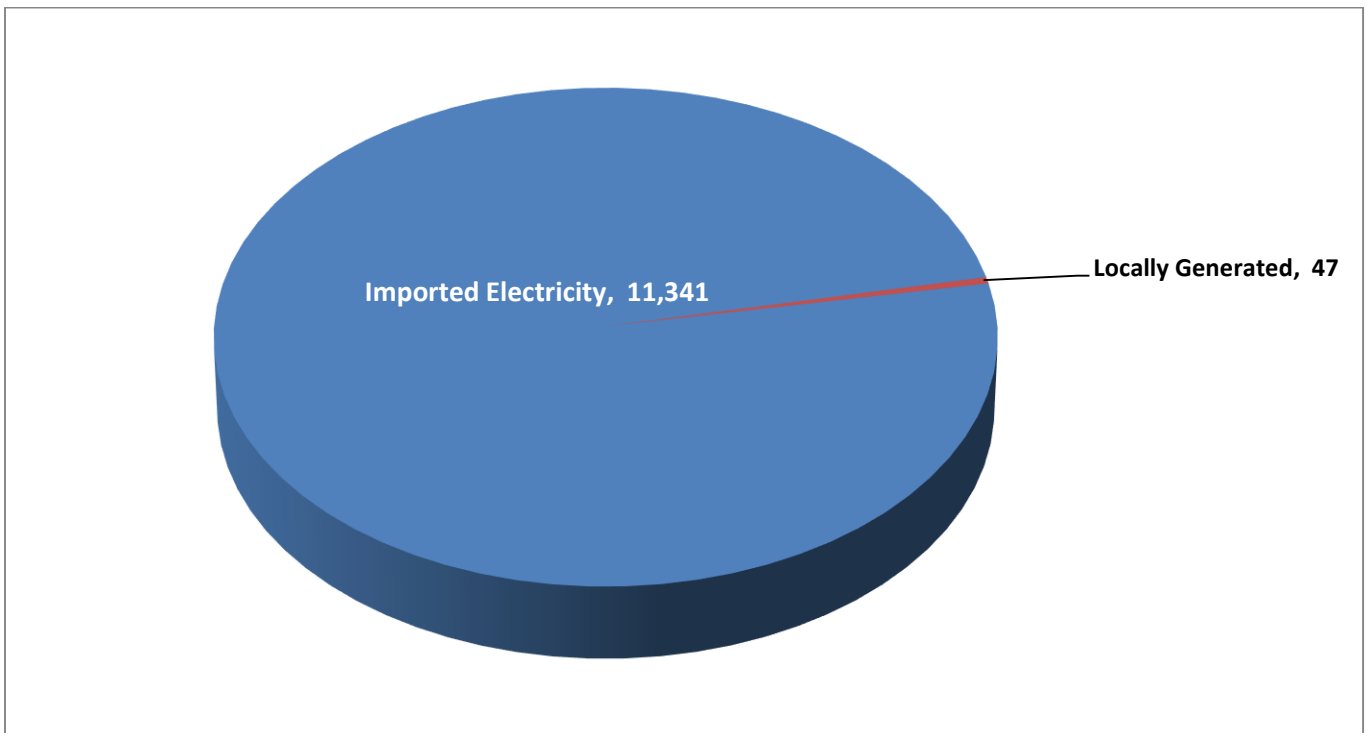


Figure 6: Electricity Supply by Source in the eThekweni Municipal Area (GWh)

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

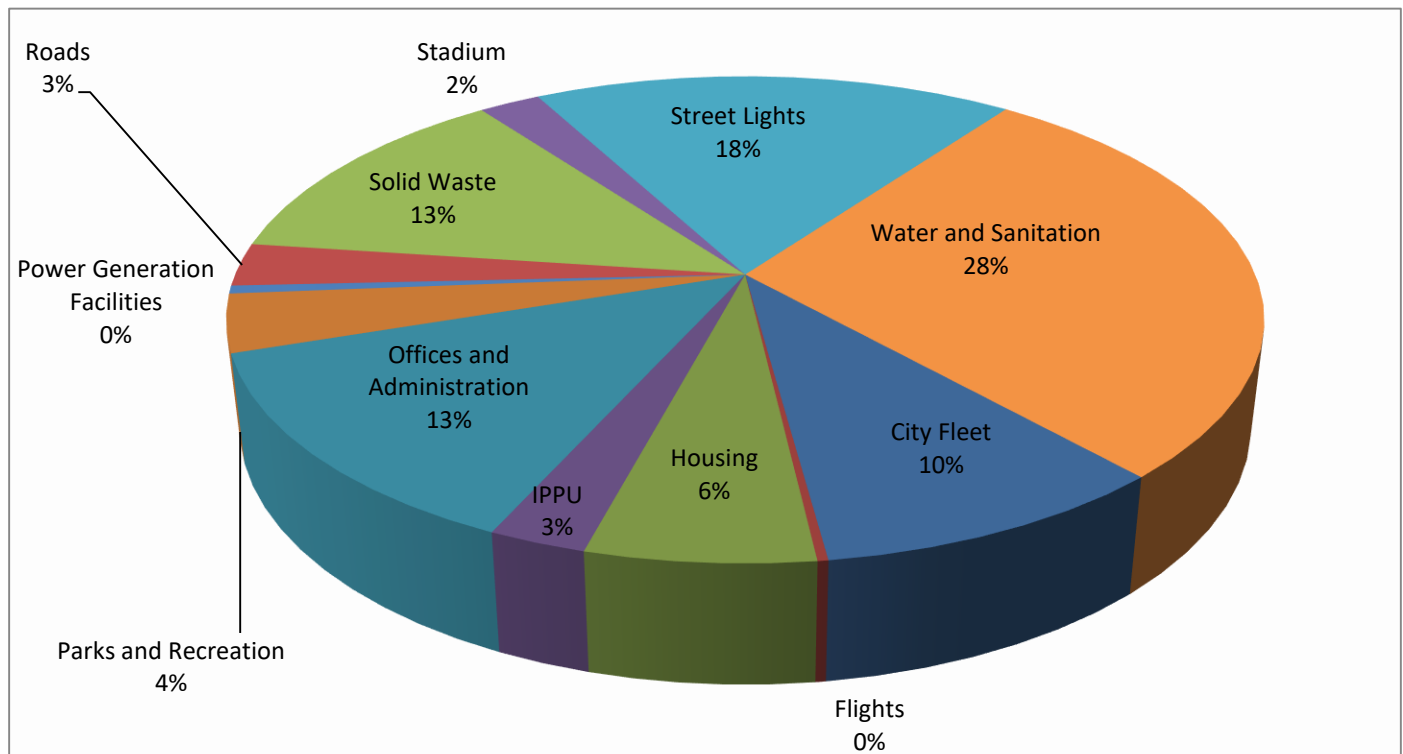


Figure 7: Municipal Emissions by Infrastructure Type tCO₂e (excluding electricity transmission losses)

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 |
|------------------|---|------------------|--|--------------------------|--|
| R 51.15 | tCO ₂ e / million Rand of operating budget | 1,785,214 | tCO ₂ e (Municipal Scope 1 & 2) | R 349100.00 ⁹ | Million Rand Operating Budget (2016/ 2017) |
| R 266.45 | tCO ₂ e / million Rand of Capital budget | 1, 785,214 | tCO ₂ e (Municipal Scope 1 & 2) | R 6 700.00 ¹⁰ | Million Rand Capital Budget (2016/ 2017) |
| 79.12 | tCO ₂ e / Permanent employee | 1, 785,214 | tCO ₂ e (Municipal Scope 1 & 2) | 22 563 ¹¹ | 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 |
|------------------|---|------------------|--|--------------------------|-------------------------------------|
| 3.33 | tCO ₂ e / household | 3,601,109 | tCO ₂ e (Residential Scope 1 & 2) | 1 082 597 ¹² | Number of households within the EMA |
| R 34.14 | tCO ₂ e / retail trade sales | 2,072,205 | tCO ₂ e (Commercial Scope 1 & 2) | R60 700.00 ¹³ | 2016 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 |
|------------------|-----------------------------|------------------|-------------------------------------|--------------------|---------------------------|
| 6.20 | tCO ₂ e / Capita | 23,692,691 | tCO ₂ e (Scope 1 & 2) | 3,820,174 | Population within the EMA |
| 7.44 | tCO ₂ e / Capita | 28,471,885 | tCO ₂ e (Scope 1, 2 & 3) | 3,820,174 | 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

⁹www.durban.gov.za/Resource_Centre/reports/Budget/Documents/ServiceDeliveryandBudgetImplementationPlan2016.17.pdf

¹⁰www.durban.gov.za/Resource_Centre/reports/Budget/Documents/ServiceDeliveryandBudgetImplementationPlan2016.17.pdf

¹¹EThekweni Municipality, Human Resources

¹²Global Insight/Economic Development & Investment Promotion Unit/Procurement & Infrastructure: Development engineering

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

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 |
|---------|----------------------|---------------------|-----------------|----------|
| Yr 2010 | 1,104,212 | 25,962,074 | 27,066,285 | |
| Yr 2011 | 1,551,420 | 26,097,979 | 27,649,400 | 2.2% |
| Yr 2012 | 1,526,431 | 27,833,965 | 29,360,395 | 6.2% |
| Yr 2013 | 1,450,928 | 27,290,630 | 28,741,558 | -2.1% |
| Yr 2014 | 1,586,674 | 27,505,329 | 29,092,003 | 1.2% |
| Yr 2015 | 1,715,259 | 25,352,653 | 27,067,912 | -7.0% |
| Yr 2016 | 1,818,581 | 26,599,303 | 28,417,885 | 5% |

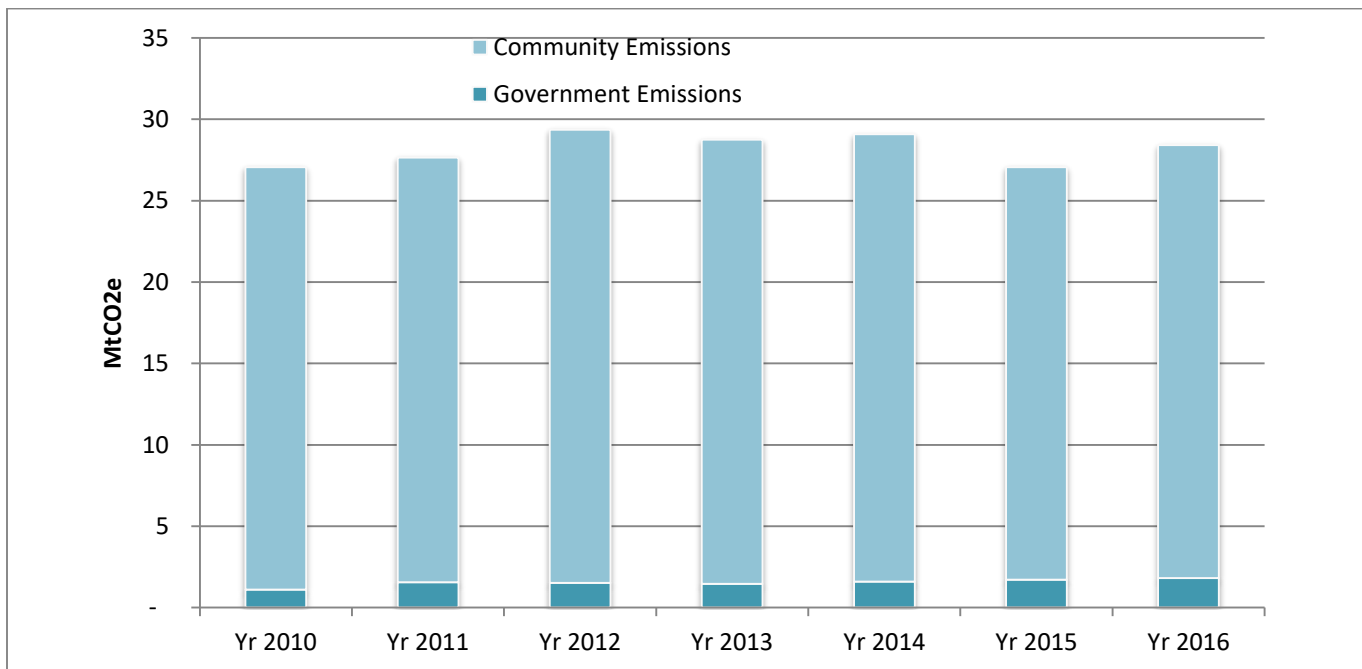


Figure 5: Historic Emissions Data for the eThekweni Municipality (tCO₂e)

Total emissions have increased by 1 349 972 tCO₂e in 2016. The emission for municipal sector and community sector have increased by 103,321.8 tCO₂e and 1,24,650.4 tCO₂e. Table 12 shows a detailed summary of the differences between 2015 and 2016 emissions.

Table 11: Data Comparison between 2015 and 2016 Reporting Periods

| Scope | Type | Sub-Type | 2015 (tCO ₂ e) | 2016 (tCO ₂ e) |
|---------------------------|-------------------------|--------------------------------------|---------------------------|---------------------------|
| Municipal Scope 1 | Fuel Consumption | Stationary Fuel Combustion | 1,412.0 | 2,909.5 |
| | | Vehicle Fleet | 31,216.6 | 42,933.4 |
| | Solid Waste | Solid Waste (CH ₄) | 82,700.2 | 82,066.0 |
| | Wastewater Treatment | Wastewater (CH ₄) | 17,435.0 | 3,417.9 |
| | IPPU | Bitumen | 49,711.1 | 50,584.2 |
| Municipal Scope 2 | Electricity Consumption | Buildings | 164,888.4 | 134,822.0 |
| | | Streetlights & Traffic Signals | 120,161.7 | 120,054.8 |
| | | Water Delivery Facilities | 102,104.2 | 77,567.7 |
| | | Transmission and Distribution Losses | 1,049,239.5 | 1,226,866.9 |
| | | Solid Waste Facilities | 3,108.6 | 2,149.5 |
| | | Wastewater Facilities | 38,921.3 | 41,842.4 |
| Municipal Scope 3 | Transport Systems | Streetlights | - | 1,094.6 |
| | | Transit Fleet | 31,491.8 | 31,115.0 |
| | | Flights | 1,882.4 | 1,157.2 |
| Subtotal Municipal | | | 1,715,259.3 | 1,818,581.1 |
| Community Scope 1 | Fuel Consumption | Stationary Fuel Combustion | 4,620,025.2 | 4,577,351.8 |
| | | Mobile Fuel Combustion | 6,211,787.7 | 6,450,835.2 |

| | | | | |
|---------------------------|------------------------------------|-------------------------|---------------------|---------------------|
| | Solid Waste | Solid Waste | 190,683.0 | 183,574.0 |
| | Industrial Processes & Product Use | IPPU | 146,295.0 | 156,422.0 |
| | Industrial Processes & Product Use | IPPU | 44,333.4 | 47,885.4 |
| | Agric & Landuse | Agric & Landuse | 87,868.4 | 87,868.4 |
| Community Scope 2 | Electricity Consumption | Residential | 2,568,723.2 | 3,399,158.3 |
| | | Commercial | 2,048,861.0 | 2,072,205.3 |
| | | Industrial | 4,732,537.2 | 4,980,061.9 |
| Community Scope 3 | Transport Systems | Air Transport Systems | 273,782.6 | 264,070.2 |
| | | Water Transport Systems | 4,427,756.4 | 4,427,756.4 |
| Subtotal Community | | | 25,352,653.0 | 26,599,303.4 |
| Total | | | 27,067,912.3 | 28,417,884.6 |

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 2016 total GHG emissions have increased from 27,067,912 tCO₂e in 2015 to 28,417,885 tCO₂e.

Figure 1 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.