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eThekwini Greenhouse Gas Emissions Inventory 2024

Technical Report

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1 INTRODUCTION

1.1 ETHEKWINI MUNICIPALITY

The eThekwini Municipal Area (EMA) covers an area of approximately 2 556 square kilometres of which 36% is rural and a further 29% is peri-urban. The Municipality has an estimated population of approximately 4.4 million residents, constituting a 7% share of South African's total population, and is the third most populated municipality in the country. The local economy is driven by key sectors including transport and logistics activities associated with the Port of Durban, domestic and export-oriented manufacturing, and tourism. The Gross Domestic Product (GDP) of eThekwini Municipality during 2024 amounted to R453,9billion (bn) with a per capita income of R91,955.

The EMA is governed by eThekwini Municipality, with an Operating Budget of R64,2bn (2023/2024) and a Capital Budget of R7,1bn. During the 2024 reporting period, the Municipality employed a total workforce of 27,931 employees on a permanent and temporary basis. Basic services provided by the eThekwini Municipality are described in **Table** 1.

Table 1: Basic services provided by the eThekwini Municipality

Description	Details	Description	Details
Basic Services	Housing	Infrastructure	Stormwater
	Water		Roads
	Sanitation		Sidewalks
	Electricity & Lighting		Pedestrian bridges
	Solid Waste		Footpaths
	Transport		
	Safety & Security		
	Health		

1.2 ETHEKWINI GREENHOUSE GAS INVENTORY

In December 2010, eThekwini Municipality became a signatory to the Global Cities Covenant on Climate ("Mexico City Pact"). In terms of this agreement, the Municipality has committed to transparent monitoring, reporting, verification, and the registration of the Municipality's greenhouse gas (GHG) emissions inventory. As part of this, the Municipality is also reporting on the disclosure of climate change commitments, mitigation and adaptation measures and associated actions through the Carbon Cities Climate Registry. This commitment positions the Municipality within an international network of cities advancing climate accountability and data-driven decision making.

In this context, the development and periodic updating of the eThekwini Greenhouse Gas Emissions Inventory (GHGEI) serve as a foundational instrument for fulfilling these international reporting obligations. The GHGEI provides a robust evidence base to support policy formulation, enabling the Municipality to track emissions trends over time, identifying key emission sources and drivers, an establishing science-informed climate mitigation targets and long-term emissions reduction pathways. Furthermore, the

inventory supports the integration of climate considerations into broader municipal planning processes, including infrastructure development, service delivery, and economic planning.

The compilation and reporting of the GHGEI also ensures alignment with national climate policy frameworks, including the National Climate Change Response White Paper (Department of Environmental Affairs, 2011) which emphasises the importance of systematic measurement, reporting, and mitigation of emissions across all spheres of government. It is further supported by the National Greenhouse Gas Emissions Reporting Regulations (2016), promulgated under the National Environmental Management: Air Quality Act (NEM: AQA), which establish mandatory requirements for the collection, calculation, and annual reporting of GHG emissions data using standardised methodologies and sector classifications. Collectively, these international and national frameworks position the GHGEI as a critical tool for advancing climate governance within the Municipality, enabling a transition from emissions accounting to proactive, evidence-based climate action and supporting the long-term objective of a low-carbon and climate-resilient urban economy.

2 INVENTORY PARAMETERS

2.1 PROTOCOLS

The eThekwini Municipality's 2024 GHGEI Report was developed in accordance with the Local Government GHG Emissions Analysis Protocols, established by ICLEI – Local Governments for Sustainability, namely the:

- International Local Government GHG Emissions Analysis Protocol Version 1.0; and
- Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories Version 1.1.

These protocols provide a standardized methodological guideline to assist local governments in quantifying and reporting GHG emissions associated with both municipal operations and community-wide activities. Both protocols are based on the Corporate GHG Protocol developed by the World Resources Institute (WRI), the World Business Council for Sustainable Development (WBCSD), and a technical guidance provided by the Intergovernmental Panel on Climate Change (IPCC)[1]. Emission-generating activities are categorised and reported according to defined emission scopes, enabling consistent and transparent accounting. The protocols were rigorously applied to ensure that the eThekwini 2024 GHGEI is methodologically consistent and comparable with emissions inventories developed by other municipalities and organisations globally that utilise the same reporting framework.

2.2 BOUNDARIES

2.2.1 Temporal Boundary

The 2024 eThekwini GHGEI comprises emissions occurring during the 2024 calendar year, as required by ICLEI.

[1] IPCC is a scientific body affiliated to the United Nations Framework Convention on Climate Change (UNFCC)

2.2.2 Operational Boundaries

The municipal GHGEI is structured to distinctly account for emissions associated with the operational activities of the eThekwini of the eThekwini Municipality (i.e. local government emissions) and those arising from broader socio-economic activities occurring within the EMA (i.e. community emissions). This separation ensures clarity in distinguishing emissions under direct municipal control from those within the Municipality's jurisdiction but outside its operational influence. These two sectors are broken down into the following analyses.

- Government Operations Analysis

The government operations analysis is defined by an organisational boundary and includes emissions resulting from activities, infrastructure, and services under the operational and financial control of the eThekwini Municipality during the 2024 reporting period. This encompasses emissions from the use of municipal assets, facilities, and service delivery systems.

- Community Operations Analysis

The community operations analysis is defined by a geopolitical boundary and includes all GHG emissions generated by residential, commercial, industrial, and other socio-economic activities occurring within the municipal jurisdiction. This analysis reflects emissions from activities undertaken by the general public and private sector entities within the eThekwini Municipal Area for the 2024 reporting year.

Together, these analytical components provide a comprehensive city-wide emissions profile.

2.3 SCOPES

The eThekwini Municipality 2024 GHGEI comprehensively captures all significant sources of GHG emissions, within the municipal geopolitical boundary and the organisational boundary of the Municipality. Emissions are systematically categorised into direct and indirect sources and reported in accordance with the standardised scope-based framework (Scope 1, Scope 2, and Scope 3). This classification enables a clear delineation of emission sources, enhances transparency, and ensures methodological consistency. Differentiation across emission scopes is critical to preventing double counting and ensuring accurate and reliable representation of the Municipality's emissions profile.

2.3.1 Municipal Operations Emissions Scopes

Municipal operations emissions included in the inventory were categorised into the following scopes:

- **Scope** 1 – Direct emission sources owned or operated by eThekwini Municipality.
- **Scope 2** – Indirect emission sources.
- **Scope 3** – Indirect and embodied emissions over which eThekwini Municipality exerts significant control or influence. Certain emissions from contracted services were included in the municipal operations emissions inventory in instances where the service provided by the contractor is commonly provided by the municipality. The contractor emissions can be either direct or indirect, and are therefore classified as scope 3 emissions within the municipal operations inventory regardless of the source.

Table 2 provides a detailed classification of emission sources included within each reporting scope of the 2024 municipal operations inventory. Scope 1 encompasses direct emissions arising from municipal activities under operational control, including stationary and mobile fuel combustion, waste management processes, and municipal power generation. Scope 2 includes indirect emissions associated with the consumption of purchased electricity, including emissions from electricity use as well as transmission and distribution losses. Scope 3 captures other indirect emissions resulting from municipal activities but occurring from sources not owned or controlled by the Municipality, such as employee air travel and electricity consumption from Eskom-owned streetlighting infrastructure within the municipal area.

Table 2: Emission sources included in the 2024 municipal operations inventory

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

2.3.2 Community-scale Emissions Scopes

Community-scale emissions included within the 2024 inventory were categorised into the following scopes:

- **Scope 1 -** All direct emission sources located within the geopolitical boundary of eThekwini Municipality.
- **Scope 2 -** Indirect emissions that result as a consequence of activity within eThekwini Municipality's geopolitical boundary
- **Scope 3 -** Indirect and embodied emissions that occur as a result of activity within the geopolitical boundary.

Table 3 provides a detailed classification of the emission sources within each reporting scope of the 2024 community-scale emissions inventory. Included in Scope 1 are direct emissions arising from community activities, including stationery and mobile fuel combustion, pre-harvest cane burning and industrial processes and product use. Scope 2 accounts for indirect emissions from electricity consumption while Scope 3 includes additional indirect emissions generated from activities not directly controlled by reporting entities, and encompasses emissions associated with air and marine transportation systems.

Table 3: Emission sources included in the 2023 community inventory

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

3 INVENTORY DETAILS

3.1 MUNICIPAL EMISSIONS

This section provides a sectoral breakdown of GHG emissions across the Municipality. The analysis includes a comprehensive description of emission sources, underlying activity data, and the methodological approaches and calculation procedures applied to derive emissions estimates.

3.1.1 Buildings and Other Facilities

The emissions from the buildings and other facilities are generated from operations of municipal assets, administrative facilities, public venues, libraries, parks and recreational facilities operated by the eThekwini Municipality (**Table 4**).

Table 4: Emissions inventory and data disclosure for municipal buildings and other facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	515	0	2.1	517
▪ Emissions Source: Stationary combustion of fuel by municipal buildings and other facilities – Activity Data: ICLEI recommended data type - Known fuel use calculated from fuel purchase data – Emissions Factor: ICLEI recommended factor - Default by fuel type (Appendix B) – Data Source: eThekwini Procurement Department					
Scope 2	Purchased Electricity				69,564

- Emissions Source: Electricity consumption by municipal buildings and other facilities
  - Activity Data: ICLEI recommended data type - Known electricity use
  - Emissions Factor: Eskom emission factor (Appendix B)
  - Data Source: Treasury Department; Eskom

3.1.2 Streetlights and Traffic Signals

This sector represents emissions from streetlights and traffic signals either owned by the municipality or Eskom. However, the emissions from the streetlights operated by Eskom are categorised as Scope 3, and it covers outlying area of the EMA which are not directly operated by the Municipality (**Table 5**). within peri-urban and outlying areas of the eThekwini Municipal Area, streetlighting infrastructure supplied and operated by Eskom is accounted for under Scope 3 emissions, as these sources fall outside the direct operational control of the Municipality.

Table 5: Emissions inventory and data disclosure for streetlights and traffic signals

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				157,401
■ Emissions Source: Electricity consumption by municipal owned and operated streetlights and traffic signals – Activity Factor: ICLEI specified alternative activity data - Installed wattage – Emissions Factor: Eskom emission factor (Appendix B)					
Scope 3	Electricity consumed by Eskom street lighting				-
■ Emissions Source: Electricity consumption by Eskom owned and operated streetlights – Activity Data: ICLEI recommended activity data - Known electricity use – Emissions Factor: Eskom emission factor (Appendix B) – Data Source: Electricity Department; Eskom					

3.1.3 Water Delivery Facilities

The emissions from water delivery facilities sector are generated from facilities used for the transportation, treatment, and distribution of drinking water as detailed in **Table 6**.

Table 6: Emissions inventory and data disclosure for municipal water delivery facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				17,699
■ Emissions Source: Electricity consumption by water pump stations and reservoirs – Activity Data: ICLEI recommended activity data - Known electricity use – Emissions Factor: ICLEI recommended factor - Eskom emission factor (Appendix B) – Data Source: Eskom					

3.1.4 Wastewater Facilities

The wastewater sector includes GHG emissions generated from the wastewater facilities starting from the collection of sewage (including pumpstation), treatment processes, to the discharge of treated wastewater and sludge, and the transportation used **Table 7**.

Table 7: Emissions inventory and data disclosure for municipal wastewater facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	-	47,164	-	47,164
■ Emissions Source: Incomplete combustion of digester gas at a WWTP with anaerobic digestion – Activity Data: Population served; ICLEI Equation 10.2 – Data Description: Population served by wastewater treatment plants with anaerobic digesters					
Scope 1	Process Emissions	-	2,666	20,681	23,347
■ Emissions Source: Anaerobic and facultative treatment lagoons – Activity data: Population served- ICLEI Equation 10.4 – Data Description: Population served by treatment lagoons adjusted for industrial discharge ■ Emissions Source: WWTP with nitrification/denitrification – Activity Data: Population served- ICLEI Equation 10.7 – Data Description: Population served by the WWTP with nitrification/denitrification adjusted for industrial discharge ■ Emissions Source: WWTP without nitrification/denitrification					

– Activity Data: Population served- ICLEI Equation 10.8					
– Data Description: Population served by the WWTP without nitrification/denitrification adjusted for industrial discharge					
■ Emissions Source: Effluent discharge to receiving aquatic environment					
– Activity Data: Population served- ICLEI Equation 10.10					
– Data Description: Population served					
– Data Source: eThekwini Water & Sanitation					
Scope 2	Purchased Electricity				42,215
■ Emissions Source: Electricity Consumption					
– Activity Data: ICLEI recommended data type - Known electricity use					
– Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B)					
– Data Source: Treasury, Eskom					

3.1.5 Vehicle Fleet

The vehicle fleet sector includes all GHG emissions generated by the municipal owned vehicles (on-road and off-road) (**Table 8**). This encompasses emissions from fuel combustion across fleet vehicles managed by various municipal departments.

Table 8: Emissions inventory and data disclosure for municipal vehicle fleet

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Mobile Combustion	64,382	48.98	674.62	65,106
■ Emissions Source: Fuel combustion by on-road and off-road vehicles					
– Activity Data: ICLEI recommended activity data - Fuel purchases					
– Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B)					
– Data Source: City Fleet, EWS, DSW					

3.1.6 Transit Fleet

The transit sector encompasses GHG emissions associated with mass transit services provided within the Municipality to service the community of the EMA. However, as the

Municipality's transit fleet operations are currently outsourced to a private contractor, the associated emissions generated are classified as Scope 3rather than Scope 1 emission given that they arise from services not directly operated or controlled by the Municipality (**Table 9**).

Table 9: Emissions inventory and data disclosure for municipal transit fleet

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 3	Mobile Combustion	28,416	16	314	28,746
■ Emissions Source: Fuel combustion by on-road and off-road transit fleet – Activity Data: ICLEI recommended activity data - Fuel purchases – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011; Appendix B) – Data Source: Tansnat					

3.1.7 Power Generation Facilities

The Municipality does not own or operate any fossil fuel power generation facilities. However, it owns and manages a large proportion of electricity distribution infrastructure within the EMA. Emissions associated with electricity transmission and distribution losses within municipally owned network are therefore categorised as Scope 2 emissions, as they result from the consumption and distribution of purchased electricity as illustrated in **Table 10.**

Table 10: Emissions inventory and data disclosure for municipal power generation and electrical distribution facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Power Generation facilities: Fugitive Emissions				-
■ Emissions Source: Sulphur Hexafluoride (SF6) – Activity Data: SF6 consumption data – Emissions Factor: ICLEI recommended factor type (Appendix B)					
Scope 2	Transmission & Distribution Losses: Technical				278,467
■ Emissions Source: Technical transmission and distribution losses – Activity Data: eThekwini Electricity Department calculations – Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B)					
Scope 2	Transmission & Distribution Losses: Non-Technical				791,906

- Emissions Source: Non-technical transmission and distribution losses
  - Activity Data: eThekwini Electricity Department calculations
  - Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B)
  - Data Source: eThekwini Electricity Department

3.1.8 Solid Waste Facilities

The eThekwini Municipality owns and operates four solid waste landfills facilities. Fugitive methane (CH4) emissions generated from waste decomposition processes in the landfills are classified as Scope 1 emissions, as they originate from sources under the direct operational control of the Municipality as shown below, **Table 11**.

Table 11: Emissions inventory and data disclosure for municipal solid waste facilities

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Fugitive Emissions	-	115,944	-	115,944
■ Emissions Source: Landfills with comprehensive LFG collection systems – Activity Data: ICLEI recommended data type - ICLEI Equation 9.1 ■ Emissions Source: Landfills with no LFG collection systems – Activity Data: ICLEI recommended model and data type – First Order Decay Model – Data Source: eThekwini Cleansing and Solid Waste Department					
Scope 2	Purchased Electricity				210
■ Emissions Source: Electricity consumption – Activity Data: ICLEI recommended data type - Known electricity use – Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B) – Data Source: Treasury Department					

3.1.9 Air Travel

Greenhouse gas emissions generated from work-related air travel by municipal employees, are categorised as Scope 3 emissions, as these arise from activities not directly controlled or operated by the Municipality **(Table 12).**

Table 12: Emissions inventory and data disclosure for municipal air travel

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 3		362	0	4	366
■ Emissions Source: Fuel combustion by air transport systems – Activity Data: GHG Protocol recommended data type – number of flights and destination data – Emissions Factor: DEFRA 2011 emissions factor – emission factor based on length of flight (Appendix B) – Data Source: Rennies Travel					

3.2 COMMUNITY EMISSIONS

3.2.1 Residential Sector

All emissions generated by the residential sector within the EMA including emissions associated with electricity consumption (Scope 2) and stationary fuel combustion (Scope 1), are presented in Table 13.

Table 13: Emissions inventory and data disclosure for community residential sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion	489,518	1,044	1,335	491,897
■ Emissions Source: Stationary combustion fuel – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011, Appendix B) – Data source: National Department of Energy					
Scope 2	Purchased Electricity				2,271,252
■ Emissions Source: Electricity consumption – Activity Data: ICLEI recommended data type - Known electricity use – Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B) – Data Source: eThekwini Electricity Department					

3.2.2 Commercial Sector

This sector includes all GHG emissions generated by the commercial activities within the EMA, primarily arising from electricity consumption (Scope 2), as detailed in (**Table 14**).

Table 14: Emissions inventory and data disclosure for community commercial sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 2	Purchased Electricity				2,186,732
■ Emissions Source: Electricity consumption – Activity Data: ICLEI recommended data type - Known electricity use – Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B) – Data Source: eThekwini Electricity Department; ESKOM					

3.2.3 Industrial Sector

This sector includes all GHG emissions generated by the industrial sector within the EMA, including emissions associated with electricity consumption (Scope 2) as well as stationary fuel combustion (Scope 1), as detailed in **Table 15.**

Table 15: Emissions inventory and data disclosure for community industrial sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Stationary Combustion				4,899,196
■ Emissions Source: Stationary combustion fuel – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Defra 2011, Appendix B) – Data Source: National Department of Energy					
Scope 2	Purchased Electricity				3,332,586
■ Emissions Source: Electricity consumption – Activity Data: ICLEI recommended data type - Known electricity use					

– Emissions Factor: ICLEI recommended factor type - Eskom emission factor (Appendix B) – Data Source: eThekwini Electricity Department

3.2.4 Transport

The transport sector includes GHG emissions generated by community owned on-road and off-road vehicles as well as the air and marine transport systems used by the communities as illustrated in **Table 16**. Air and marine transport systems are classified as Scope 3 emissions.

Table 16: Emissions inventory and data disclosure for community transport sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Mobile Combustion	7,622,326	7,452	74,927	7,704,705
▪ Emissions Source: On-road and off-road vehicles					
Scope 3	Mobile Combustion – Air Travel	272,838	302	2,684	275,841
▪ Emissions Source: Air transport systems fuel combustion					
Scope 3	Mobile Combustion – Water Travel	4,004,012	4,342	419,403	4,427,756
▪ Emissions Source: Water transport systems fuel combustion – Activity Data: ICLEI recommended activity data - Known fuel use – Emissions Factor: ICLEI recommended factor - Default by fuel type (Appendix B)					

3.2.5 Agriculture

The agriculture sector includes greenhouse gas (GHG) emissions associated with key agricultural activities within EMA, specifically enteric fermentation from livestock and pre-harvest sugarcane burning, as detailed in **Table 17**. Both emission sources are classified as community Scope 1 emissions, as they arise from direct biological and combustion processes occurring within the Municipality.

Table 17: Emissions inventory and data disclosure for community agricultural sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
			Tonnes CO_2e		
Scope 1	Enteric Fermentation		16,558		16,558

▪ Emissions Source: Enteric fermentation by livestock – Activity Data: IPCC 2006 recommended data – livestock type and numbers – Emissions Factor: IPCC 2006 emissions factor - Default by animal type (Appendix B) – Data Source: National Department of Agriculture, Forestry and Fisheries.					
Scope 1	Residue Burning		51,573	19,738	71,310
▪ Emissions Source: Infield pre-harvest sugarcane burning – Activity Data: IPCC 2006 Equation 2.27 Estimation of GHG Emissions – Emissions Factor: IPCC 2006 factors – Data Source: Environmental Planning &Climate Protection Department					

3.2.6 Solid Waste

The solid waste sector includes GHG emissions generated from privately owned landfills facilities situated within the Municipality's geopolitical boundary. These emissions, primarily associated with waste decomposition processes, that originate from sources outside direct municipal ownership and control (**Table 18**).

Table 18: Emissions inventory and data disclosure for community solid waste sector

Scope	Emissions Source	CO_2	CH_4	N_2O	Total
		Tonnes CO_2e			
Scope 1	Fugitive Emissions		128,038		128,038
▪ Emissions Source: Fugitive emissions generated by two privately owned landfills – Activity Data: ICLEI recommended model and data type – First Order Decay Model					

4 EMISSIONS ANALYSIS

Across both the Municipal Operations Analysis and the Community Operations Analysis, the principal contributor to GHG emissions is Scope 2 indirect emissions from electricity consumption. However, within community inventory, Scope 1 emissions from direct activities are of a comparable magnitude to Scope 2 emissions, indicating a significant contribution from direct fuel combustion and process-related sources (**Table 19**).

Table 19: GHG emissions inventory results

EMISSIONS SCOPE	MUNICIPAL EMISSIONS (tCO_2e)	COMMUNITY EMISSIONS (tCO_2e)
Scope 1	254,659 (15.52%)	13,450,471 (51.84%)
Scope 2	1,357,462 (82.71%)	7,790,571 (30.03%)
Scope 3	29,112 (1.77%)	4,703,598 (18.13%)

4.1 MUNICIPAL EMISSIONS

As shown in Figure 1, power generating facilities dominates the municipal GHG emissions (65%), and this aligns with the Scope 2 emissions in Municipal operations shown in Table 19. It is associated with electricity transmission and distribution losses. Secondary contributions arise from electricity consumption in streetlights and traffic signals (10%), the public lighting infrastructure, followed by wastewater and solid waste treatment facilities (7%) respectively. Direct emissions from fleet operations and buildings are comparatively minor. High emissions on power-generating facilities indicate fossil fuel-based electricity the main source for GHG emissions in the municipal operations.

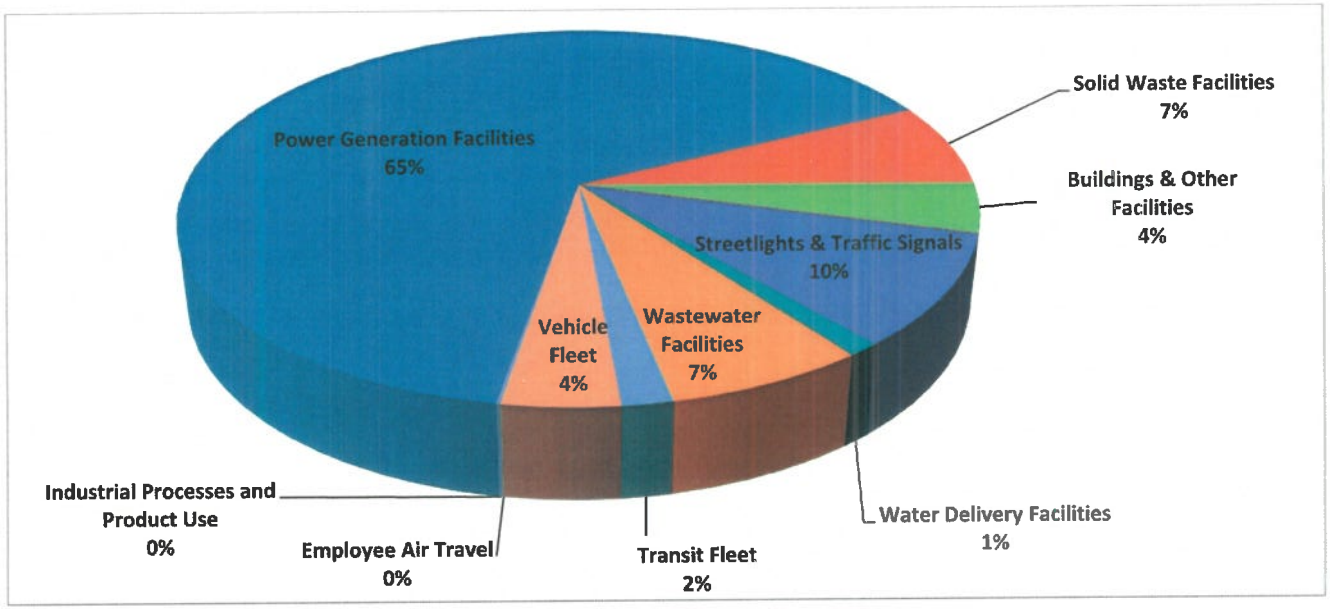

Figure 1: Municipal Sector Emissions

Table 20: Municipal sector emissions

Municipal Sector	Emissions Scope	Emissions (tCO_2e)
Buildings and Other Facilities	Scope 1	517
	Scope 2	69,564
Additional Scope 3 Emissions	Scope 3	366
Power Generation Facilities	Scope 2	1,070,373
Sanitation and Solid Waste Facilities	Scope 1	115,944
	Scope 2	210
Streetlights and Traffic Signals	Scope 2	157,401
	Scope 3	-
Vehicle Fleet	Scope 1	65,106
	Scope 3	28,746
Wastewater Facilities	Scope 1	70,510
	Scope 2	42,215
Water Delivery Facilities	Scope 2	17,699
Industrial Process and Product Use	Scope 1	2,582

4.1.1 Municipal GHG Emissions Intensity Figures

Emission intensity indicators for municipal operations are presented in **Table 21**. These figures were calculated by combining all municipal scope 1 and 2 emissions and dividing them by the relevant indicator.

Table 21: Municipal GHG intensity figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
R 25.11	tCO_2e / million Rand of operating budget	1,612,121	tCO2e (Municipal Scope 1 & 2)	R 64,200.00	Million Rand Operating Budget (2023/ 2024)
R 227.06	tCO_2e / million Rand of Capital budget	1,612,121	tCO2e (Municipal Scope 1 & 2)	R 7,100.00	Million Rand Capital Budget (2023/ 2024)
66.66	tCO_2e / Permanent employee	1,612,121	tCO2e (Municipal Scope 1 & 2)	24,183	Permanent Employees

4.2 COMMUNITY EMISSIONS

4.2.1 Community Emissions Analysis

The community emissions profile is dominated by transport and industrial sectors, contributing approximately 48% and 32% of total emissions, respectively (**Figure 2**, Table 22). Secondary contributions arise from residential (11%) and commercial (8%) sectors, while IPPU, waste, and AFOLU sectors contribute marginally. This distribution highlights a predominantly energy- and transport-driven emissions structure, with mitigation efforts needing to prioritise low-carbon mobility systems and industrial decarbonisation.

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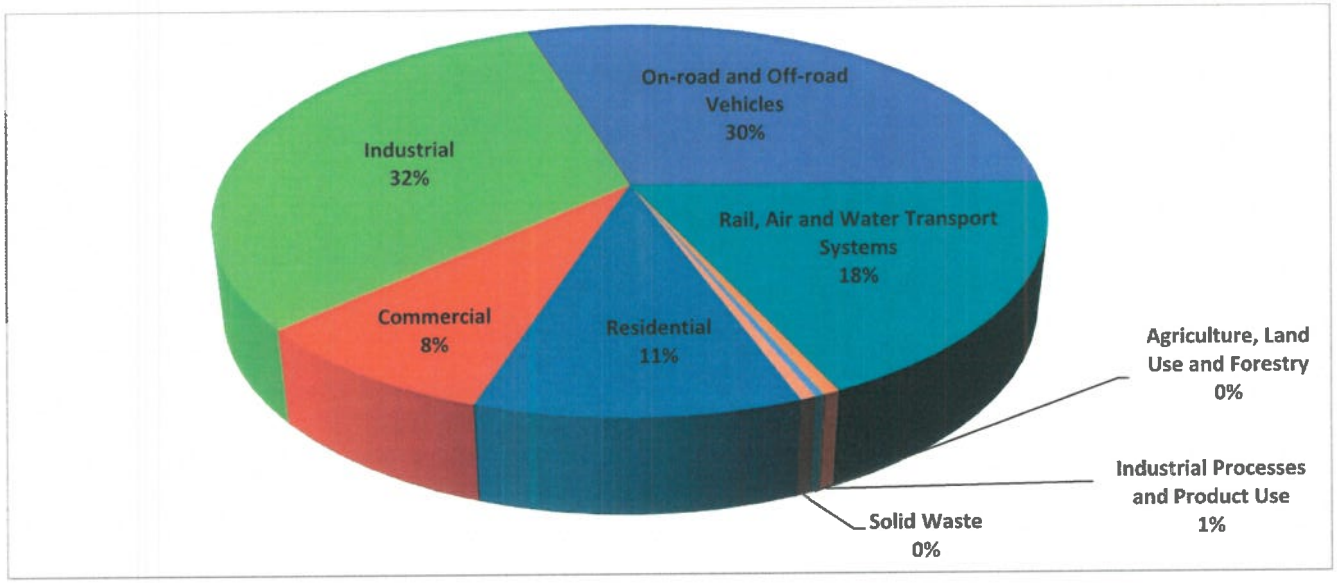

Figure 2: Community Sector Emissions

Table 22: Community sector emissions

Community Sector	Emissions Scope	Emissions (tCO_2e)
Residential	Scope 1	491,897
	Scope 2	2,271,252
Commercial	Scope 2	2,186,732
Industrial	Scope 1	4,899,196
	Scope 2	3,332,586
On-road and Off-road Vehicles	Scope 1	7,704,705
Rail, Air and Water Transport Systems	Scope 3	4,703,598
Solid Waste	Scope 1	128,038
Industrial process & Product Use	Scope 1	94,436
Agriculture, Land Use and Forestry	Scope 1	87,868

4.2.2 Community Emissions Intensity Figures

Emissions intensity figures calculated for the EMA for 2024 are provided in **Table 23**. These metrics were derived by aggregating relevant sectoral emissions across Scope 1 and Scope 2 categories and normalising them against appropriate activity-based indicators, such as population, economic output, or sector-specific activity levels. This approach enables the assessment of emissions efficiency, facilitates temporal trend analysis, and supports benchmarking against comparable urban systems and reporting frameworks

Table 23: Community GHG intensity figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
2.06	tCO2e / household	2,763,150	tCO2e (Residential Scope 1 & 2)	1,339,259	Number of households within the EMA
R18.90	tCO_2e / million Rand of Capital budget	2,186,732	tCO2e (Commercial Scope 1 & 2)	R 115,700.00	2024 Annual retail trade sales

4.2.3 Total Emissions Intensity Figures

Total emission intensity indicators for both municipal operations and the broader community are presented in the Table 24 below. These metrics were derived by consolidating relevant sectoral emissions across applicable reporting scopes and normalising them against appropriate activity-based indicators, thereby enabling a comparative assessment of emissions efficiency and performance

Per capita emission intensity values have been calculated using two methodological approaches: (i) total Scope 1 and Scope 2 emissions, representing direct and electricity-related emissions, and (ii) total Scope 1, Scope 2, and Scope 3 emissions, incorporating additional indirect sources. This dual approach facilitates alignment with different reporting frameworks and enhances comparability across inventories utilising varying scope definitions.

Table 24: Total Emissions Intensity Figures

Intensity Figure	Unit	Metric Numerator	Unit	Metric Denominator	Unit
5.13	tCO2e / Capita	22,853,163	tCO2e (Scope 1 & 2)	4,458,281	Population within the EMA
6.54	tCO2e / Capita	29,175,112	tCO2e (Scope 1, 2 & 3)	4,399,650	Population within the EMA

5 COMPARISON AGAINST PREVIOUS INVENTORIES

The 2010 eThekwini GHGEI is adopted as the baseline year, as it represents the first inventory developed using a clearly defined and consistent methodology for data collection, processing, and reporting. This baseline provides a robust reference point against which subsequent emissions trends can be assessed.

Analysis of historical emissions data indicates a relatively stable emissions trajectory over the reporting period, with total emissions fluctuating within a narrow range of approximately 27–28 $MtCO_2e$. These variations reflect marginal year-on-year changes rather than significant structural shifts in the Municipality's emissions profile.

The limited variability in total emissions suggests that efficiency gains or mitigation interventions implemented to date have not yet resulted in a significant structural decoupling of emissions from economic and population growth. Consequently, while emissions remain relatively stable in absolute terms, the underlying emissions drivers indicate a persistent dependence on energy-intensive systems.

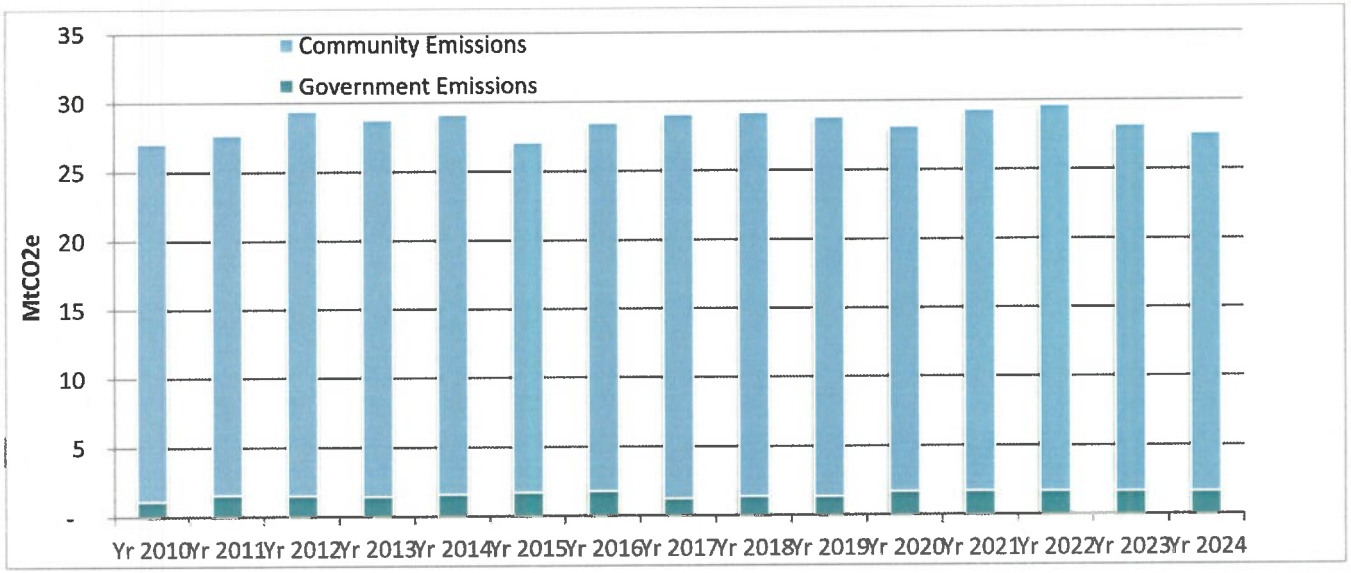

Figure 3: Comparison of Emissions 2010 through to 2024

Table 25: Percentage change of Emissions from baseline

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	1,817,486	26,647,189	28,464,675	5.2%
Yr 2017	1,261,219	27,764,419	29,025,638	2.0%
Yr 2018	1,393,662	27,781,450	29,175,112	0.5%
Yr 2019	1,363,657	27,440,798	28,804,454	-1.3%
Yr 2020	1,715,465	26,426,352	28,141,817	-2.3%
Yr 2021	1,740,189	27,564,465	29,304,654	4.1%
Yr 2022	1,719,252	27,901,415	29,620,667	1.1%
Yr 2023	1,678,588	26,507,755	28,186,344	-4.8%
Yr 2024	1,641,233	25,944,639	27,585,873	-2.1%

Table 25 provides a longitudinal comparison of greenhouse gas (GHG) emissions for both municipal operations and community-wide activities over the period 2010 to 2024, highlighting changes in the overall emissions profile and sectoral contributions.

For the 2024 reporting year, total emissions were estimated at 27,585,873 tCO_2e. Of this total, the community sector accounted for the predominant share at 25,944,639 tCO_2e (94%), while municipal operations contributed 1,641,233 tCO_2e (6%). This distribution underscores the dominant influence of broader socio-economic activities within the municipal boundary relative to emissions directly under municipal control.

A year-on-year comparison indicates that total emissions decreased by approximately 2.1% between 2023 and 2024, representing a reduction of 600,471 tCO_2e. This decline is attributable to reductions observed in both sub-inventories, with municipal emissions decreasing by 37,355 tCO_2e and community emissions declining by 563,116 tCO_2e over the same period.

While the overall reduction reflects a positive trend, the emissions profile remains largely driven by community-scale activities, highlighting the importance of targeted mitigation interventions beyond municipal operations to achieve sustained emissions reductions.

Table 26: Comparison of Emissions 2023 against 2024

Scope	Type	Sub-Type	2023 (tCO_2e)	2024 (tCO_2e)
Municipal Scope 1	Fuel Consumption	Stationary Fuel Combustion	517.3	517.3
		Vehicle Fleet	70,239.8	65,105.9
	Solid Waste	Solid Waste (CH4)	115,969.2	115,943.5
	IPPU	Bitumen	2,582.4	2,582.4
	Wastewater Treatment	Wastewater (CH4)	68,440.5	70,510.2
Municipal Scope 2	Electricity Consumption	Buildings	84,704.1	69,564.5
		Streetlights & Traffic Signals	168,382.4	157,400.6
		Water Delivery Facilities	19,721.5	17,699.1
		Transmission and Distribution Losses	1,070,357.1	1,070,372.7
		Solid Waste Facilities	185.0	209.8
		Wastewater Facilities	47,455.5	42,215.4
Municipal Scope 3	Transport Systems	Streetlights	1,111.9	-
		Transit Fleet	28,503.7	28,746.2
		Flights	427.9	365.8
Subtotal Municipal			**1,678,588.4**	**1,641,233.3**
Community Scope 1	Fuel Consumption	Stationary Fuel Combustion	5,730,418.0	5,391,093.3
		Mobile Fuel Combustion	7,326,673.2	7,704,705.0
	Solid Waste	Solid Waste	130,851.0	128,038.0
	Industrial Processes & Product Use	Industrial Process	140,418.0	94,436.0
	Industrial Processes & Product Use	SF_6	44,330.0	44,330.0
	Agric & Land use	Agric & Land use	87,868.4	87,868.4
Community Scope 2	Electricity Consumption	Residential	2,414,046.9	2,271,252.1
		Commercial	2,296,322.5	2,186,732.4
		Industrial	3,644,124.8	3,332,586.5
Community Scope 3	Transport Systems	Air Transport Systems	264,946.1	275,841.2
		Water Transport Systems	4,427,756.4	4,427,756.4
Subtotal Community			**26,507,755.3**	**25,944,639.3**
Total			**28,186,343.7**	**27,585,872.7**

6 CONCLUSIONS

Total greenhouse gas (GHG) emissions for the 2024 reporting year were estimated at 27,585,872.7 tCO_2e, representing a net reduction of approximately 600,471 tCO_2e compared to 2023. The emissions profile remains predominantly driven by community-scale activities, which account for 94% (25,944,639 tCO_2e) of total emissions, while municipal operations contribute the remaining 6% (1,641,233 tCO_2e). A year-on-year comparison indicates reductions across both sub-inventories, with municipal emissions decreasing by 37,355 tCO_2e and community emissions declining by 563,116 tCO_2e. This reflects measurable progress in emissions management across both municipal operations and the wider urban system.

The observed reductions are largely attributable to decreased electricity consumption across both municipal facilities and community sectors, suggesting improvements in energy demand management and efficiency. However, despite this positive trend, the emissions profile continues to be structurally influenced by high-emitting sectors, most notably transport within the community which remains the single largest and most persistent source of emissions. Sustained and meaningful decarbonisation will therefore require targeted, sector-specific interventions particularly within transport and industry alongside continued improvements in energy efficiency and a transition towards lower-carbon energy sources.

Strengthening the GHGEI as a decision-support tool, coupled with the implementation of robust mitigation strategies and enhanced stakeholder engagement, will be critical to accelerating emissions reductions and advancing eThekwini's transition towards a low-carbon, climate-resilient urban future.

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