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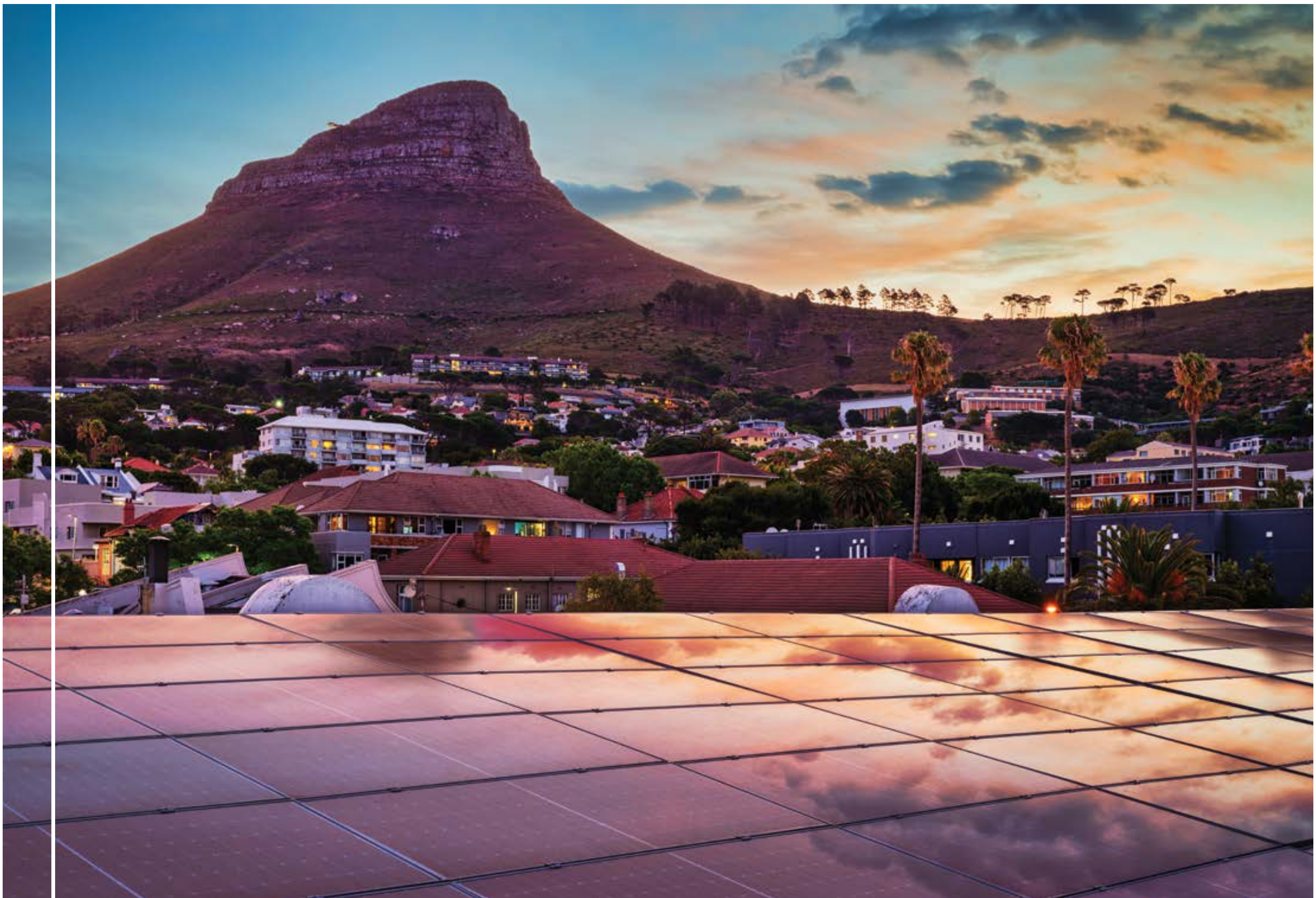

CAPE TOWN STATE OF ENERGY AND CARBON 2025

Making progress possible. Together.

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The City thanks the following contributors:

The Green House consultancy services:
Alice Gwynne-Evans • Bianca van Zyl
David Walwyn • Matthew Burke • Yvonne Lewis

City Energy Directorate project team:
Adrian Stone
Ashlin Naidoo
Cabral Wicht
Caitlin Sole
Chelsea Leibrandt
Fadzai Kadzinga
Johan Mouton
Makeya Karlie
Priscilla de Comarmond
Rebecca Cameron

Photography:
Bruce Sutherland and Cindy Waxa, City of Cape Town (unless stated otherwise)

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Foreword by the **Executive Mayor**

One of the most compelling things about municipal government is scale. Cities organically grow very large systems of infrastructure, and in the developing South, they are getting bigger fast. This report focuses on Cape Town's energy system at a detailed level, linking it to an overview of carbon accounting of greenhouse gases.

Carbon accounting touches on many of the other fascinating systems in the city, including water, wastewater, solid waste, green spaces, agriculture, and even air conditioners and transformer switchgear. This systems view, with energy in the foreground, provides an important planning resource for illustrating the links and trade-offs between systems in the city metabolism.

Within the energy system, the electricity supply industry has gone through tumultuous upheavals since the last Cape Town State of Energy and Carbon (SOEC) report in 2021. The severe load-shedding of 2022 and 2023 has altered the landscape of the sector irrevocably and has thrust many new challenges and changes upon the City's electricity utility. The 2050 Energy Strategy, which we adopted in 2023, captures our strategic objectives for the coming decades, and this SOEC 2025 report now assesses the data on the state of play as the strategy rolls out.

This report matters because Cape Town's electricity utility is facing profound financial, operational and structural changes that demand a detailed and credible understanding of the city's energy system.

The State of Energy section of the report provides this evidence base. It analyses how declining electricity sales, efficiency gains and small-scale embedded generation (SSEG) uptake are reshaping a capital-intensive wires business, weakening traditional cost recovery, complicating cross-subsidy models, and accelerating the need to adapt to new customers, new services such as wheeling, and diversified supply options, including an imminent wholesale market for electricity.

The State of Carbon section, in turn, applies a consistent, cross-sectoral carbon accounting framework to inform our transition to decentralised, carbon-neutral energy. To this end, it tracks our progress on mitigating emissions within Cape Town's broader energy, infrastructure and natural systems.

Together, these perspectives support sound decisions on utility reform, climate mitigation and investment, and demonstrate the City's commitment to transparent, high-quality reporting.

Geordin Hill-Lewis
Executive Mayor, City of Cape Town

Executive Summary

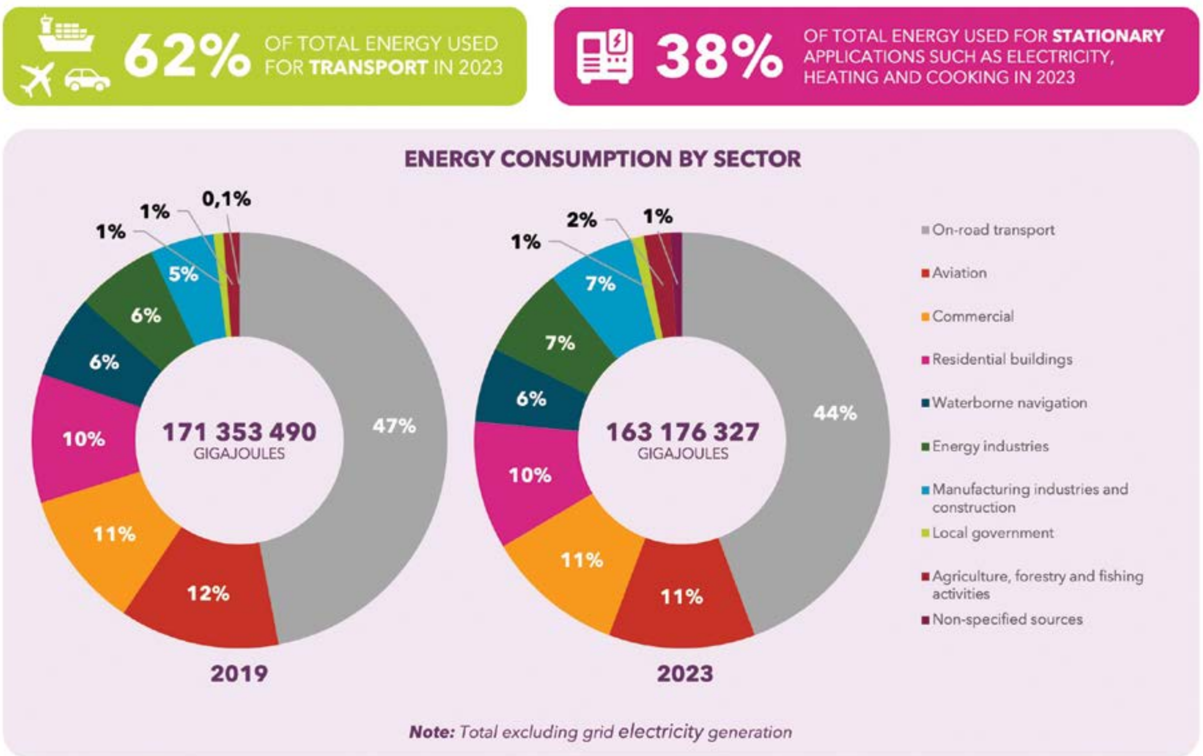
State of Energy

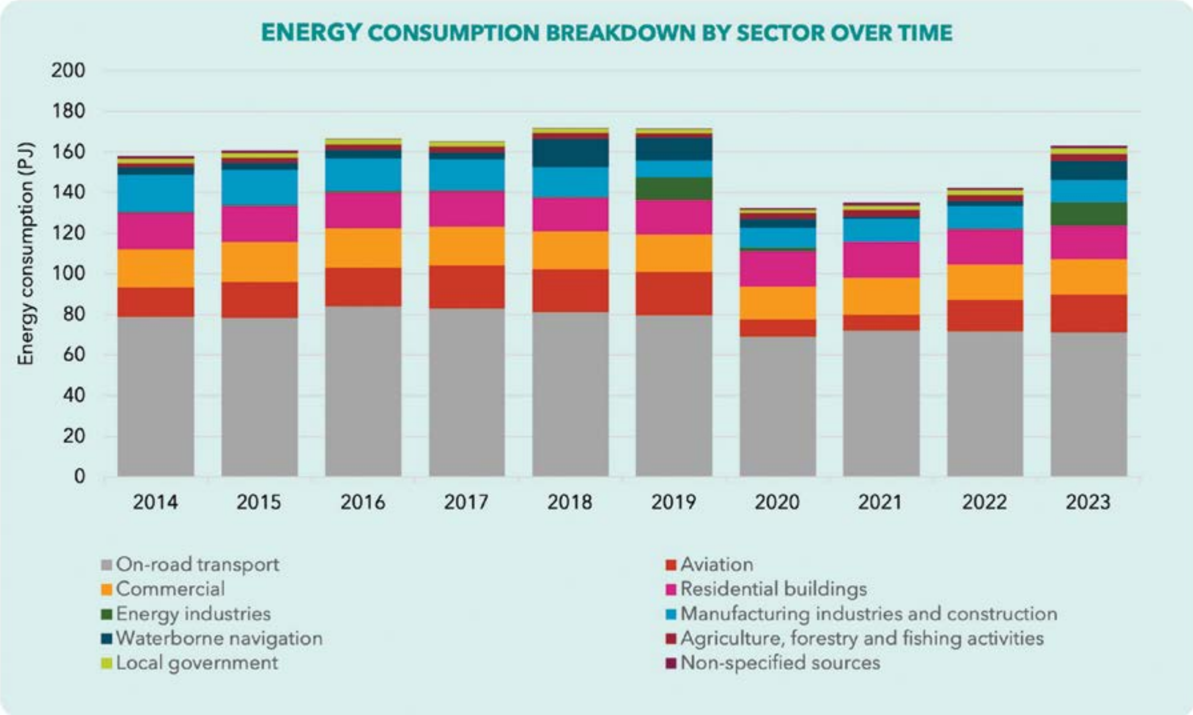
Cities are energy-intensive engines of modern economies. Globally, cities account for 78% of energy use and more than 60% of greenhouse gas (GHG) emissions (UN, 2020). Cape Town is no exception: The city's energy system underpins its economic activity, mobility, and quality of life, while also exposing residents and businesses to affordability challenges, reliability risks and carbon emissions.

In 2023, the City of Cape Town (hereafter 'the City') approved its ***2050 Energy Strategy*** (City of Cape Town, 2023d), which sets out a bold vision of "a resilient energy system where all residents and businesses have access to reliable, affordable and carbon-neutral energy". To deliver on this vision, we need to track the rapidly changing energy landscape and assess whether trends are moving towards or away from the strategy's guiding principles.

This 2025 SOEC analyses Cape Town's energy supply and demand between 2014 and 2023, drawing on the best available data at the time of publishing. The following two charts summarise the results:

Figure 1: Energy consumption by sector, 2019 vs 2023 and 2014–2023





Sources: ACSA (2025); City of Cape Town (2023c, 2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); Stats SA (2025b); Transnet (2025)

Key takeaways from the State of Energy

1. **Despite rapid population growth, energy demand is not increasing, but has been increasingly volatile:**
   In contrast to the ongoing growth seen in industrialising economies, total energy consumption remains below the 2019 peak and continues to fluctuate in response to economic conditions and supply disruptions. Commercial and industrial electricity demand declined sharply during Covid-19 and remained depressed under load-shedding, while per capita electricity use has fallen by around 30% over the past decade.

2. **Petroleum fuels continue to dominate, despite growth in renewables:**
   Renewable electricity and small-scale embedded generation (SSEG) are increasing, yet 78% of total energy consumption within the metro's boundaries is from the direct combustion of fossil fuels, underscoring the scale of the decarbonisation challenge.

3. **Load-shedding changed the structure of Cape Town's energy system:**
   The 2022–2023 period saw supply interruptions of unprecedented duration and severity, with load-shedding in 2023 occurring over 75% of the time at some level, and 30% of the load (stage 6) disconnected for nearly one in every eight hours. This had long-lasting effects on electricity demand, economic output and confidence, the regulatory and trading landscape, and energy behaviour across households and businesses. Load-shedding also created an opportunity for vandalism and theft to escalate beyond normal levels as a result of the regular and publicly advertised outages, further compounding operational and reliability challenges.

4. **The local liquid fuels supply chain rode out severe supply-and-demand shocks while buffering load-shedding, but affordability remains a concern:**
   The Astron refinery closure (2020–2022) and elevated demand for diesel during load-shedding (2021–2023) were shocks that could have led to fuel shortages. However, the system coped thanks to local import and storage capacity and an industry adept at scaling up to target opportunities. This system resilience comes at a cost, though, and long-term underlying price increases, extremely volatile fuel prices and the carbon tax have intensified affordability pressures.

5. **Transport dominates the energy mix and fossil fuel dependence, but the electrification challenge is imminent:**
   Typical of cities without concentrated heavy industry, Cape Town's transport sector dominates total energy consumption (62% in 2023), made up almost entirely of petrol and diesel. This embeds exposure to global oil markets, but also makes the sector resilient. Even partial electrification of this substantial block of energy, which seems more likely with dropping electric vehicle prices, will require large-scale change to provide the necessary local grid infrastructure and electricity supply capacity.

6. **Electricity consumption patterns are changing unevenly across sectors and incomes:**
   High-income households are increasingly offsetting grid electricity through efficiency measures, liquified petroleum gas (LPG) and SSEG, which expanded rapidly between 2019 and 2024. Low-income households remain largely grid-dependent, constrained by affordability and limited access to resilience options.

7. **The City's electricity business faces growing financial and system complexity:**
   Declining electricity sales – driven by price response, efficiency gains and SSEG uptake – are reducing the capacity for cross-subsidisation and for cost recovery by the capital-intensive wires business. Additionally, the City's electricity utility must, within a short space of time, adapt to a changing customer base, restructure its business lines, and accommodate new services, such as wheeling, at scale. Moreover, the utility has to diversify its supply options to hedge against price and supply risk through own builds, power purchase agreements with independent power producers (IPPs) and licensed traders, and trade in the imminent South African Wholesale Electricity Market.

8. **Certain activities may not be possible with electricity prices in the third quartile of global prices, and rising:**
   Despite the additions over the past decade, a large transmission and generation capacity expansion programme, whether private or public, needs to unfold. Electricity prices are already in the third quartile of world prices, and history shows that prices do not drop during periods of rapid capacity expansion. Therefore, prices will likely continue to rise in real terms. Given highly competitive global markets, local energy-intensive industry seems unlikely.

9. **In a global age of data science, access to and the quality of energy and activity data in South Africa is a mixed bag:**
   The City's internal and open data, Eskom's national data and the Department of Forestry, Fisheries and the Environment's scheduled emitters data (SAIGE formerly known as SAGERS) were all greatly improved since the last publication, although Eskom data at the local distribution level was not directly accessible. Important datasets such as liquid fuel sales and local vehicle registrations, while accessible, are increasingly self-regulated and/or less publicly available, less transparent and/or less relevant, reducing their practical value. With some exceptions, local data providers overall fall short of international standards for openness, usability, data quality, and especially metadata availability.

Energy Strategy principles – headline insights

The City's Energy Strategy principles provide a lens for interpreting the data:

- **Reliability:** Load-shedding in 2022 and 2023 was unprecedented, with disruptions at an order of magnitude higher than in 2015. Reliability challenges continue to affect businesses and households, with extreme levels of vandalism having taken root, which has ripple effects on economic performance and quality of life.
- **Affordability:** Rising electricity tariffs and volatile fuel prices have deepened affordability pressures. High-income households are increasingly insulated through SSEG and efficiency, while vulnerable households remain exposed, with limited options to manage costs.
- **Carbon neutrality:** Technology and regulation have slowed electricity emissions growth, while renewable electricity generation is increasing, albeit still only comprising a modest share. Deep electricity decarbonisation seems some way off, and petroleum fuels still dominate energy demand, underlining the post-2030 decarbonisation challenge. This combines with dropping prices to set up electric vehicles (EVs) as the next major transition test, especially for utilities. Drops in per capita GHG emissions are partly the result of national economic stagnation, yet pragmatic choices in technology and business models offer cities a low-emissions growth pathway.
- **Resilience:** The system has demonstrated resilience in weathering refinery shutdowns and supply disruptions, aided by storage and imports. At the same time, SSEG growth signals a structural shift towards decentralised, more resilient energy supply for households and businesses.

The analysis above shows both the progress made and the ongoing risks. Cape Town's energy landscape is being reshaped by load-shedding, affordability constraints and a rise in self-generation, but petroleum fuels continue to dominate, and structural inequalities persist. To build a more reliable, affordable, carbon-neutral and resilient energy system, the City will need to align new energy pathways with inclusive service delivery and long-term fiscal sustainability.

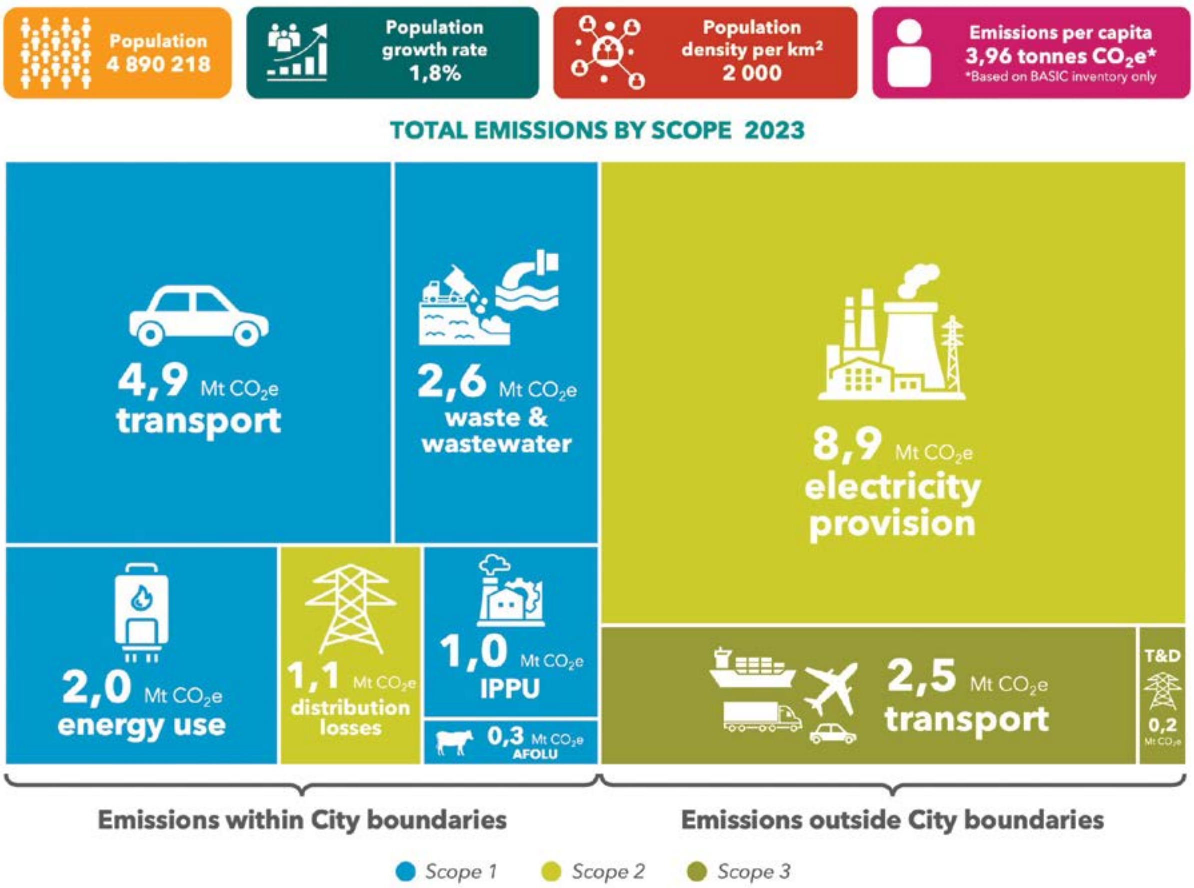
State of Carbon

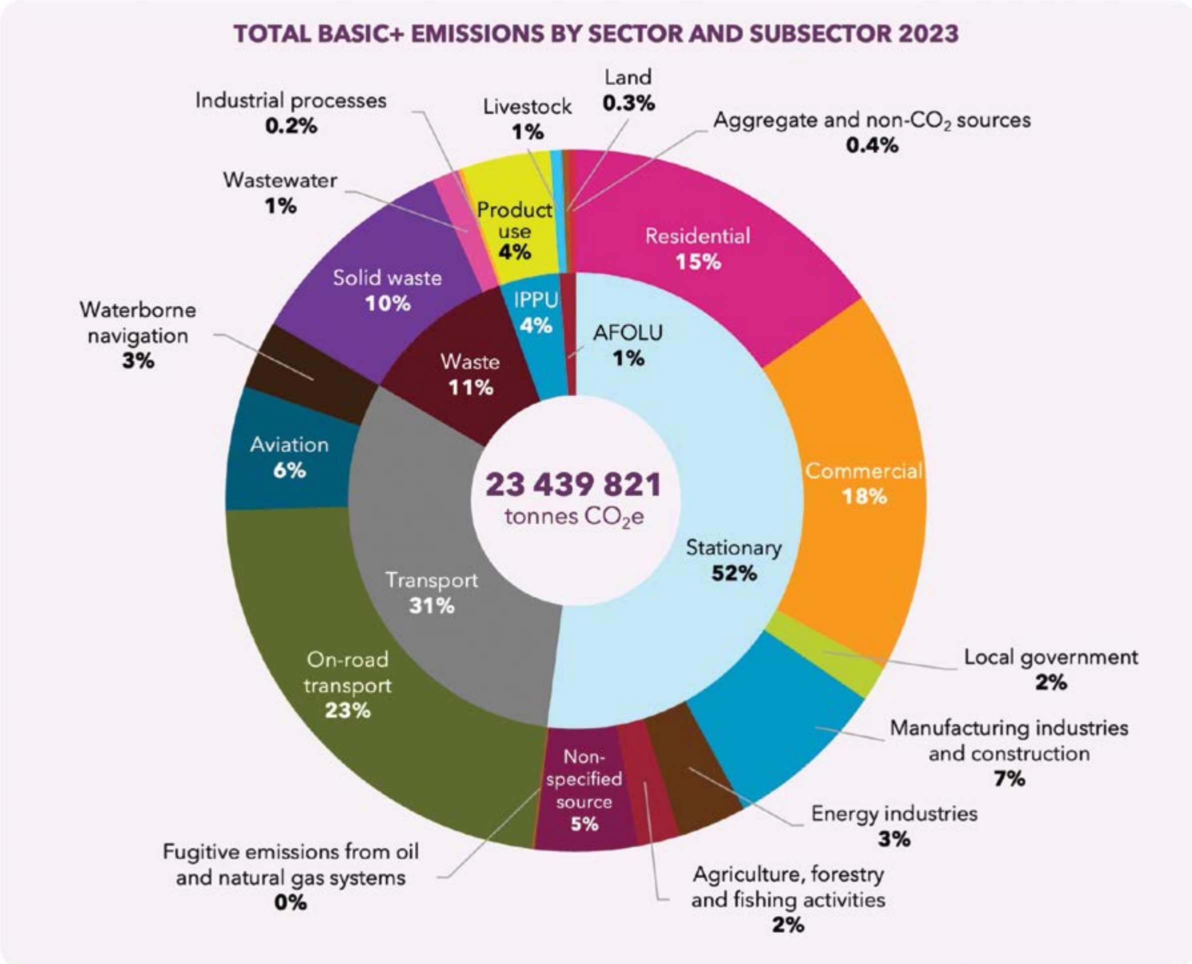
Cape Town's GHG emissions reflect the complex interaction between its energy system, urban form, economic structure and waste sector profile. The City has committed to becoming carbon-neutral by 2050, with interim science-based targets for 2030. Tracking progress against these goals requires a detailed and transparent inventory of emissions across all sectors.

Drawing on the best available data, the State of Carbon analysis offers a comprehensive, cross-sectoral view of Cape Town's GHG emissions. It informs mitigation progress tracking and future actions, supports a systems view of key urban infrastructure and natural systems, and demonstrates the City's commitment to maintaining credible environmental, social and governance reporting within the constraints of a developing-country local government context.

This 2025 SOEC examines Cape Town's emissions between 2014 and 2023. The high-level results are summarised in the following charts:

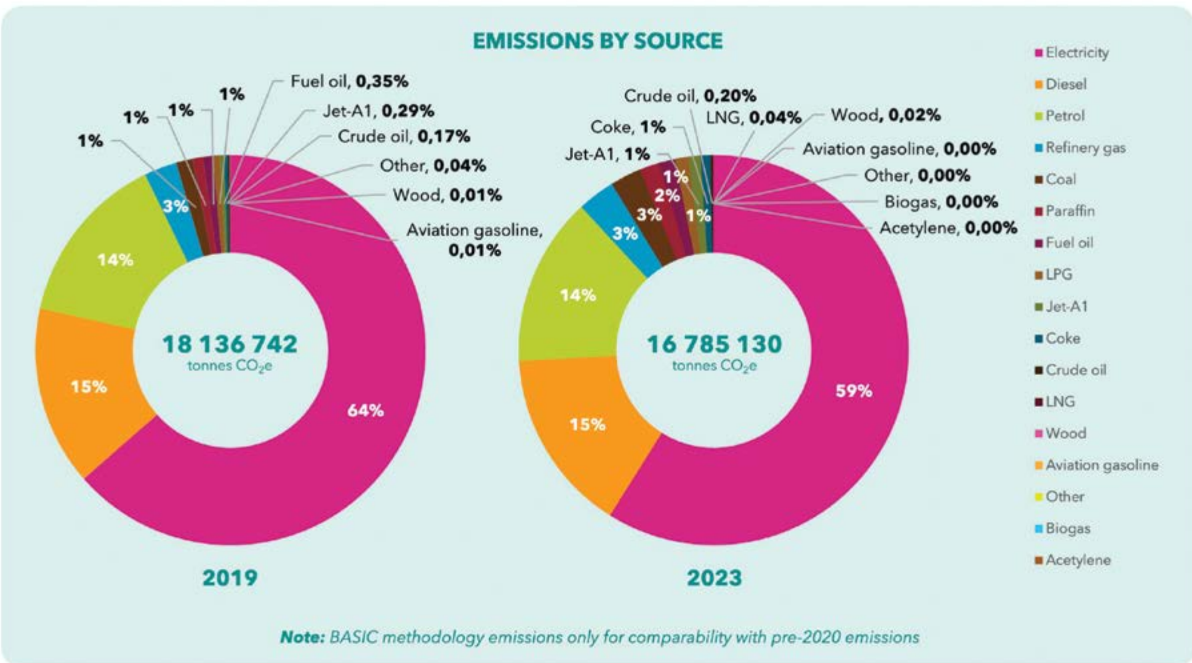
Figure 2: Cape Town's total emissions breakdown by scope, sector, subsector and location in 2023

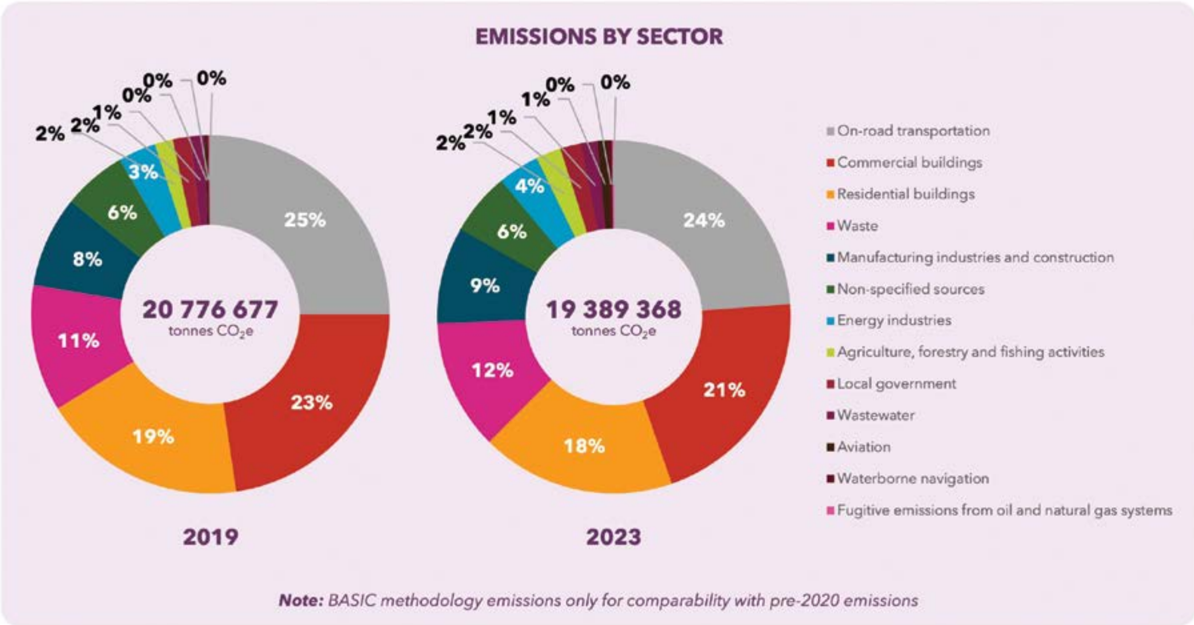




Sources: ACSA (2025); City of Cape Town (2018, 2023a, 2023c, 2025c); DEE (2023); Eskom (2025a); LEAP model; Stats SA (2024, 2025a); Transnet (2025); FAO (2024); EnviroServ; SAWIC; DEA (2016); DFFE (2018, 2020 & 2022, n.d); NASA EarthData (2025); WCG (2025b); SARS (2025a)

Figure 3: Cape Town's emissions by source and sector, 2019 vs 2023





Sources: ACSA (2025); City of Cape Town (2018, 2023a, 2023c, 2025c); DEE (2023); Eskom (2025a); LEAP model; Stats SA (2024, 2025a); Transnet (2025); FAO (2024); EnviroServ; SAWIC; DEA (2016); DFFE (2018, 2020 & 2022, n.d); NASA EarthData (2025); WCG (2025b); SARS (2025a)

In 2023, Cape Town's emissions profile continued to be dominated by stationary energy and transport, which together account for the majority of citywide emissions. The waste and wastewater sectors remain significant contributors, while industrial processes and product use (IPPU) and agriculture, forestry and other land use (AFOLU) form smaller but increasingly important parts of the picture. For the first time, the City has expanded its emissions inventory reporting to include AFOLU and IPPU, moving to the BASIC+ level of the Global Protocol for Community-Scale GHG Inventories (GPC) reporting. This makes Cape Town one of the first municipalities in South Africa to adopt this more comprehensive reporting standard, strengthening its evidence base for climate action.

The emissions trends reveal both opportunities and challenges. While electricity-related emissions have declined with changes in the national grid's emission factor, transport emissions remain stubbornly high, reflecting the city's sprawling settlement patterns and dependency on private vehicles. Waste emissions are slowly decreasing through diversion initiatives and landfill gas capture, but population growth and service expansion continue to add pressure. Together, these dynamics underscore the urgency of structural transformation in energy, mobility, waste and land use if the City is to meet its 2030 and 2050 GHG emission reduction targets.

Key takeaways from the State of Carbon

1. **Stationary energy dominates:** Over half (52%) of total BASIC+ emissions in 2023 were from stationary energy use, particularly residential (15%) and commercial (18%) buildings. This is due to the continued reliance on coal-generated electricity.

2. **Transport remains a major source:** Transport contributed 31% of emissions in 2023, with on-road transport alone making up 23%. Aviation (6%) and waterborne navigation (3%) also represent significant shares.

3. **Waste sector still substantial contributor:** The waste sector contributes 11% of citywide carbon emissions. Solid waste disposal and wastewater emissions together remain a substantial part of the city's emissions profile, underlining the importance of landfill gas capture and treatment.

4. **New categories tracked:** For the first time, the City has reported on IPPU and AFOLU, which together account for around 5% of total emissions under BASIC+ reporting.

5. **Overall emissions have declined along the voluntary target line:** Cape Town's BASIC emissions fell from approximately 20,8 $MtCO_2e$ in 2019 to 19,4 $MtCO_2e$ in 2023 (a 6,5% absolute drop, but a 12,8% per capita drop) and remain on track towards the City's interim 2030 target of 19,25 $MtCO_2e$.

6. **Target compliance in the future will be more challenging:** While the City is close to meeting its voluntary 2030 BASIC inventory reporting target, the target line drops much faster after 2030 as is typical for developing jurisdictions under most target-setting frameworks aligned with the Paris Agreement.

7. **Local dependencies may hamper future decarbonisation:** Technology and regulation have slowed electricity emissions growth, while renewable electricity generation is increasing, albeit still comprising a modest share. Deep electricity decarbonisation, however, seems some way off, and petroleum fuels still dominate energy demand, with the transition to transport electrification yet to come. National economic stagnation and shocks are also a significant driver of emissions reductions, raising questions about the real capacity of South African cities, including Cape Town, to cope with the accelerated 'burden sharing' of decarbonisation required after 2030.

8. **South Africa has not used the carbon budget it argued for in its mitigation policy, as its economy has not grown, and therefore, it cannot be seen as a 'developing' country, complicating its participation in target-setting schemes nationally and regionally:** Climate change mitigation has been a growing feature of energy policy since the International Panel on Climate Change's first assessment report in 1990. Since the 2015 Paris Agreement, the principle of carbon neutrality has been broadly accepted outside of the United States, as necessary. Most policy analysts also accept that it is not fair to ask all economies to decarbonise at the same rate. So-called 'developing' countries, including South Africa, have argued for a greater share of the carbon budget to improve the wellbeing of their people. Compared to this group of countries, however, South Africa's economy and energy demand has been stagnant, keeping emissions growth low, but making the rapid transition required after 2030 very difficult economically.

Local government

Alongside its role as a local authority, planner and licensed electricity distributor, the City of Cape Town is itself an energy user and a source of emissions through the delivery of municipal services. Water treatment, wastewater management, waste disposal, transport operations as well as the municipal buildings and fleet all consume significant amounts of electricity and fuel. In 2023, local government operations consumed 1,7 % of citywide energy and accounted for around 3–4% of Cape Town's total electricity demand, which translated to 2% of the citywide emissions.

The City has implemented various measures to reduce this carbon footprint, including rooftop solar installations on municipal buildings, widespread energy efficiency retrofits, and landfill gas extraction projects at Coastal Park, Bellville South and Vissershok. At the same time, population growth and urban expansion are increasing demand for water, sanitation and waste services, driving up energy use and emissions relating to these services. Compounding this is the challenge of declining revenue from electricity sales as customers shift to SSEG. This dual pressure – growing service demand and tightening budgets – highlights the importance of continued investment in efficiency and renewable energy solutions in the City's own operations.

Key takeaways from the State of Energy and Carbon for the local government sector

1. **Energy sources used in the sector:** Energy supply is split between electricity (52%), liquid fuels (41% diesel, 8% petrol), and a very small share of paraffin and Jet-A1. Fuel use is dominated by the City's fleet and MyCiTi public bus service.

2. **Main drivers of electricity consumption:** Electricity demand in the sector is concentrated in water and sanitation treatment activities, streetlights and municipal buildings.

3. **Electricity-heavy operational emissions profile:** The City's operational emissions profile is strongly weighted towards electricity usage activities (78%), with the balance associated with diesel (18%) and petrol (3%).

4. **A leader in operational mitigation:** Energy efficiency retrofits, rooftop and ground-mounted solar photovoltaic (PV) systems as well as landfill gas capture and landfill gas-to-power projects continue to reduce emissions and costs, even as service demands rise. These are supported by active communications and engagement forums to build collaboration. While these projects still cover only a small share of energy use and emissions at a citywide scale, they build supply chains and platforms for learning and scaling up by all stakeholders.

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ABBREVIATIONS

AC	alternating current
ACSA	Airports Company South Africa
AFOLU	agriculture, forestry and other land use
ASIDI	average system interruption duration index
ASIFI	average system interruption frequency index
BOD	biological oxygen demand
BRT	bus rapid transit
CCT	City of Cape Town Metropolitan Municipality
CDP	Carbon Disclosure Project
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CO_2e/kWh	carbon dioxide equivalent per kilowatt hour
COAS	Carbon Offset Administration System
COD	chemical oxygen demand
Covid-19	coronavirus disease 2019
CPI	consumer price index
CSIR	Council for Scientific and Industrial Research
CSS	Customer Satisfaction Survey
DC	direct current
DEA	Department of Environmental Affairs (became DFFE in June 2019)
DEE	Department of Electricity and Energy
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy (became DEE in August 2024)
EAF	energy availability factor
ESG	environmental, social and governance
EV	electric vehicle
FAO	Food and Agriculture Organisation
FBE	free basic electricity
F-gas	fluorinated gas
FIASA	Fuels Industry Association of South Africa
FOD	first-order decay
GABS	Golden Arrow Bus Service
GDP	gross domestic product
GEF	grid emission factor
GHG	greenhouse gas
GHS	General Household Survey
GJ	gigajoules
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GVA	gross value added
GWh	gigawatt-hours

GWp	gigawatt peak (capacity)
GWP	global warming potential
HyTrA	Hydrogen Tryout Areal
IBIA	International Bunker Industry Association
IDC	Industrial Development Corporation
IEA	International Energy Agency
IEEE	Institute of Electrical and Electronics Engineers
IPCC	International Panel on Climate Change
IPP	independent power producer
IPPU	industrial processes and product use
kg	kilogram
kgCO$_2$	kilogram of carbon dioxide
ktCO$_2$e	kilotonne of carbon dioxide equivalent
kVA	kilovolt-amp
kW	kilowatt
kWh	kilowatt-hours
kWp	kilowatt peak (capacity)
ℓ	litre
ℓ/capita/day	litres per person per day
LCOE	levelised cost of energy
LCOS	levelised cost of storage
LED	light-emitting diode
LNG	liquified natural gas
LPG	liquified petroleum gas
MAL	maximum allowable limit
MC	methane commitment
mg	milligram
mg/ℓ	milligram per litre
MtCO$_2$e	million tonnes of carbon dioxide equivalent
MV	million volts
MVA	million volt-amps
MW	megawatt
MWh	megawatt-hours
MWp	megawatt peak (capacity)
N$_2$O	nitrous oxide
NASA	National Aeronautics and Space Administration
NaTIS	National Traffic Information System
NERSA	National Energy Regulator of South Africa
NZC	net-zero carbon
OCGT	open-cycle gas turbine
PJ	petajoules
PPA	power purchase agreement
PRASA	Passenger Rail Agency of South Africa
PV	photovoltaic
R	South African rand
REC	renewable energy certificate
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SAIGE	System for Administration of Integrated Greenhouse Gas Emissions
SAGERS	South African Greenhouse Gas Emissions Reporting System
SAPIA	South African Petroleum Industry Association
SARS	South African Revenue Service
SAWIC	South African Waste Information Centre
SF$_6$	sulphur hexafluoride
SOEC	State of Energy and Carbon
SSEG	small-scale embedded generation
Stats SA	Statistics South Africa
tCO$_2$e	tonnes of carbon dioxide equivalent
TJ	terajoules
TWh	terawatt-hours
UNFCCC	United Nations Framework Convention on Climate Change
WCG	Western Cape Government
WWTP	wastewater treatment plant

GLOSSARY

average system interruption duration index (ASIDI): Indicates the average system interruption duration in minutes per kVA served over a defined period. The ASIDI of a network is calculated using a load-based rather than a customer-affected approach. The sum of load kVA interruption durations should be calculated separately for sustained interruptions and load-shedding.

average system interruption frequency index (ASIFI): Indicates the average frequency of system interruption over a defined period. The ASIFI of a network is calculated using a load-based rather than a customer-affected approach and is recommended in utilities where updated customer–network links are not available.

BASIC emissions inventory reporting: Emissions reporting that covers scope 1 and 2 emissions from stationary energy and transportation, as well as scope 1 and 3 emissions from waste.

BASIC+ emissions inventory reporting: Emissions reporting that includes everything at the BASIC level, as well as emissions from IPPU, AFOLU and transboundary transportation. The latter involves more challenging data collection and calculation processes.

carbon neutrality/net-zero carbon: A state where carbon dioxide emissions from anthropogenic activities equal carbon dioxide removal.

carbon tax: A tax on emissions measured in tonnes of CO_2 equivalent, applied to certain fossil fuel uses and other GHG emissions above a threshold.

City: The City of Cape Town, a municipality established by the City of Cape Town Establishment Notice No. 479 of 22 September 2000, issued in terms of the Local Government: Municipal Structures Act 117 of 1998, or any structure or employee of the City acting in terms of delegated authority.

city: The greater metropolitan area of Cape Town in which the City has jurisdiction.

City supply areas: Geographical areas within the municipal boundaries of Cape Town that purchase electricity from the City.

climate change: A change of climate that is attributed directly or indirectly to human activity, alters the composition of the global atmosphere, and is in addition to natural climate variability observed over comparable time periods.

consumption: The actual amount of energy utilised or expended over a specific period (e.g. in kWh) to perform a given process or end-use service (e.g. heating, lighting, transportation, manufacturing).

decarbonisation: The process by which countries, individuals or other entities aim to achieve zero fossil carbon. This typically refers to a reduction of the carbon emissions associated with electricity, industry and transport.

demand: The necessity or desire for energy consumption that drives economic and social activity. Demand is the amount of power and energy that customers in various sectors (e.g. industrial, residential, transport) require at any given time.

energy efficiency: Actions taken to save energy, such as better building design.

energy poverty: A lack of access to clean, safe and affordable energy leading to severe social and economic consequences (City of Cape Town, 2023d).

energy security: Having a resilient energy system where all residents and businesses have access to reliable, affordable and carbon-neutral energy (City of Cape Town, 2023d). Energy security is also viewed as the collective effect of the four principles of the City's 2050 Energy Strategy, namely reliability, affordability, carbon neutrality, and resilience.

Eskom: South Africa's public electricity utility.

Eskom supply areas: Geographical areas within the municipal boundaries of Cape Town that purchase electricity directly from Eskom.

fossil fuel: A hydrocarbon-containing material such as coal, crude oil (refined into petrol and diesel) and natural gas that forms naturally in the earth's crust from the remains of dead plants and animals, and is extracted and burned as a fuel.

fuel adulteration: The illegal and harmful practice of mixing foreign substances such as paraffin, solvents or low-grade fuels with diesel or petrol to reduce costs and increase profits.

green attributes: Carbon offsets and renewable electricity credits generated and sold.

Homelight tariff: A residential electricity tariff offered by Eskom for households consuming relatively small amounts of electricity, often including a small free monthly allocation to support basic energy access.

Lifeline tariff: A subsidised electricity tariff offered by the City for low-income households, providing a small monthly allocation of free electricity to ensure access to meet basic energy needs. Eligibility is typically based on average household consumption and, in some cases, property value.

load-shedding: An energy utility's method of reducing demand on the energy generation system by temporarily switching off the distribution of energy to certain geographical areas.

load-shedding mitigation: The percentage of total load-shedding (in GWh) offset by the City's interventions.

local government: One of the three spheres of government, along with provincial and national government.

location-based grid emission factor: The emission factor based on the electricity generated within specific geographic boundaries.

market-based grid emission factor: The emission factor based on contractual instruments (e.g. renewable energy certificates).

maximum allowable limit: The maximum value that a system, component or parameter can safely handle without violating standards or damaging equipment.

mitigation: In the context of climate change, a human intervention to reduce emissions or enhance GHG sinks.

non-technical losses (electricity): Losses during electricity distribution that are not related to the technical functioning of the system, such as theft or unbilled consumption.

peak capacity (kWp, MWp, GWp): The capacity in terms of which a photovoltaic facility is normally measured, as opposed to average output. The average output over a year typically approaches 20% of peak capacity where the solar resource is good.

prosumer: Someone who both produces and consumes energy. In some cases, they may also provide energy services, such as energy storage and demand flexibility.

Province: Western Cape Province is the geographic region of South Africa, while the Western Cape Government is the administrative subdivision established by South Africa's constitution.

reliability: The availability of sufficient energy of a suitable quality when it is needed.

renewable energy: Power generated from one or more of the following sources: sun (photovoltaic or concentrated solar), wind, water (hydro) and biomass (landfill gas, biogas, biomass).

resilience: Feature of an energy system with increasing capability to restore or adapt energy system functionality in the event of a shock or stress, and reduced exposure to shocks and stresses.

scope 1: Direct GHG emissions from within Cape Town's municipal boundaries, including fuel combustion (diesel, petrol, jet fuel, fuel oil), transport, and process emissions from waste, wastewater and industry.

scope 2: Indirect GHG emissions from purchased electricity, reflecting Cape Town's reliance on South Africa's coal-intensive national grid.

scope 3: Other indirect GHG emissions outside Cape Town's municipal boundaries, such as transmission and distribution losses, aviation, and freight transport.

supply: The provision of energy resources (e.g. fossil fuels, renewable energy, electricity) to end users. It encompasses the entire supply chain, including extraction, production, transformation, transmission and distribution to the point of consumption.

technical losses (electricity): Losses that relate to the technical functioning of the system, occurring during electricity transmission and distribution.

territorial scope 1 emissions: Emissions that physically occur within the City's jurisdiction, but are attributable to activities serving areas beyond its boundaries.

waterborne navigation: The process of travelling over water using boats and ships, or a mode of transportation involving such travel. Also classified as "marine".

white products: Clean, clear and low-impurity fuels from the refining process, including jet fuel, petrol, diesel and LPG.

1 A guide to the Cape Town State of Energy and Carbon 2025 report

The City of Cape Town ('the City') strives to create a city of hope for all, as outlined in its Integrated Development Plan 2022–2027. This means driving inclusive economic growth and enhancing quality of life for all who live in Cape Town. Energy and other resources are critical to achieving this vision, yet also create by-products of waste and GHG, which could undermine the progress made if not managed well. Having high-quality data and analysis with regular and transparent reporting enables the City, businesses and residents to manage energy and resources optimally, and informs evidence-based decision-making by a wide range of stakeholders.

The Cape Town State of Energy and Carbon (SOEC) report, therefore, forms a critical part of the City's voluntary public reporting responsibility. It is both a mirror and a map, reflecting the most recent energy and emissions profile for Cape Town, and providing the data to guide further strategies, policies and implementation plans. Through detailed information and analysis, it traces energy flows into and through the city, the GHG emissions released, and the waste produced. It provides the anatomy and physiology of Cape Town's energy and material metabolism, helping citizens, planners and policymakers understand its inner workings.

Cape Town has already demonstrated its resilience and capacity for rapid adaptation. During the severe drought of 2015–2018, residents managed to reduce their average daily water consumption from over 1 200 million litres per day (MLD) to less than 600 MLD (City of Cape Town, 2025e). This extraordinary collective achievement captured the world's attention. The experience showed that change is not only possible, but achievable when Capetonians act decisively and collaboratively. This report is a continuation of that spirit: a tool to inform, reflect, and provoke action. It provides an overview of current patterns of energy use and GHG emissions, identifies opportunities for efficiency and innovation, and encourages every sector of society to contribute to an energy-efficient, lower-carbon and more sustainable future.

In the pages that follow, readers will find statistics, charts and a narrative that provide insight into Cape Town's energy and carbon emissions from 2014 to 2023, with a particular and detailed focus on the period 2019–2023, which included two major disruptors, namely the Covid-19 pandemic and the load-shedding crisis (see Box 1).

Importantly, the City acknowledges that this report is an interpretation of the data available from the perspective of a metropolitan municipality given the time and resources available to the project. The intention of making the data open is to encourage additional perspectives to be developed by stakeholders with other expertise to enhance the value of the data to the public interest. Engagement with the data and team is through the following URLs:

- SOEC Open Data: ***https://odp-cctegis.opendata.arcgis.com/***
- Queries specific to the open data can be directed to an email on the department's website: ***www.capetown.gov.za/SOEC***
- Collaboration requests or requests for additional data require a research request process: ***https://www.capetown.gov.za/City-Connect/Access-information/Submit-a-research-request***

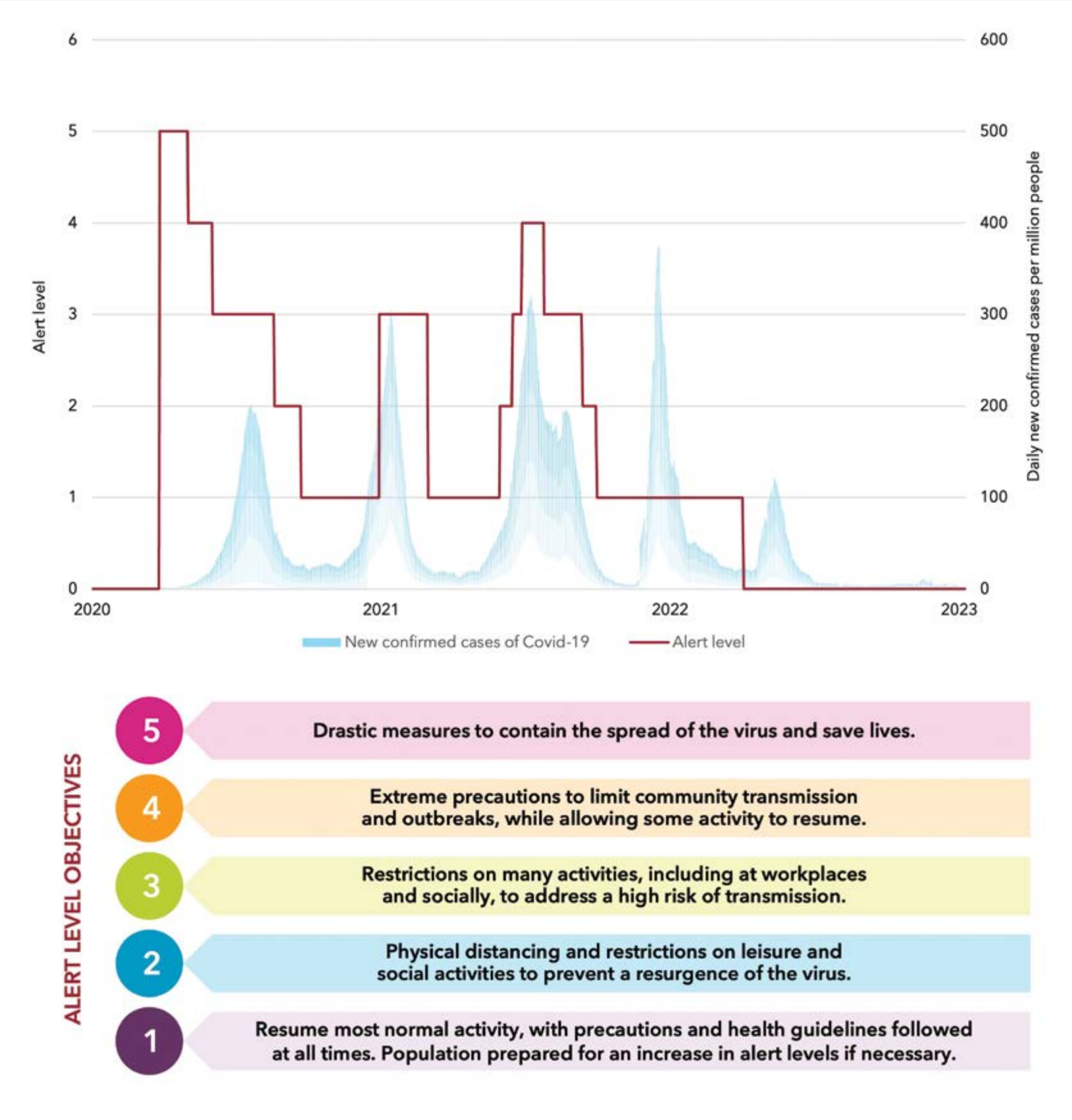
Box 1: Megatrends that affected the 2025 SOEC

The years 2019 to 2023 were a particularly turbulent time for South Africa. The period included the Covid-19 pandemic (2020–2022) as well as the load-shedding crisis (mainly 2022–2023). These two phenomena, further described below, significantly affected the national state of energy and carbon: Both reduced economic activity and, therefore, energy use, while load-shedding also accelerated the adoption of new energy technologies. For the City and other municipalities, the two events increased the vulnerability of service delivery systems, and particularly electricity supply. Where the impacts are evident in the data, this report highlights them as anomalies to the overall trend.

SHOCK: COVID-19 PANDEMIC

South Africa responded to the Covid-19 pandemic by implementing three cycles of a nationwide lockdown, starting in March 2020. These dictated severe restrictions on individual movement, the closure of schools and non-essential businesses, and a complete ban on sporting events and public gatherings (WHO, 2021; Staunton, 2020). The pandemic itself extended over four waves of infection, but by the final wave, much of the population had been vaccinated and the risk of mortality had significantly reduced. As a result, further lockdown phases in the first quarter of 2022 were avoided.

Figure 4: National state-of-disaster alert levels, overlaid on daily new confirmed Covid-19 cases

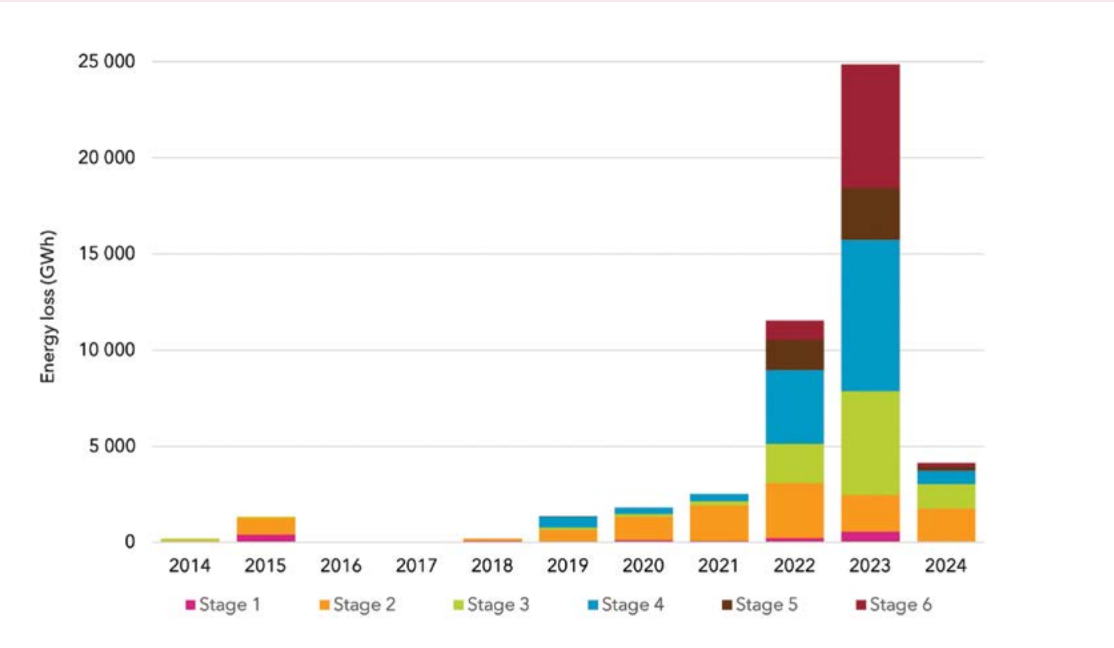


Sources: South African Government, WHO (2021)

SHOCK: LOAD-SHEDDING AND THE NATIONAL ENERGY CRISIS

South Africa's national electricity supply crisis was marked by frequent load-shedding due to unplanned breakdowns at major power stations, along with delays in returning plants back to operation. This resulted in stage 4 and higher load-shedding levels being implemented almost continuously in certain years. Load-shedding took place on 157 days in 2022, and 290 days in 2023. This resulted in unmet energy demand of 11,5 TWh and 24,9 TWh respectively, equivalent to 5% and 11% of annual national demand (CSIR, 2024), and reduced the potential growth in gross domestic product (GDP) by at least 0,7% and 1,4% respectively for the two years, according to estimates from the South African Reserve Bank (Loewald, 2023).

Figure 5: National load-shedding by stage



Source: CSIR (2024)
**Note: While the 2024 data covers the year up until June only, minimal load-shedding was experienced after April 2024.*

Box 2: Working from home as the new norm

Alongside the pandemic's immediate disruptions, one enduring structural shift has been the rise of hybrid and remote work – reshaping energy use across homes, offices and transport. These changes now appear to have become accepted practice, at least in part.

Prior to the Covid-19 pandemic, remote work in South Africa was virtually non-existent. Only about 1,2% of job advertisements offered remote options in early 2020. However, the pandemic triggered a major shift. By 2022, 56% of employed South African adults were either working from home permanently or adopting hybrid arrangements. Even by early 2024, despite efforts by employers to bring staff back on-site, more than half of employees continued working from home as part of a hybrid model (part of the week at the office, and part at home). By early 2025, however, overall remote or hybrid job listings were modest (4% of vacancies), although the information technology sector stands out, with roughly 11% of its job listings offering remote or flexible work, up from 2% in 2019. (See sections 2.4.1.2 and 2.4.1.3 for sector-level impacts.)

<table>
<tr><th rowspan="2">COUNTRY</th><th rowspan="2">PRE-COVID WORK FROM HOME</th><th colspan="3">POST-COVID</th></tr>
<tr><th>WORK FROM HOME</th><th>HYBRID MODEL</th><th>IN-OFFICE WORK ONLY</th></tr>
<tr><td>Australia</td><td>5%</td><td>36%</td><td colspan="2">62%</td></tr>
<tr><td>United States</td><td>4%</td><td>8%</td><td>30%</td><td>58%</td></tr>
<tr><td>Europe</td><td>5%</td><td>8%</td><td>30%</td><td>57%</td></tr>
<tr><td>South Africa</td><td>1%</td><td>10%</td><td>29%</td><td>60%</td></tr>
</table>

Sources: Duja Consulting (2025); Malinga (2025); Stevens (2025); Munyeka (2024)

1.1 Structure of this report

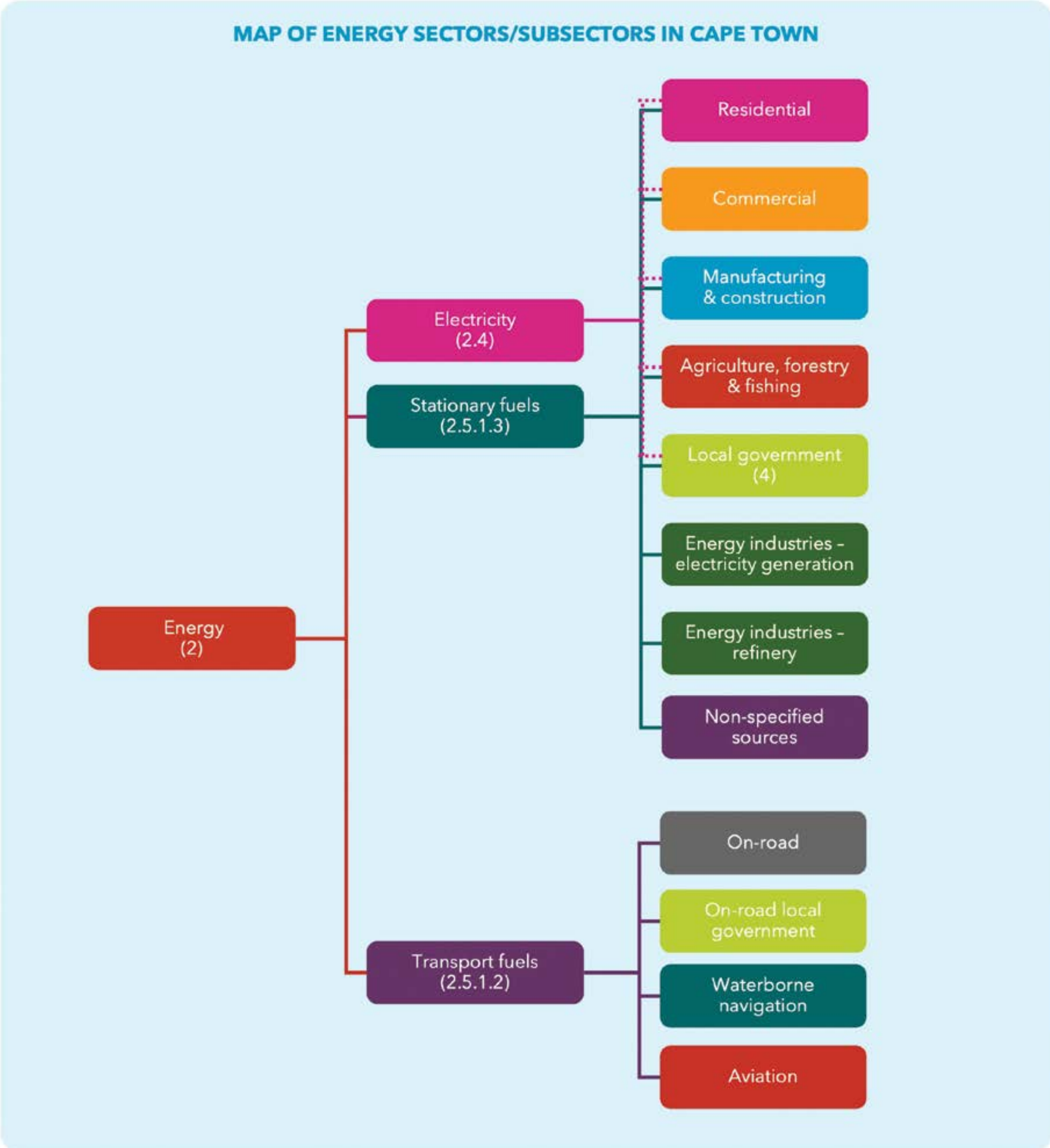
This **first chapter** provides the rationale for the SOEC report; describes the megatrends of Covid-19 and load-shedding, which have shaped much of the data presented in the report; describes what information is contained in the report; and touches on data quality, which is an important factor in interpreting the data.

Chapter 2 then explains where Cape Town's energy comes from and how it is used. It shows which sectors consume each type of energy, and in what quantities. The chapter is organised into two main sections: one focusing on electricity, and the other on solid, liquid and gaseous fuels (see Figure 6 for a chapter map by energy type). Each of these main sections begins with an overview of sectoral energy use and trends (see Figure 7 for a chapter map by sector and subsector), followed by sections structured around the four guiding principles that underpin the City's vision for energy security, namely reliability, affordability, carbon neutrality, and resilience.

Figure 6: Map of Cape Town's energy sources

Source: UN Stats (2018)

Figure 7: Map of Cape Town's energy sectors



Chapter 3 outlines Cape Town's GHG emissions, highlighting their sources, how they have changed since 2014 (where data is available), and what these trends reveal about consumption and emission patterns. GHG emissions include those from all energy sources and uses in the city – such as liquid fuels, electricity, solid and liquid waste, and water – as well as emissions from IPPU and AFOLU.

Chapter 4 focuses on the energy and emissions relating to the City's own operations.

As an emerging economy, South Africa faces high levels of debt, poverty and unemployment, and urgently needs sustained economic growth. While the impacts of Covid-19 have receded, and the energy crisis has begun to ease, new and ongoing global challenges, including conflicts, climate change, trade tensions and emerging diseases, continue to affect the economic landscape. Therefore, the core themes of this SOEC report – reliability, affordability, carbon neutrality, and resilience – remain as critical for the future as they have been in the past.

1.2 Data quality

Reliable data is vital for the City's ability to plan, monitor and report on progress towards its energy and carbon-neutrality goals. Without accurate, complete and transparent datasets, decision-makers risk working with partial pictures of the system, which can lead to weak or misdirected interventions. High-quality data is also essential to building public trust, supporting intergovernmental collaboration, and aligning Cape Town's reporting with international best practice.

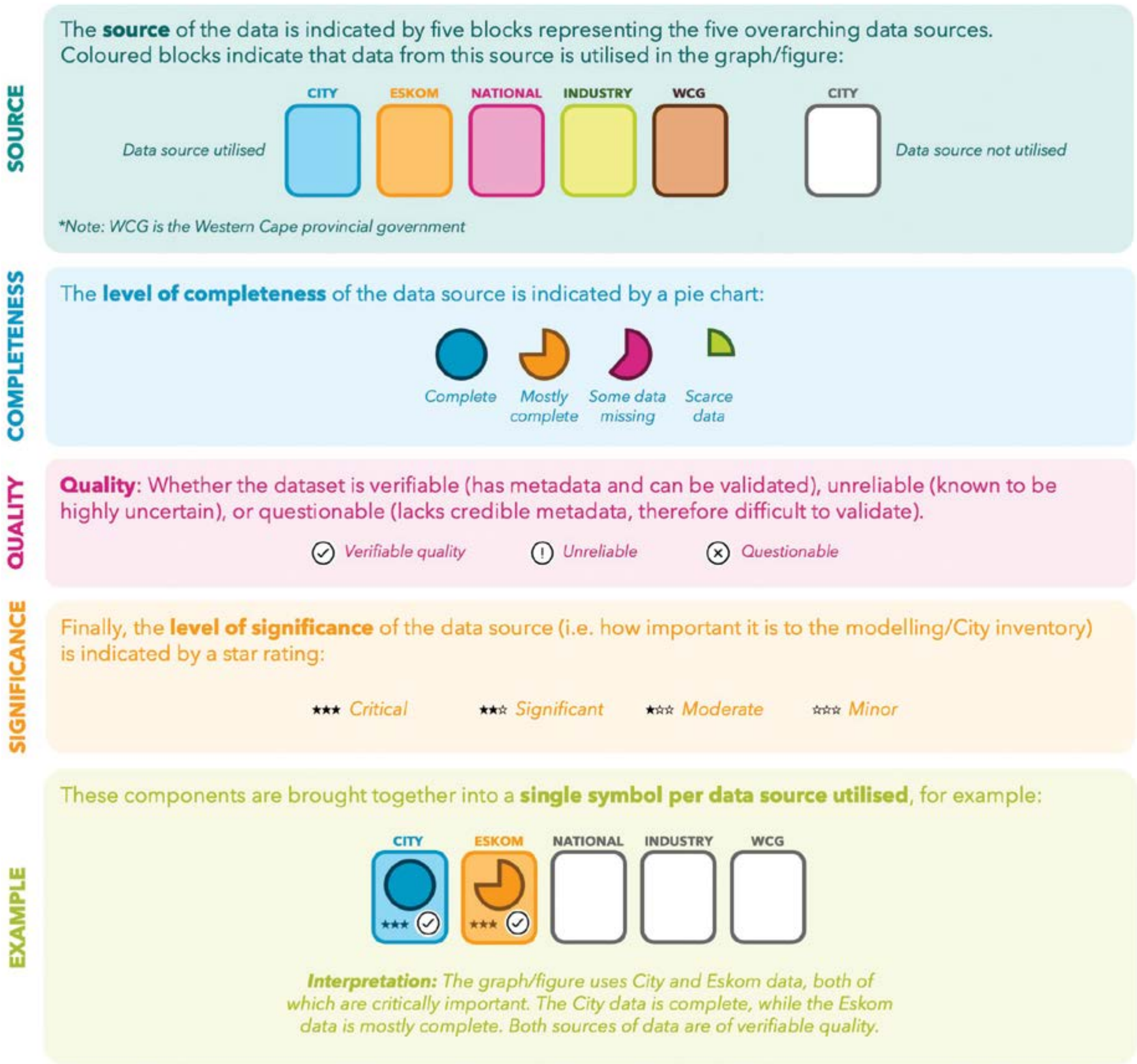
To reflect the importance of data quality, this report introduces a simple data quality key (Figure 8 below), which is used throughout the sections that present energy data and trends. Appearing with each graph or figure, the key indicates:

- **the data source**, i.e. where the data comes from, such as Eskom, National Government, Western Cape Government (WCG), industry or the City itself;
- **data completeness**, i.e. whether the dataset is complete, mostly complete, or has gaps;
- **data quality**, i.e. whether the dataset is verifiable (metadata can be validated), unreliable (known to be highly uncertain) or questionable (lacks credible metadata and, therefore, is difficult to validate); and
- **data significance**, i.e. how critical the dataset is to Cape Town's inventory or modelling (minor, moderate, significant or critical).

This allows readers to see where the evidence base is robust, and where caution should be exercised in interpretation.

Note that the data quality key is only applied in sections that analyse energy supply (source) and demand (sector) trends. It is not used in the sections on reliability, affordability, carbon neutrality, and resilience, nor in the State of Carbon chapter, due to the many data sources, variables and emission factors used in deriving the GHG emissions results. However, the GHG calculations presented there are still based on the same underlying energy datasets.

Figure 8: Data quality key used in the SOEC report



Box 3: A note on Eskom data and the City's data reporting mandate

Accurate electricity data is at the heart of Cape Town's SOEC report and GHG inventory. While the City supplies around 70% of customers (78% of total electricity), Eskom supplies the rest (22% of total electricity). Therefore, to report fully and transparently, both sources must be included.

The City receives complete and reliable records from its own electricity utility, but has faced delays in accessing updated sales data from Eskom. In this report, this meant relying on older Eskom figures from the period 2017–2020 and scaling them up to current levels. Although this allows the City to produce an energy and emissions inventory, the quality of the data is indicated as 'scarce' because the most recent customer sales data is unavailable. It is important to note that this challenge applies only to **Eskom sales data within Cape Town's municipal boundaries**. Other Eskom datasets – relating to electricity generation and plant performance indicators – are well documented and accessible through the Eskom data portal.

Nevertheless, this challenge highlights the need for stronger, more reliable data-sharing frameworks between government entities. Open, standardised data access would allow the City to publish inventories with greater confidence, while also supporting national climate reporting and planning. More on the City's mandate with regard to data reporting can be found in Annexure A.

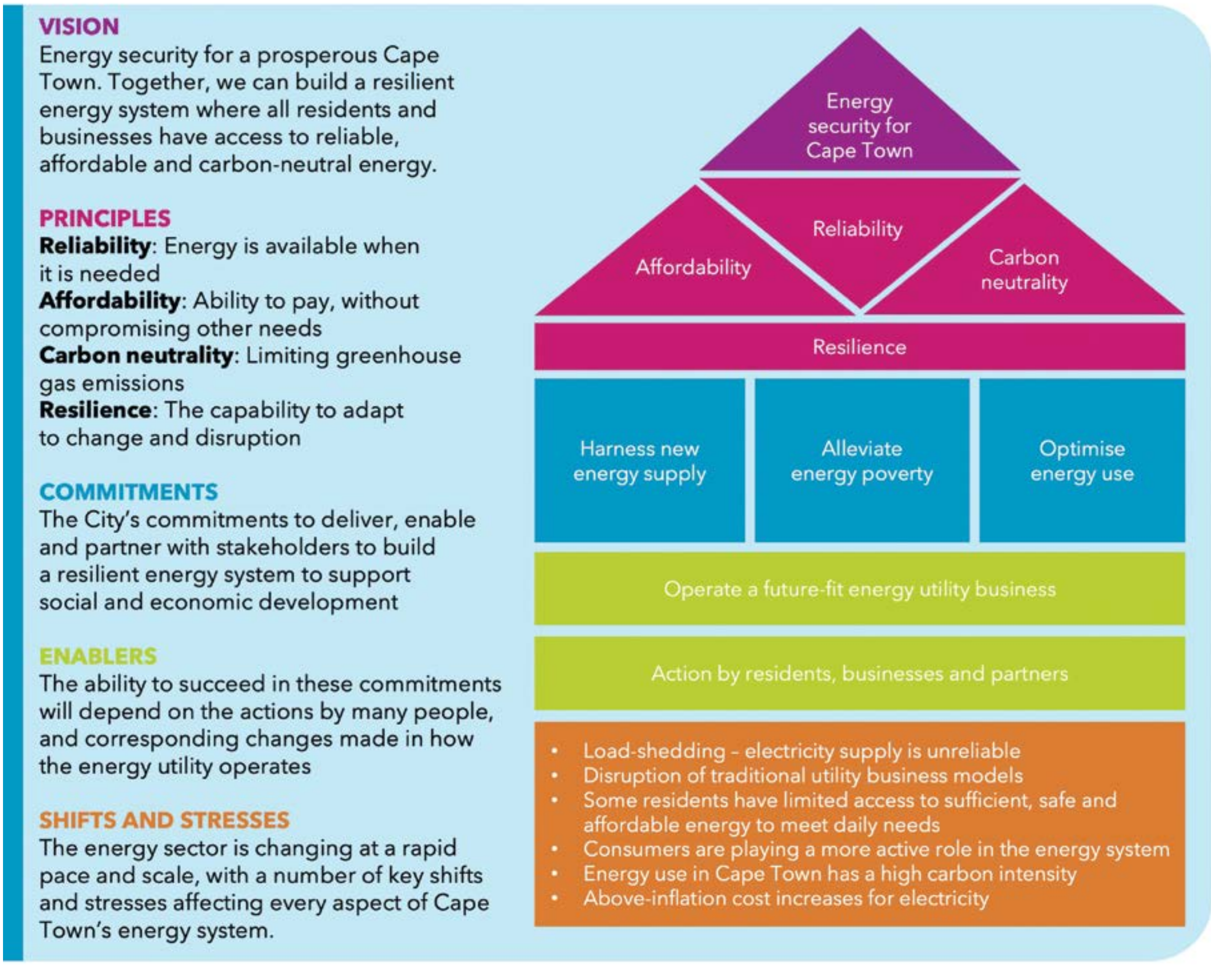
2 State of Energy

2.1 Introduction

Globally, cities account for 78% of all energy consumed and more than 60% of the world's GHG emissions (UN, 2020) because of their high population densities, concentration of economic activity, and sprawling built environments. As urban areas continue to grow, both in size and population, the demand for energy grows. This is why understanding where this energy comes from and how it is consumed, and developing appropriate policies, is essential to long-term sustainability, improved quality of life, and inclusive economic growth.

In 2023, the City approved its ***2050 Energy Strategy***. The strategy charts a path to greater energy security, which is defined as "a resilient energy system where all residents and businesses have access to reliable, affordable and carbon-neutral energy". This bold vision requires the City to track the rapidly changing energy sector and assess whether it is moving towards or away from the strategy's vision and principles. These principle – reliability, affordability, carbon neutrality, and resilience – serve as the lens through which the City evaluates Cape Town's energy system.

Figure 9: Summary of the City's 2050 Energy Strategy



Source: City of Cape Town (2023d)

This section of the report outlines Cape Town's state of energy, including how energy is used, the sources from which it is generated, and how these have changed between 2014 and 2023. The section is divided into three main sections, namely overall energy system trends (2.3), electricity (2.4) and solid, liquid and gaseous fuels (2.5).

2.2 Energy security

According to the City's ***2050 Energy Strategy***, energy security rests on the four interlinked principles of **reliability, affordability, carbon neutrality, and resilience**. The table below reviews Cape Town's main energy sources across these principles, highlighting whether current trends are **stable, improving or declining**, and explaining the underlying drivers. Together, these insights provide a baseline for future interventions and investments that will shape Cape Town's transition to a secure, inclusive and low-carbon energy future.

Overall, energy security in Cape Town has declined in the period 2019–2023, but is showing signs of stabilising. At a system level, this was driven by a significant decline in reliability, as well as decreasing affordability. Improvements in energy security were only evident at the individual customer level for those able to access capital to shield themselves from declining energy security within the system as a whole.

Table 1: Summary of key trends from the State of Energy chapter

	RELIABILITY	AFFORDABILITY	CARBON NEUTRALITY	RESILIENCE
Electricity City supply areas	Stable • Steenbras pumped storage reduces the severity of load-shedding by up to two stages. • System interruption frequency (ASIFI) consistently below thresholds. • Increased spend on replacement of obsolete equipment. • However, reliance on Eskom bulk supply still creates vulnerability.	Stable/declining • Tariffs rising faster than CPI, though City smooths Eskom increases. • Expanded Lifeline tariff protects low-income households. • Affordability remains a challenge for many customers.	Improving • Growth of SSEG and municipal solar projects. • Grid emissions factor slowly declining, with more renewables.	Stable • Increasing share of prepaid customers reduces non-technical losses. • Active revenue protection and metering replacement. • Consistent annual allocation of revenue towards repairs and maintenance. • Small diversification beyond Eskom, though overall share remains low.
Electricity Eskom supply areas	Declining • Eskom EAF fell from 65% (2020) to 55% (2023), only partly recovering in 2024. • Load-shedding risks remain high.	Declining • Above-inflation tariff increases (250% since 2014 vs 60% CPI). • Costs passed through to municipalities and end users.	Stable/improving • Renewable IPPs increasing, but coal dependence keeps emission factor high.	Declining • Heavy reliance on ageing coal fleet. • Limited flexibility or redundancy in supply.
Liquid fuels transport	Stable • Supply secured via imports and refinery. • Global market shocks can disrupt prices and availability. • Recent investment in refinery.	Declining • Linked to volatile global oil prices and exchange rates. • Rising costs affect freight and private mobility. • Transport making up a larger proportion of expenditure.	Declining • Small increase in public transport and EV uptake. • Transport sector remains highly carbon-intensive.	Stable • Mature supply chain, but highly exposed to global shocks. • Limited national refining capacity increases vulnerability.
Liquid and gaseous fuels stationary energy	Stable • Used mainly in industry and households for heating/cooking. • Supply relatively consistent through imports.	Stable • Prices sensitive to international markets, but less volatile than transport fuels.	Declining • Use of LPG, paraffin and diesel remains carbon-intensive. • Some substitution with cleaner fuels, but limited. • Use of liquid fuels in stationary applications is linked to load-shedding.	Stable • Availability generally secure, though affordability constrains access for poorer households.

	RELIABILITY	AFFORDABILITY	CARBON NEUTRALITY	RESILIENCE
Solid fuels	Stable • Supply for industrial users remains reliable via national logistics.	Declining • Relatively low-cost energy source, but subject to carbon tax.	Declining • Highly emissions-intensive, incompatible with carbon-neutrality goals. • Significant fuel-switching appears to have taken place.	Declining • Dependence on coal exposes industry to regulatory risks, and possible future supply constraints.
Emerging fuels: Hydrogen	Stable (emerging) • Still in pilot phase (HyTra, Sasol MVP). • Potential to support industrial resilience in the future.	Stable (expensive) • Green hydrogen remains approximately 3x the cost of grey hydrogen. • High transport and infrastructure costs slow uptake.	Improving (future) • Key to decarbonising hard-to-abate sectors (steel, chemicals, heavy transport).	Stable (emerging) • Strategic investment and Western Cape roadmap set foundations. • Risk of slow market development and stranded assets.

KEY Improving Stable Declining

Energy security in Cape Town cannot be understood by looking at individual energy sources in isolation. The city's energy ecosystem is highly interconnected: Vulnerabilities in one supply chain can ripple into others, and interventions in one area can unlock benefits across the system. For example, Eskom's declining generation availability has driven both load-shedding and tariff increases, which, in turn, have accelerated the uptake of SSEG and battery storage. Similarly, the volatility of liquid fuel prices not only affects transport costs, but also influences household and business decisions around the use of electricity, efficiency measures and fuel substitution.

This interconnectedness underscores the importance of assessing energy security across the principles of reliability, affordability, carbon neutrality, and resilience, while recognising that progress or decline in one principle can have compounding effects elsewhere. Reliability and affordability, for instance, can be in tension with each other. Investment in infrastructure to improve system reliability can lead to an increase in electricity tariffs and heighten energy poverty. The latter remains a major challenge; many households, particularly in informal areas, still rely on paraffin, candles and solid fuels as substitutes or backups when grid electricity is unaffordable or unavailable. These coping strategies highlight the need for integrated policy that simultaneously addresses affordability, infrastructure access and service reliability, rather than treating them as separate concerns.

Apart from growing energy poverty, there is another, equally important trend that will challenge energy systems. As fossil fuel use diminishes, particularly in the transport sector, the electron economy, which is driven by the use of electricity, must expand. This trend is already visible in the Cape Town data, which shows some diversification of the energy source and the gradual uptake of EVs in the private and public transport sector. Greater reliance on electricity will require that systems of electricity supply and distribution meet all the standards as outlined in this section, but at a greater scale. Electricity must be reliable, affordable, carbon-neutral and resilient. If the economy and daily life is to rely on the electron, it is imperative that energy security is suitably prioritised.

Carbon neutrality and resilience, meanwhile, are long-term goals that shape Cape Town's trajectory towards sustainable development. Expanding renewable energy and energy efficiency lowers the city's emissions intensity, while reducing dependence on Eskom's coal-based supply. At the same time, resilience depends not just on diversifying energy sources, but also on protecting infrastructure against theft, vandalism and climate-related risks. The growth of decentralised solutions such as rooftop solar and batteries demonstrates how carbon neutrality and resilience can reinforce each other, delivering a cleaner energy supply that also enables greater autonomy from system shocks. Yet these benefits remain unevenly distributed, with higher-income households and businesses better able to invest in such solutions. The challenge for Cape Town, therefore, is to leverage these transitions in ways that broaden access, reduce inequality, and build an inclusive and secure energy future.

2.2.1 The City's mandate: control, influence and concern

Like all other local governments in South Africa, the City has defined legislative competences, responsibilities and powers. Some functions fall exclusively in the domain of local government, while others are shared with other spheres of government. The City's area of control includes core responsibilities such as the provision of basic services, for which it is fully accountable.

However, not all key infrastructure and regulatory decisions that affect the options available to the municipality, businesses and residents are within municipal control. Decisions made by other spheres of government and state-owned enterprises can act as critical enablers or barriers to economic growth and poverty reduction in the city. Many functions outside of the City's direct authority still fall within its area of influence, where collaboration with government departments, state-owned entities, non-governmental organisations and other partners can help address residents' needs.

Finally, some issues fall within the City's area of concern, where it has limited ability to influence decisions, resource allocation or service quality. In these cases, the City prioritises partnership and cooperation, but also holds other spheres of government accountable for fulfilling their constitutional and legislative obligations in the interests of residents.

Figure 10: The City's mandate: control versus influence and concern

Figure 11 below summarises the key indicators presented in sections 2.4 and 2.4.6, showing whether the City has direct control over the indicator, whether it acts through influence, or whether the indicator reflects a critical aspect of the energy system that falls outside the City's control.

Figure 11: Indicators by area of concern, influence and control

INDICATOR	AREA OF CONCERN	AREA OF INFLUENCE	AREA OF CONTROL
ELECTRICITY			
Reliability			
Reliability of the national grid	■		
Extent of national load-shedding	■		
Load-shedding mitigation interventions			■
Sustained maintenance investment			■
City of Cape Town main substation load status overview (2024)			■
Average system interruption frequency index (ASIFI)			■
Performance of public lighting			■
Public perception of energy reliability		■	
Affordability			
Electricity tariff trajectory and affordability implications	■		
Energy affordability gaps reflected in primary lighting and cooking sources		■	
Targeting free basic electricity to support household affordability			■
Expanding access via subsidised electricity connections			■
Affordability of SSEG and battery storage	■		
Carbon neutrality			
Overall emissions intensity of electricity use in the city		■	
SSEG in the city		■	
Total capacity of approved, grid-tied and commissioned SSEG installations		■	
Total number of approved, grid-tied and commissioned SSEG installations		■	
Resilience			
Total electricity losses			■
Diversity of City electricity supply			■
Financial resilience of the electricity utility			■
Average system interruption duration index (ASIDI)			■

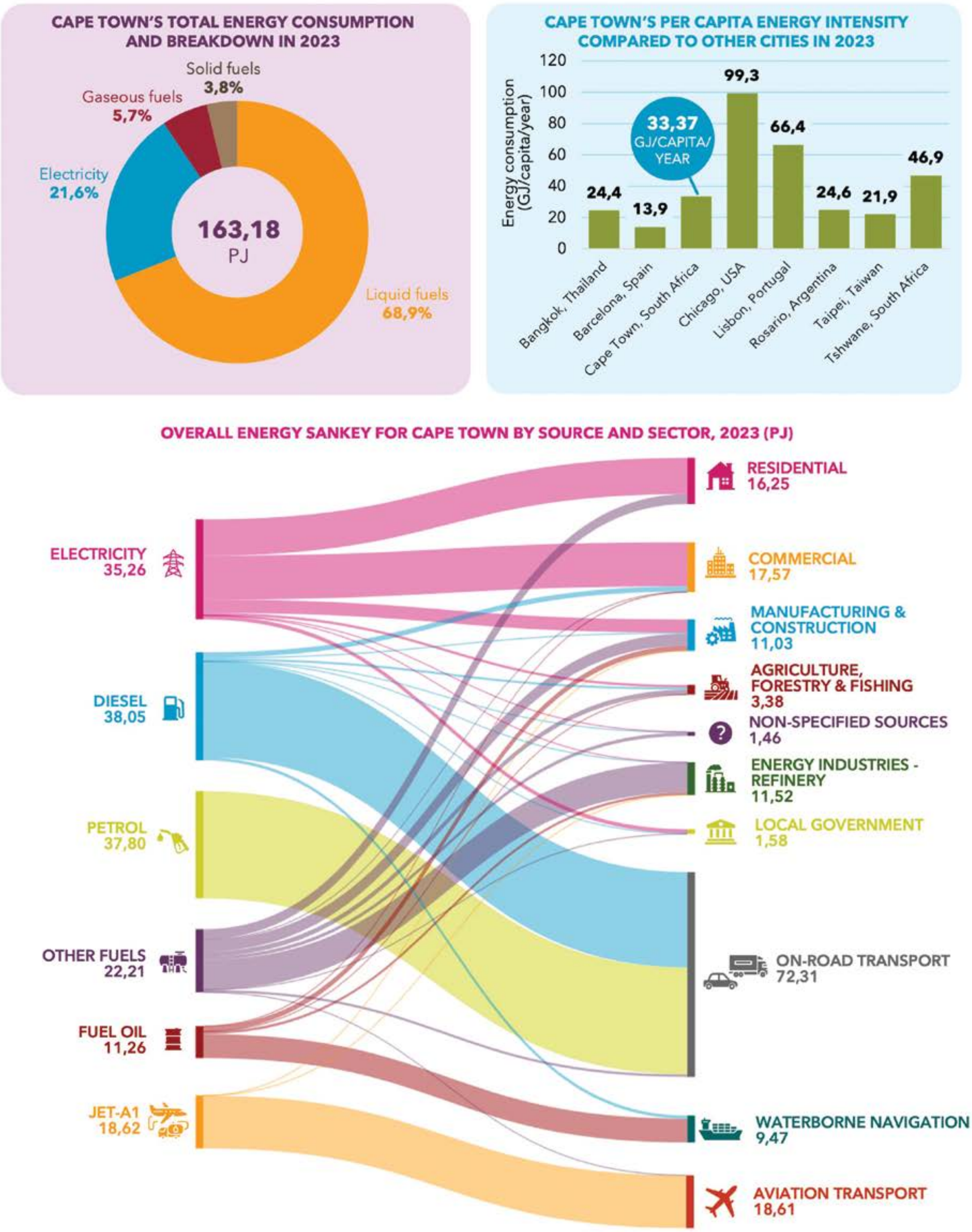
INDICATOR	AREA OF CONCERN	AREA OF INFLUENCE	AREA OF CONTROL
SOLID, LIQUID AND GASEOUS FUELS			
Reliability			
Fuel import dependency and supplier diversity	■		
Affordability			
Liquid and gaseous fuel costs	■		
Solid fuel costs	■		
Carbon tax	■		
Transport affordability		■	
Carbon neutrality			
EV sales and charging infrastructure in Cape Town		■	
Lower-carbon fuels		■	
Emissions intensity of solid, liquid and gaseous fuel use in the economy		■	
Resilience			
Ability to maintain fuel supply during major disruptions	■		

2.3 Overall energy trends

The 2023 energy balance (see Figure 12 below) shows that Cape Town consumed 163 petajoules (PJ) of energy, equivalent to 33 GJ per capita per year. This per capita figure is broadly comparable to other middle-income cities, but significantly lower than energy-intensive global cities such as Chicago or Tshwane. Cape Town's energy system is heavily reliant on fossil fuels: Liquid fuels alone account for 69% of total supply, followed by electricity (22%), gaseous fuels (6%) and solid fuels (4%). The largest energy carriers are diesel (23,2% of total supply), petrol (23,0%), electricity (22%), fuel oil (11,4%), and jet fuel (11,3%). Other fuels include coal, coke, refinery gas, (LPG), liquified natural gas (LNG), biogas, wood and paraffin.

The Sankey diagram in Figure 12 illustrates how these energy sources are distributed across sectors. On-road transport dominates consumption, being responsible for 44% of demand, followed by commercial buildings (10,8%), aviation (11,4%) and residential buildings (10,0%). The visualisation highlights Cape Town's strong dependence on transport fuels, while showing that direct residential fuel use is relatively small, even though affordability challenges make this a critical area for policy attention.

Figure 12: Overview of Cape Town's energy system, 2023



Notes: *Electricity generation industries (Ankerlig and Acacia) is on both the supply and the demand side, as diesel is used to generate electricity. Therefore, diesel for electricity generation is excluded from the final diesel count, as it is already accounted for under energy industries.*
Includes scope 1, 2 and 3 as well as territorial energy from electricity generation supplied to the grid. Transmission and distribution losses, while included in the Sankey diagram above, are not included in the City's overall energy balance.

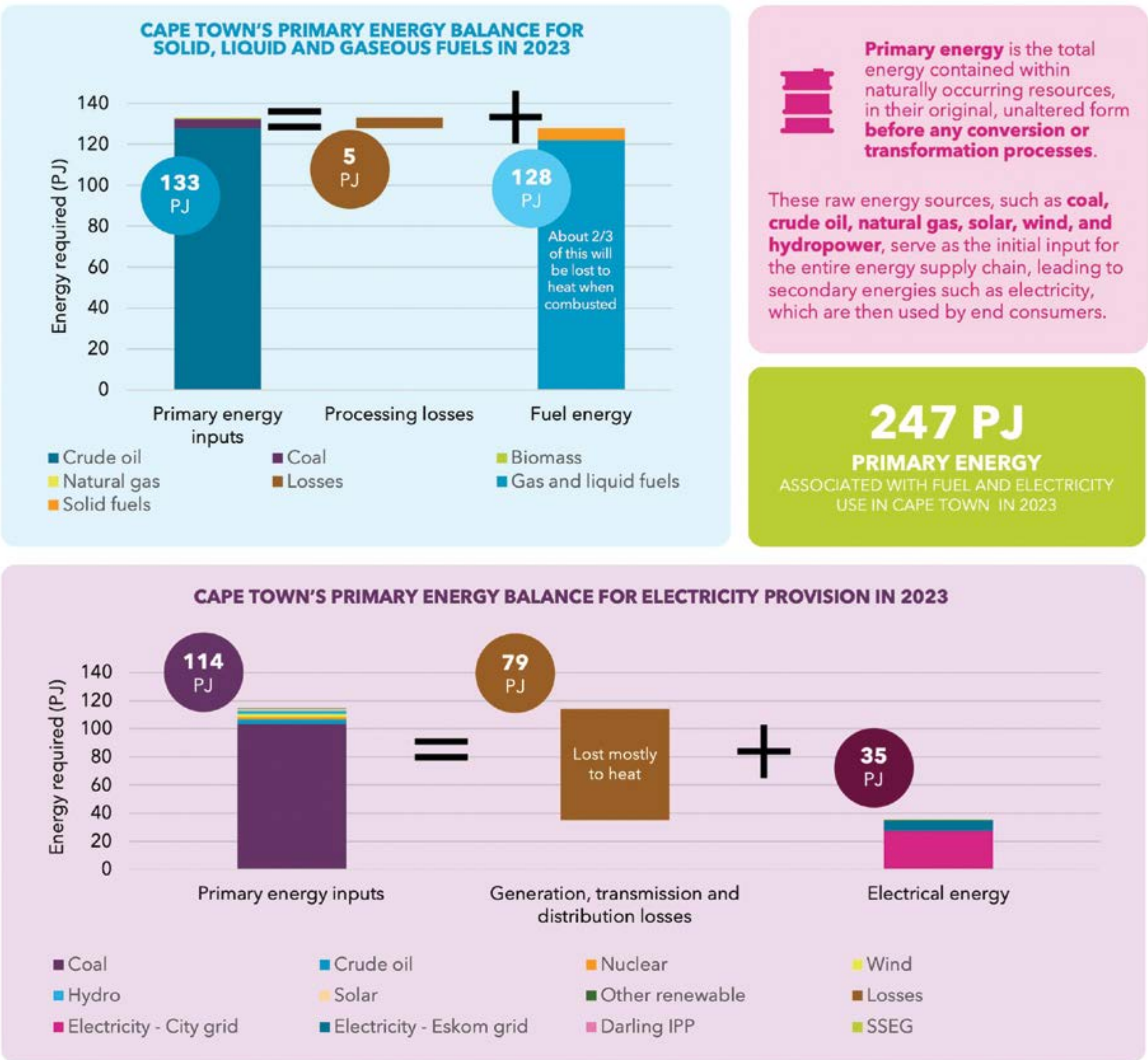
Sources: ACSA (2025); City of Cape Town (2023c, 2025c); DEE (2023); Eskom (2025a); Internal LEAP model; U.S. Energy Information Administration (2024); DFFE (n.d); Transnet (2025); CDP (2024)

A closer look at Cape Town's primary energy demand demonstrates how dependent the city is on different energy resources. Primary energy refers to energy in its raw form, before it is converted intousable fuels or electricity. Examples include crude oil, coal, natural gas, solar, wind and biomass.

In 2023, the city's primary energy supply totalled 247 PJ. More than half of this came from imported crude oil and refined petroleum products. Electricity supplied to the city is still largely generated from coal on the national grid, meaning that most of the primary energy behind Cape Town's electricity use originates from coal. Although local renewable energy sources are growing, their share of the primary energy mix remains modest.

As primary energy passes through conversion processes (such as refining crude oil, or generating electricity), a portion of this energy is lost as heat. The remainder becomes usable fuel or delivered electricity.

Figure 13: Primary energy required to meet Cape Town's energy demand, 2023



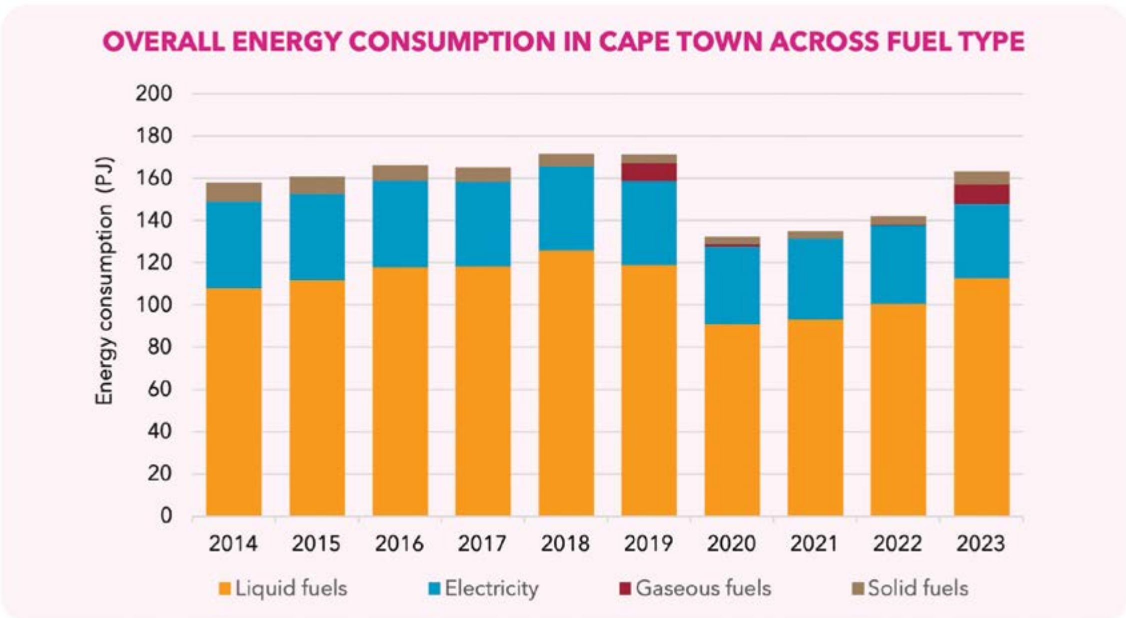
Source: City of Cape Town (2025c)

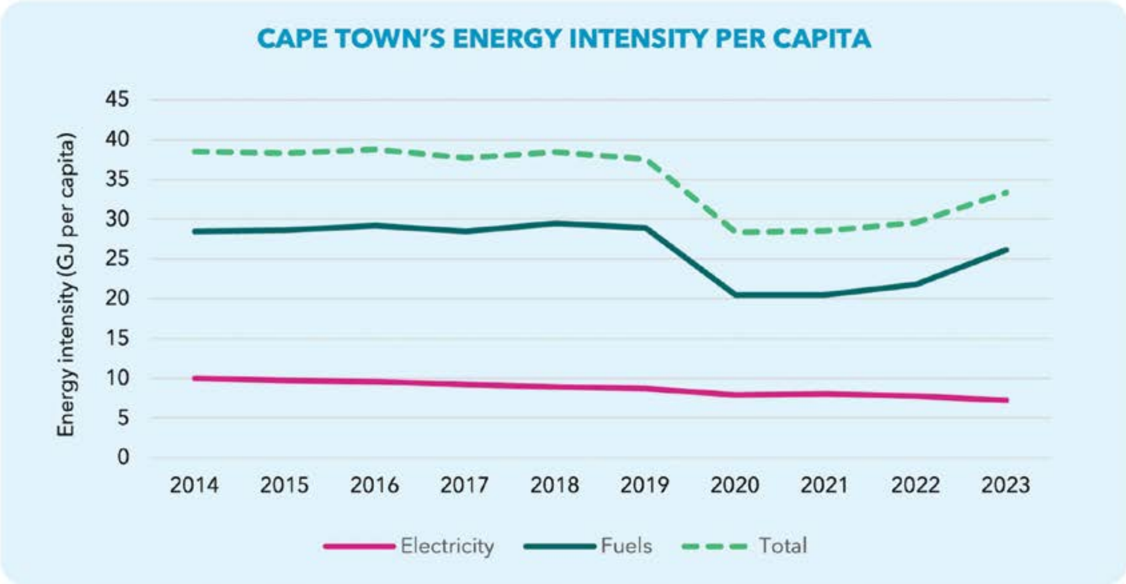
In terms of Cape Town's overall energy consumption trends (Figure 14 below), consumption has remained relatively stable over the past decade, albeit with noticeable fluctuations reflecting economic conditions, geopolitical events and supply disruptions. Between 2014 and 2019, overall consumption grew steadily, reaching just under 170 PJ in 2019. This increase was driven primarily by incremental growth in liquid fuel use, which consistently makes up the largest share of the city's energy mix, while electricity demand showed a slight decline over the same period. Solid and gaseous fuels together make up only a small share of total energy use.

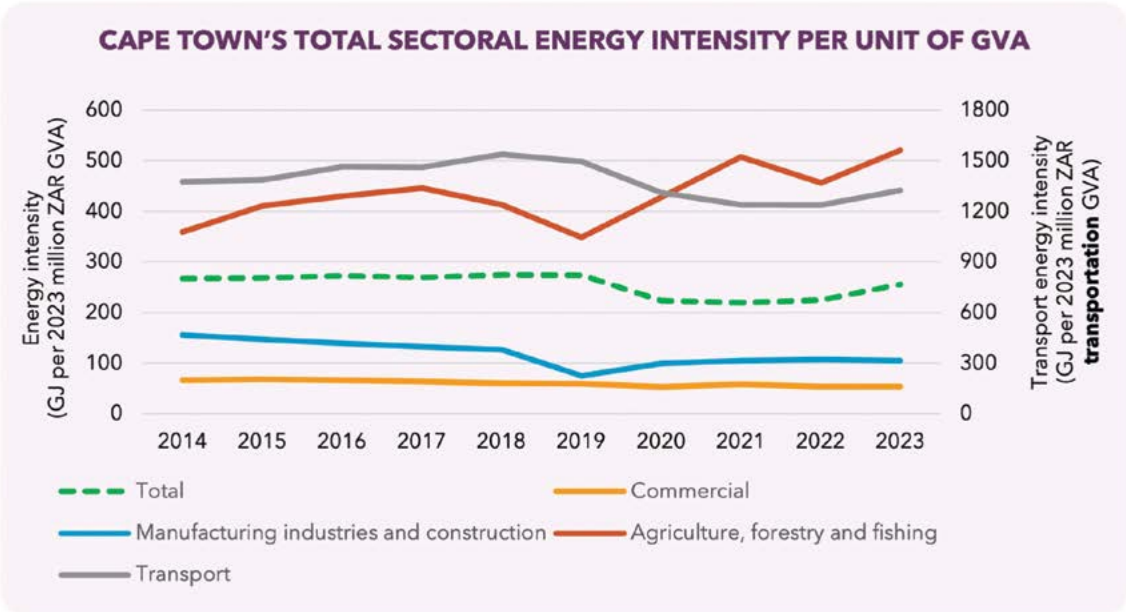
The onset of Covid-19 in 2020 brought about a sharp contraction in energy use; with total consumption dropping below 130 PJ. Both transport fuel use and electricity demand declined significantly as economic activity slowed and mobility was restricted. Although partial recovery occurred in 2021, demand did not fully return to pre-pandemic levels. The subsequent years, 2022 and 2023, show continued volatility, reflecting the combined impacts of economic pressures, load-shedding, and structural shifts in the economy. By 2023, overall energy consumption had risen again, though remaining below the 2019 peak.

The data highlights several important dynamics: Liquid fuels dominate Cape Town's energy system, reflecting the city's dependence on road transport and freight using internal combustion engines. Electricity remains the second-largest energy source, with consumption patterns reflecting a combination of influences, including efficiency improvements and suppressed demand linked to loadshedding and associated supply constraints. Solid fuels (mainly coal) and gaseous fuels (including biogas and acetylene) play only a small role. Overall, the long-term trend points to a city grappling with energy insecurity and volatility, and a continued reliance on liquid fuels.

Figure 14: Overall energy consumption trends







Sources: ACSA (2025); City of Cape Town (2023a, 2025c) DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); (Stats SA, 2025b); Transnet (2025); S&P Global (2025)

While total citywide energy consumption has remained relatively stable over the past decade, Cape Town's total energy use on a per capita basis has declined from around 37 GJ per capita in 2014 to 33 GJ in 2023. This trend reflects the combined effects of population growth and a sharp, temporary drop in fuel use during the Covid-19 lockdown period. As economic activity resumed, fuel consumption rebounded and returned close to pre-pandemic levels, highlighting the entrenched role of liquid fuels in both transport and stationary energy needs. By contrast, electricity use per capita has declined more gradually and consistently over time, contributing to the overall reduction in per capita energy intensity. The drivers behind this structural decline in electricity consumption are explored in section 2.4.1.

While per capita energy intensity shows how energy use is changing relative to the population, energy intensity per unit of gross value added (GVA) explores how efficiently the economy converts energy into economic output. Cape Town's overall energy intensity, measured as GJ per unit of GVA, has remained relatively stable over the past decade, but with notable variations across sectors. Transport is consistently the most energy-intensive sector of the economy, with intensity values averaging more than double those of other sectors, reflecting the near-total reliance on petroleum fuels used in internal combustion engine transport. After peaking around 2017–2018, transport energy intensity declined during the pandemic, and then rose again, although not to pre-2020 levels. Agriculture, forestry and fishing display significant volatility, with energy use per GVA rising sharply in some years – reflecting both the sector's sensitivity to output fluctuations, and its reliance on fuels for machinery, processing and cold storage. Manufacturing and construction have shown a more moderate upward trend in intensity since 2019, suggesting pressures from energy supply constraints and load-shedding, which often necessitate diesel generation, along with this sector being more closely linked with economic conditions. By contrast, the commercial sector remains the least energy-intensive, with values less than a quarter of those observed in transport, consistent with its more service-oriented energy profile.

Taken together, these intensity trends highlight the dual challenge facing Cape Town's energy transition: While the city has achieved reductions in electricity demand per capita and improved efficiency in some sectors, transport and fuel-reliant industries remain highly energy-intensive, exposing Cape Town's economy to volatility in fuel prices and undermining progress towards decarbonisation. At the same time, falling per capita electricity use possibly raises questions of suppressed demand, underscoring the importance of ensuring that energy efficiency and diversification efforts go hand in hand with tackling energy poverty. However, it is difficult to disentangle this decline from load-shedding effects over the same period. Sustained efforts to shift transport away from liquid fuels, alongside measures to support electrification, efficiency and equitable access in households and industry, will be essential to reducing overall energy intensity in line with resilience and carbon-neutrality goals. In addition, given that both electricity and liquid fuels are mostly still derived from fossil fuels and, therefore, linked to high carbon emissions, any attempts to decarbonise the city's energy sources must be linked to alternatives to liquid fuel use in mobility and coal-based electricity production. Such alternatives already exist.

2.4 Electricity

2.4.1 Overview of the electricity system

Electricity is the third-largest source of energy for Cape Town and accounted for almost a quarter (22%) of the city's total energy demand in 2023. Commercial activity was the largest electricity user, responsible for 44% of total demand, followed by households at 36%, and manufacturing at 13%. Smaller yet significant shares were consumed by agriculture and local government operations. These sectoral splits point to the central role of electricity in powering Cape Town's economy, as well as the need for secure electricity supply across a diverse set of end users.

Here is a timeline of milestones and achievements of the City's electricity utility over the 130 years from 1895 to 2025, based on the document *Lighting up the Fairest Cape (1895–1995)*.

Figure 15: 130 years of highlights of the City's electricity utility, 1895–2025

19TH CENTURY

1895 (13 April)
Inauguration of the Graaff Electric Lighting Works – Cape Town's first municipal power station

EARLY TO MID-20TH CENTURY

1897
Completion of Woodhead reservoir, enabling water-powered electricity generation

1903
Claremont power station commissioned

1904
Dock Road power station commissioned

1907
Muizenberg power station commissioned

1961
Athlone power station begins commercial operation

1962
Official opening of Athlone "A" power station

1970s

1973
Athlone gas turbine commissioned

1973
Table Bay power station converted to oil-firing

1974
Table Bay power station shut down due to the oil crisis

1975
Construction begins on the Steenbras pumped storage scheme

1978
Diesel standby generator at Steenbras commissioned

1978
132 kV transmission line to Steenbras energised

1979
First pump-turbine at Steenbras placed into commercial service

1980s

1982
Roggebaai gas turbine commissioned

2000-2009

2000
Creation of the Unicity, consolidating multiple electricity supply authorities

2000-2005
Electricity service integration completed; common standards and tariffs implemented

2001
Athlone, municipal gas turbines and Steenbras operated as a single, coordinated system

2001
Introduction of Free Basic Electricity (FBE) to residential customers in Cape Town

2003
First State of Energy report published

2003
Coal-fired Athlone power station ceases generation (excluding gas turbine assets)

2009
City benefits from over a decade of energy efficiency demand-side management (EEDSM) grant funding:

- Traffic signal retrofit projects
- Energy efficiency pilots in buildings (T5 fluorescent lighting, solar water heaters, power factor correction, air-conditioner timers)
- Streetlight retrofits (mercury vapour replaced by high-pressure sodium; light-emitting diode (LED) technology introduced from 2016)

2018
Signing of the Net-Zero Carbon Buildings declaration

2018
Launch of landfill gas flaring project at the Coastal Park landfill facility

2018
Launch of SmartFacility – an internal web-based municipal energy and water management application

2018-2020
SmartFacility pilot projects implemented:

- Smart water sensor devices at ten facilities
- Digital wallboard screen pilots at selected municipal facilities

2019
Steenbras actively dispatched to mitigate load-shedding (up to stage 2), reflecting a shift towards system resilience

2019 onward
Gas turbines dispatched to maintain notified maximum demand (NMD) below 952 MW during peak demand periods

2020
Athlone power station demolition permit issued; documentation of heritage significance initiated

2021-2022

2021
Energy and Climate Change Directorate realigned and renamed Energy Directorate, with a dedicated focus on energy security

2021
City's Paardevlei 132 kV switching station commissioned

2022
Low-voltage demand response aggregator tender issued to enable incentivised load curtailment during load-shedding

2022
Centenary of Steenbras lower dam commemorated

2023-2025

2023
Athlone power station declared a provincial heritage site

2023
Utility-scale battery energy storage system (BESS) roadmap approved

2023
Athlone gas turbine placed into mothballing status; Roggebaai gas turbine remains operational

2023 (26 October)
City's 2050 Energy Strategy approved by Council

2023
Introduction of a 25 c/kWh incentive top-up to the SSEG feed-in tariff

2023
125 kW solar PV system commissioned at Gugulethu depot

2023
Phase 1 of energy performance certificate (EPC) compliance completed, with 69 municipal assets compliant; next 50 assets identified

2023
Outage management system (OMS) pilot phase completed

2024 (December)
City wheeling pilot concluded, with three active one-to-one bilateral agreements

2025
Launch of the online energy services application platform to streamline applications for new or modified electricity connections

Sources: Palser, n.d. and City of Cape Town utility (1995-2025)

1909
Introduction of alternating-current (AC) generation in Cape Town

1913
Suburban municipalities unified into the City of Greater Cape Town

1923
Salt River No.1 power station commissioned

1932
Pooling agreement signed with Eskom to share generation capacity

1939
Table Bay power station commissioned

1952
Hex River power station commissioned

1953
Table Bay power station reaches full commercial operation

1955
First 66 kV gas-filled cable commissioned

1957
Pooling agreement with Eskom expires

1960
Introduction of Hire Purchase Scheme

1983
Table Bay power station decommissioned

1985-1994
Athlone power station placed on standby

1986-1989
Demolition of Table Bay power station completed

1987
Eskom begins to phase out capacity allocation arrangements

1989
Steenbras lower reservoir capacity increased by 16%

1990s

1990-1996
Major refurbishment of Steenbras pump turbines and pressure shafts

1994
Salt River No.2 power station decommissioned

1995 (11 January)
Athlone Power Station returned to commercial operation.

1995
All municipal power stations formally licensed under the national regulatory framework

1997
Completion of epoxy-lined penstock refurbishment at Steenbras

2010-2016

2010
Athlone power station cooling towers demolished

2012
Start of roll-out of advanced metering infrastructure (AMI) across municipal facilities

2013-2018
Major refurbishment works initiated at the Steenbras pumped storage scheme main plant

2014
Implementation of outage management system starts to improve outage response capabilities

2014
SSEG guidelines published; SSEG feed-in tariff introduced; first grid-tied SSEG project approved (Black River Park solar PV plant)

2014
City's first rooftop solar installation on an existing municipal building commissioned at Gallows Hill Traffic Department

2016
City's requirements for SSEG formalised, and later standardised and endorsed by Association of Municipal Electricity Utilities and South African Local Government Association

2017-2020

2017
Sustainable Energy Markets (SEM) Department established under the Energy Directorate, marking a strategic shift towards energy diversification, efficiency, energy poverty alleviation, and engagement with independent power producers (IPPs) and residents

2018
Directorate renamed Energy and Climate Change by Council resolution

2021
Steenbras operationally connected via the Paardevlei switching station, improving system integration

2021
Refurbishment of the Table Mountain landmark lighting system commenced

2021
Corporate GIS Business Portal dashboards created for SmartFacility, displaying:
- energy, solar and water consumption;
- baselines, targets and savings; and
- associated carbon emissions.

2021
Full climate change function incorporated into the SEM Department

2021
City's Climate Change Strategy approved by Council

2022
Mayor's priority programme "Energy security for economic growth" launched, focusing on load-shedding mitigation, SSEG streamlining, utility reform, and the City's Energy Strategy

2022
Climate change function transferred from SEM to the Risk and Resilience Department

2022
By October 2022, 980 of 1 499 facilities (65%) were equipped with 1 351 smart meters, targeting larger municipal consumers

2022
Embedded IPP programme launched, targeting up to 200 MW of embedded generation

2023-2024
SmartFacility aggregated annual data published on the Open Data Portal, with enhanced dashboards including:
- energy barometer;
- EPC status dashboards; and
- SAP monthly water data integration.

2024 (March-May)
Solar PV installations commissioned:
- 330 kW at Goodwood traffic management centre (March)
- 990 kW at Kraaifontein wastewater treatment works (May)

2024
Launch of an online SSEG application system via the City's e-Services platform

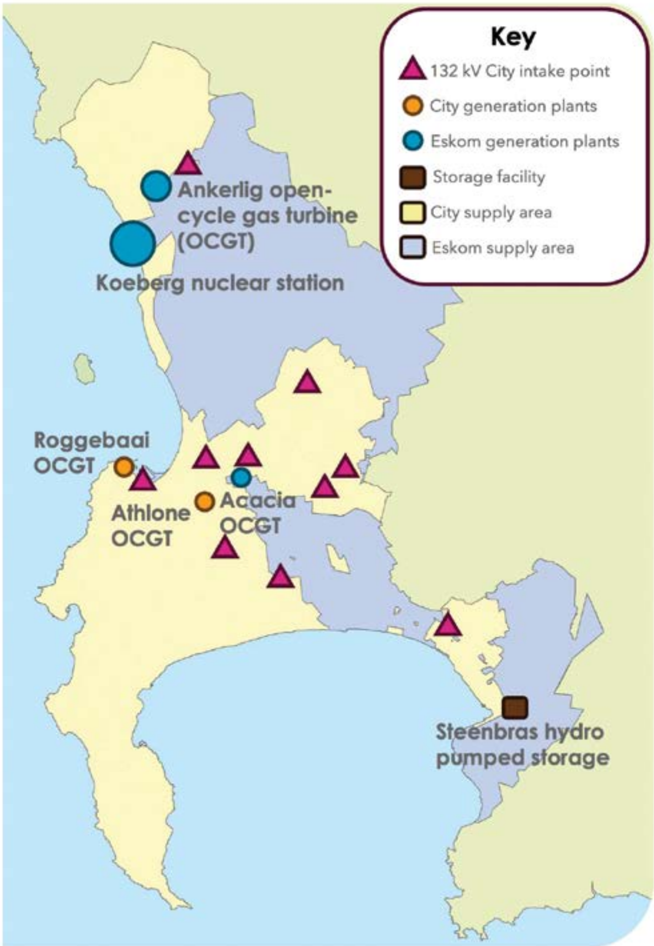
2024
LED upgrade implemented at the Table Mountain lighting system

2024-2025
Steenbras long-term refurbishment procurement relaunched and awarded for staged implementation

2024 (October)
Construction commenced on the Atlantis solar PV project (7-10 MW) - the first implemented utility-scale renewable energy generation project in South Africa to be owned and operated by a metropolitan municipality

Understanding the structure and supply areas of Cape Town's electricity sector is important for purposes of this report. The city's residents and businesses are served by two electricity distributors, namely Eskom and the City's own Energy Directorate, with each entity covering different geographic zones and serving different customer groups, as shown in Figure 16. In 2023, the Energy Directorate supplied 7 446 GWh[1] of electricity (77% of total electricity consumption in Cape Town), serving 628 144 account holders (70%) over an area of 1 334 km^2 (54% of the total municipal area). In the same year, Eskom was estimated to have provided 2 183 GWh electricity (23% of the total consumption), having served an estimated 271 235 account holders (30%) over 1 122 km^2 (46% of Cape Town's total municipal area).[2]

Figure 16: Comparison of City-supplied and Eskom-supplied electricity distribution areas, 2023



TOTAL ELECTRICITY CONSUMPTION AND CUSTOMER COUNT

	City	Eskom (estimated)
Customer count	628 144	271 235
Consumption (GWh)	7 446	2 183
Area (km^2)	1 334	1 122

TOTAL ELECTRICITY CONSUMPTION PER SECTOR (GWH)

	City	Eskom (estimated)
Residential	2 631	878
Commercial, manufacturing industries, construction and agriculture	4 556	1 172
Local government	258	133

[1] Excluding 276 GWh for Steenbras and peaking turbines, and excluding transmission and distribution losses.
[2] The Eskom data for 2021 to 2023 was scaled from a limited dataset.

Sources: City of Cape Town (2023a, 2025c); City of Cape Town Open Data Portal (2025a); Eskom (2025a)
**Note: Excluding energy industries (Steenbras and peaking turbines), and excluding transmission and distribution losses*

Eskom and the City also follow different approaches in how customers are classified for billing and reporting purposes. Eskom applies a dedicated agricultural tariff, reflecting the large number of agricultural users it supplies nationally, which enables agricultural electricity consumption to be reported separately from commercial use. By contrast, the City does not apply an agriculture-specific tariff because of the relatively small number of agricultural customers in Cape Town. These customers are grouped under commercial tariffs, which means that agricultural electricity consumption cannot be identified separately.

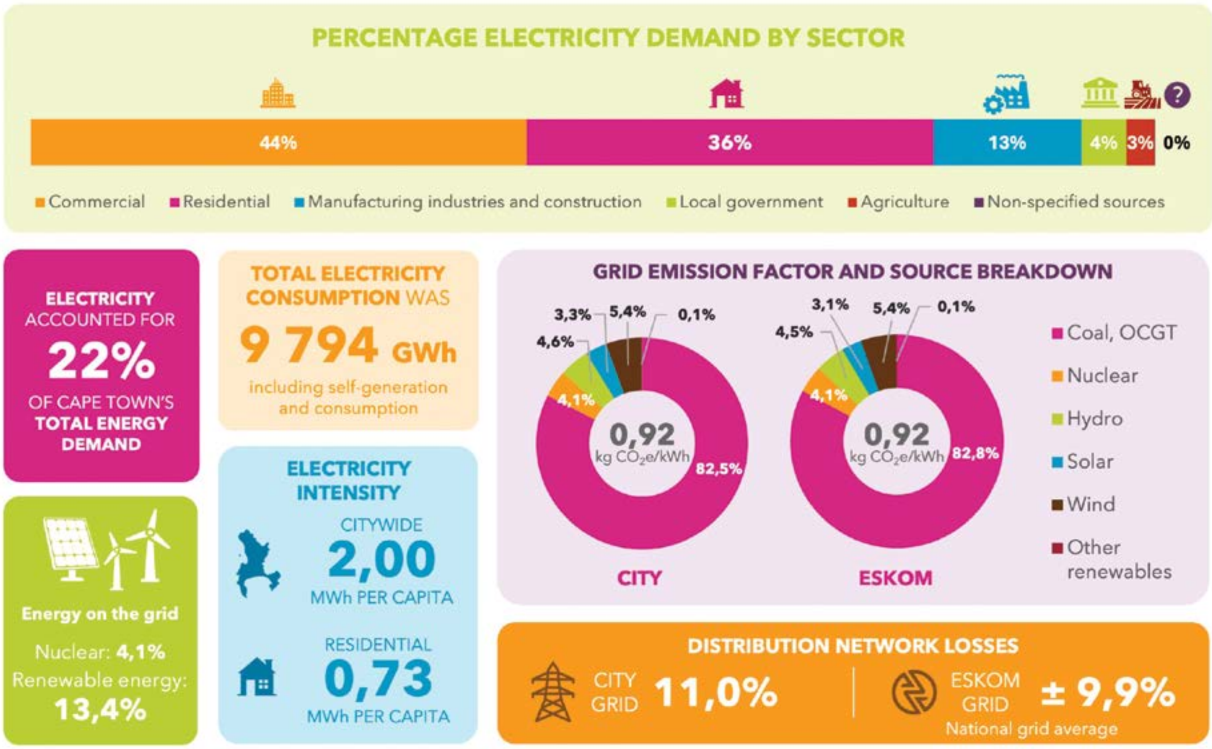
The overall electricity supply and demand picture is shown in the Sankey diagram (in Figure 17 below). The diagram offers a useful perspective of Cape Town's electricity system, showing the main suppliers, how electricity flows to different customer groups, and the relative size of each customer segment. The structure of supply reflects Cape Town's dependence on the national electricity grid, but also its efforts to diversify sources. In 2023, 13,4% of the city's electricity supply came from renewable energy – either directly (e.g. purchased directly from renewable suppliers) or indirectly (forming part of South Africa's national grid mix). This share is growing as local SSEG as well as national and embedded independent power projects increase. Nonetheless, the bulk of supply continues to come from Eskom's coal-based generation fleet, which results in an average grid emission factor (GEF) of 0,90–0,96 kg CO_2e/kWh (DFFE, 2025a), varying slightly between the City and Eskom distribution areas. This variance arises because the City supplements national grid electricity with electricity from a combination of local renewable, storage and peaking generation assets, as well as surplus embedded generation within Cape Town.

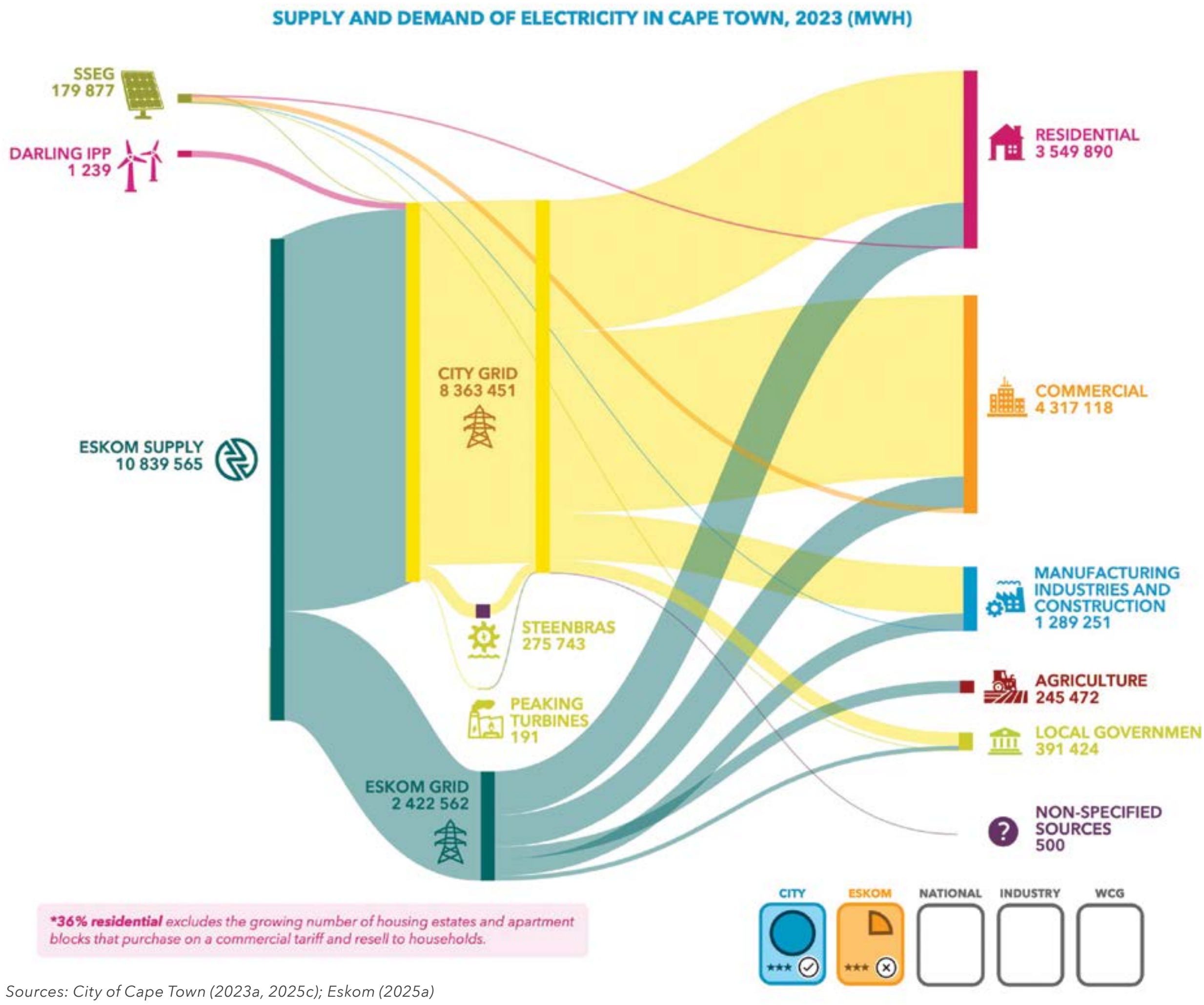
Distribution losses are another important aspect of supply: A total of 11,0% of electricity was unaccounted for on the City's grid, while Eskom reported 9,9% distribution losses nationally for 2023/24. This underlines the importance of managing technical and non-technical losses to strengthen overall system performance.

Electricity intensity provides a measure of how these dynamics translate into end use. On a per capita basis, citywide annual electricity consumption was 2 MWh, with the residential sector using an average of 0,7 MWh per person in 2023. These values point to the significant weight of commercial and industrial demand relative to residential use.

Together, the trends in Cape Town's electricity demand and early shifts in supply composition underscore the challenge of ensuring reliable and affordable electricity access for all customers, while also supporting the decarbonisation of an electricity system still dominated by coal-generated power. The City's ongoing efforts to diversify supply, expand renewable generation and strengthen energy efficiency are central to building a more resilient and sustainable electricity future.

Figure 17: Electricity sources, flows and demand, 2023





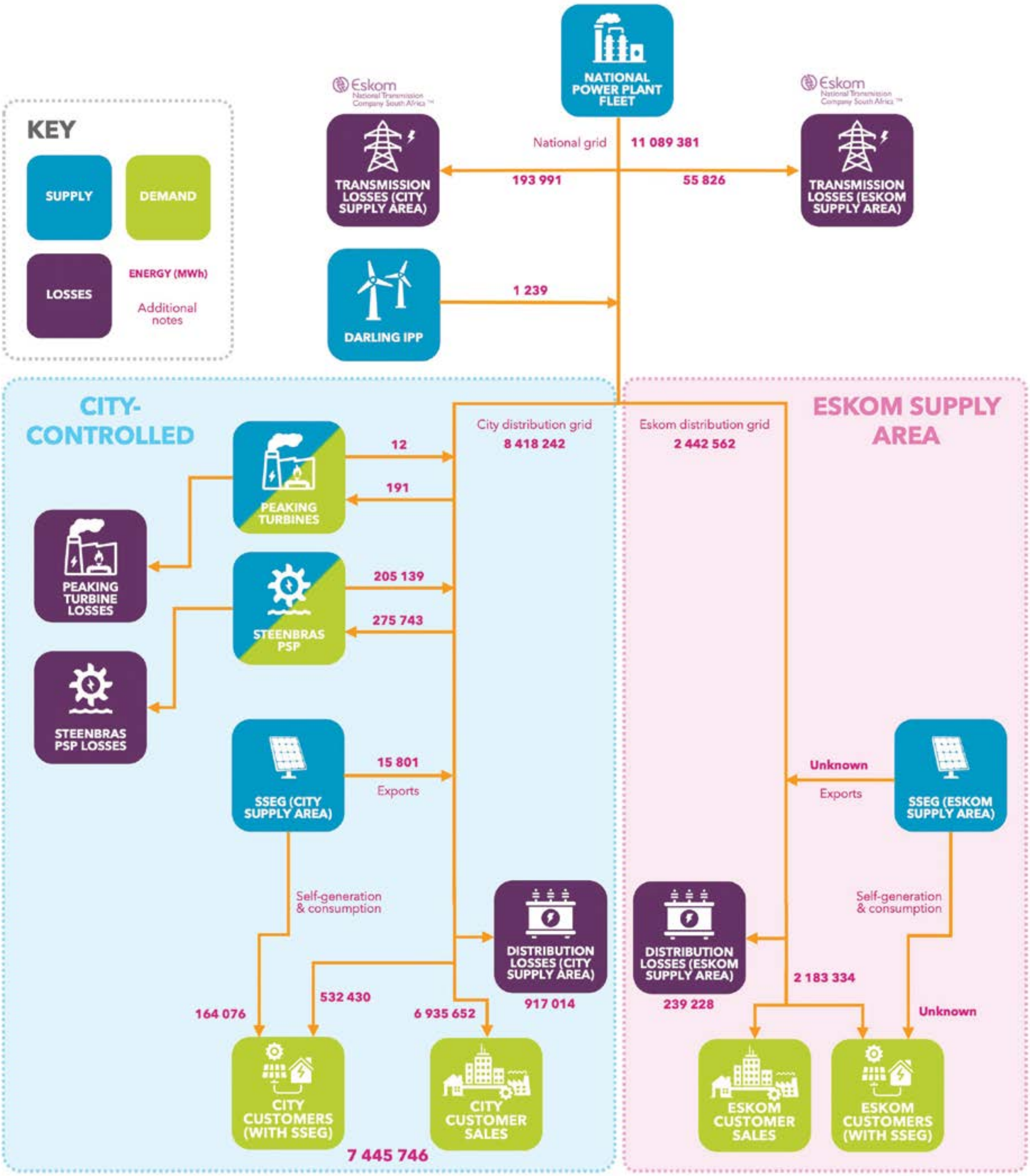
Sources: City of Cape Town (2023a, 2025c); Eskom (2025a)

Figure 18 below provides a detailed breakdown of electricity supply to Cape Town, mapping the balance between national generation, City-controlled plants and embedded sources, and highlighting where distribution losses (technical and non-technical) occur in the process of conducting, transforming and metering power. Electricity supplied to Cape Town originates primarily from the national generation plant fleet, which delivers more than 10 000 GWh across the transmission network and into the distribution networks. These flows are supplemented by smaller yet symbolically important local sources and storage. The Darling wind farm IPP contributes a modest 1 GWh of wind power annually, while the City's own storage and generation assets – Steenbras pumped storage and the gas turbine peaking plants – provide flexible capacity that is dispatched during periods of high demand or system stress. Together, these plants emphasise the importance of locally available resources for strengthening resilience in a system still largely reliant on Eskom.

In 2023, a growing share of supply came from embedded generation within Cape Town itself. SSEG, largely rooftop solar PV, added meaningful contributions, both to on-site customer consumption and exports into the grid. Although these installations still comprise only a small proportion of total supply, with the on-site portion estimated behind the City's meters,[3] they do demonstrate a diversification of the energy mix and support the City's carbon-neutrality goals. Their presence also signals the rising role of households and businesses as 'prosumers', reducing dependence on centralised supply and building resilience against load-shedding. The SSEG estimates provided in the rest of this section only represent the approved, grid-tied and/or commissioned systems in the City-supplied areas for which data is captured.

[3] *Electricity that is generated by on-site solar PV systems and is utilised on-site (i.e. generated and used on-site, without entering the City supply grid) is not measured directly, as the electricity does not pass through a City meter. As such, this electricity is estimated from installed capacity and an average generation factor.*

Figure 18: Cape Town's electricity supply system from generation to final consumption across City and Eskom networks, 2023



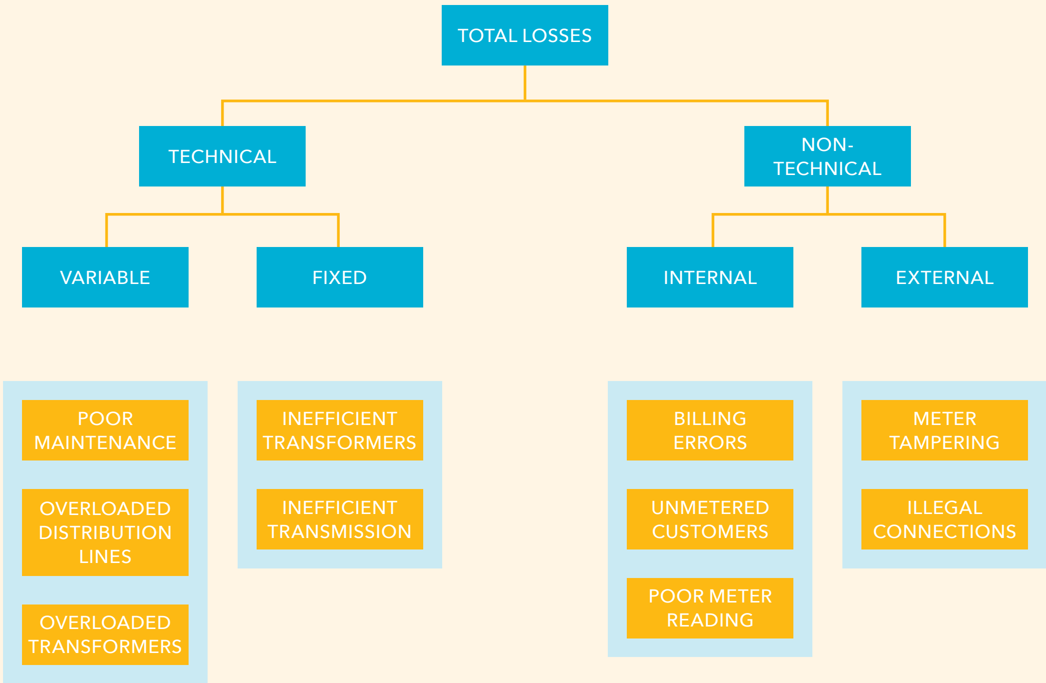
Sources: City of Cape Town (2023a, 2025c); Eskom (2025a)

In part, losses remain an inevitable component of electricity flows, with transmission and distribution losses across both the City and Eskom supply areas exceeding 1 300 GWh, equating to over 10% of total supply. Transmission losses only occur on Eskom's national transmission grid, which supplies electricity to both the City's and Eskom's distribution networks. These losses are similar to technical distribution losses and result from electricity lost in transformers and the physical transmission cables (i.e. electrical resistance).

Distribution losses occur in the City and Eskom distribution networks and include technical and non-technical losses. Box 4 provides more information on what makes up these losses. While these values are consistent with global norms, they confirm the importance of continued investment in efficient infrastructure to manage technical losses, as well as the enhancement of revenue protection from non-technical losses.

Box 4: More on distribution losses

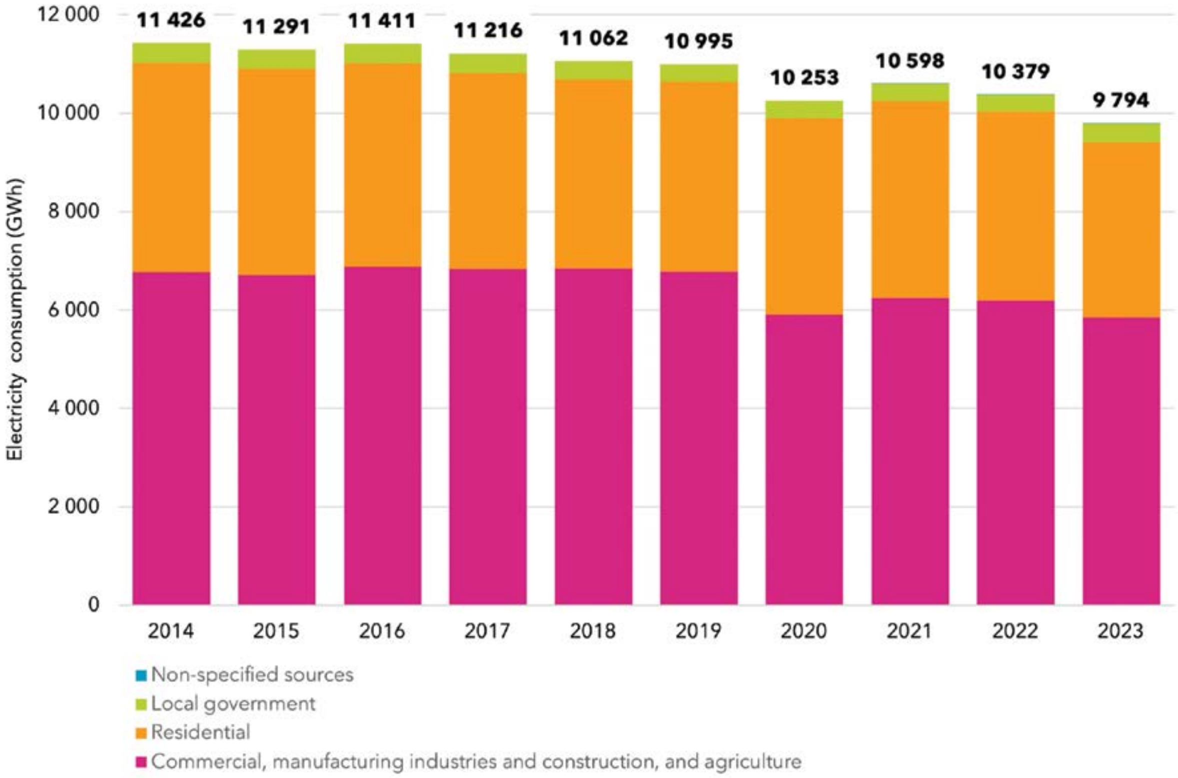
Electricity losses are calculated as the difference between the electricity bought and the electricity sold, and are made up of both technical and non-technical losses (as illustrated below). Technical losses are those that occur during electricity distribution within Cape Town's boundaries. Non-technical losses are other losses that occur during electricity distribution, including theft and unbilled consumption.



2.4.1.1 Electricity consumption trends

Electricity consumption in Cape Town has declined by 14,3% over the past decade, fluctuating between 11 426 GWh in 2014 and 9 794 GWh in 2023. However, the trend since 2019 shows more variability, with consumption dropping below 10 000 GWh in 2023 for the first time in the reporting period. This reflects both the short-term impacts of the Covid-19 lockdown in 2020, which temporarily suppressed demand, with longer-term economic impacts, and the more profound effects of intensified load-shedding in 2022 and 2023. By comparison, the earlier wave of load-shedding in 2015 had only a marginal impact on overall consumption, underscoring how much more disruptive and sustained recent supply interruptions were.

Figure 19: Total grid electricity consumption for Cape Town by sector – City and Eskom distribution networks combined



Sources: City of Cape Town (2025c); Eskom (2025a)
**Note: Excluding energy industries (Steenbras and peaking turbines), and excluding transmission and distribution losses. Residential consumption excludes estates on commercial tariffs reselling to households.*

The sectoral breakdown highlights the ongoing dominance of residential and commercial electricity use, which together accounts for the bulk of sales. Manufacturing and construction contribute a smaller but steady share, while agriculture and local government collectively make up a much smaller fraction of total sales.

The general trend of declining electricity consumption is linked not only to the megatrends of Covid-19 and load-shedding, but also to factors such as stricter energy use standards for buildings, greater energy efficiency in appliances, increases in embedded generation (not all of which is captured in the data presented in this report) and customers' higher price sensitivity due to an escalating electricity price. The relative significance of these factors can be assessed by considering the usage patterns by sector in the sections that follow.

2.4.1.2. Residential electricity consumption trends

This section explores residential demographics, electricity tariffs, trends in electricity consumption as well as the distribution of that consumption for residential subgroups of interest. The affordability analysis in section 2.4.3 discusses the drivers and implications of the observed trends in more detail: tariff increases and falling sales, with affordability pressuring cost recovery (2.4.3.1), persistent energy poverty (2.4.3.2), low-income electricity subsidies (2.4.3.3), electrification (2.4.3.4), and the affordability drivers of SSEG (2.4.3.5). SSEG uptake is further detailed in sections 2.4.4.2 to 2.4.4.4. Section 2.5.1.3.1 provides a complementary overview of residential fuel use, expanding on the available data to build out the trajectory of energy access and energy poverty.

Over the past decade, the city's population has steadily increased, driven by in-migration from other major urban centres, as well as urbanisation. In 2023, only two thirds of households were in formal dwellings, while nearly a third lived in informal housing or informal accessory dwellings (so-called 'backyarder developments'). Projections suggest that by 2030, as much as three quarters of new households in Cape Town will be low-income and mostly informal.

Rapid population growth, particularly in low-income and informal settlements, puts pressure on electrification programmes as well as subsidised services. In 2023, there were around 277 110 informal structures in "areas of informality of varying size and density in Cape Town", excluding backyarders (City of Cape Town, 2025g). These areas mostly include portions of land that are reserved for infrastructure expansion, are on unsuitable or unsafe terrain, or are subject to legal or ownership disputes. The number of such structures is estimated to have grown by 49% since 2018 (City of Cape Town, 2025g), or over 18 000 new structures per annum. While many of these households are ineligible for electrification, this is an order of magnitude greater than the City's annual electrification target, even when allowing for a majority in Eskom-supplied areas. **As a result, households without a formal electricity connection are increasing, and will likely continue to do so.**

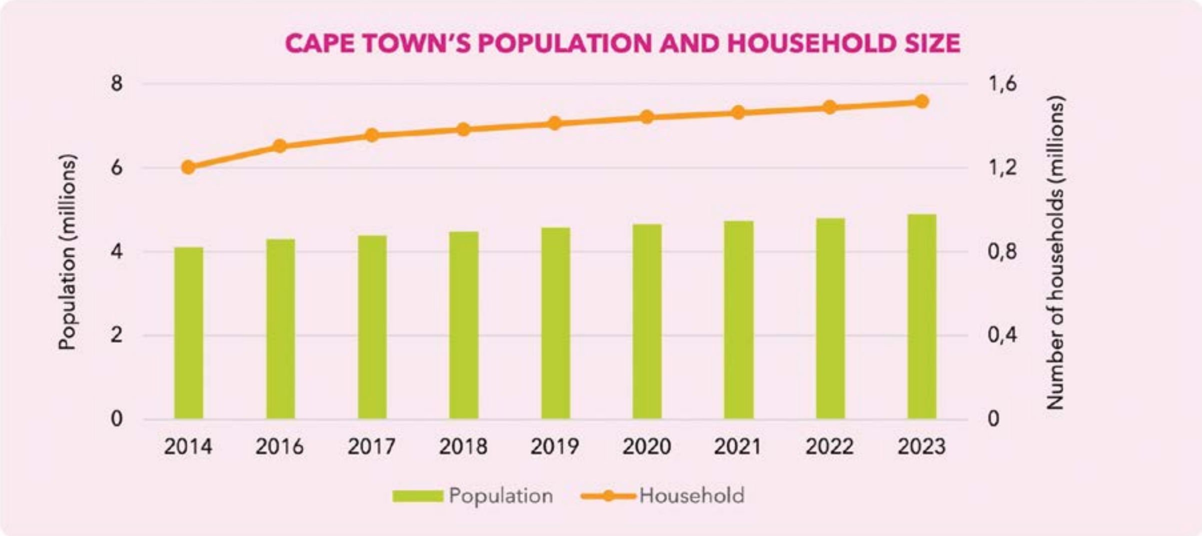
The four residential tariffs shown in Figure 20 seek to balance affordability and cost recovery, while ensuring that subsidies reach households most in need. The shares of customers on each tariff are shown in Figure 21, which also contrasts the distribution of consumption across the tariff groups. Customers on Lifeline tariffs receive both a free basic electricity allocation and subsidised electricity (see Box 5 and section 2.4.3.3 for more details).

Box 5: Policy on free basic electricity

Free basic electricity (FBE) is a South African government policy aimed at providing a minimum level of free electricity to qualifying low-income households, often referred to as "indigent households", to alleviate energy poverty and improve their quality of life. The minimum level of supply is set at a national benchmark of 50 kWh established in 2003. Actual eligibility is determined by each municipality's indigent registration criteria. See section 2.4.3.3 for more.

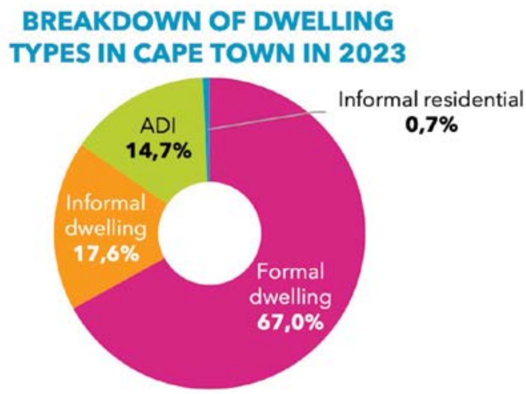
Consumption profiles vary significantly across tariff groups. Despite the FBE allocation, Lifeline customers typically consume less than 350 kWh per month, clustering strongly in the 100–250 kWh range, which is consistent with households who rely on multiple fuels and energy-stacking strategies. Domestic tariff customers show a wider spread of usage, peaking around 200–400 kWh per month, while those paying the Home User tariff demonstrate the highest and most dispersed consumption, with some recording usage levels exceeding 1 000 kWh per month (Figure 21).

Figure 20: Growth in population and households, and composition of dwelling types, 2023



DWELLING TYPES

A **formal dwelling** is a structure built according to approved building plans	An **informal dwelling** or "shack" is a makeshift structure, not erected according to approved architectural plans
An **accessory dwelling - informal (ADI)** is an informal unit on the same surveyed residential property as the main dwelling	**Informal residential** refers to informal structures on erven that do not clearly meet any descriptions

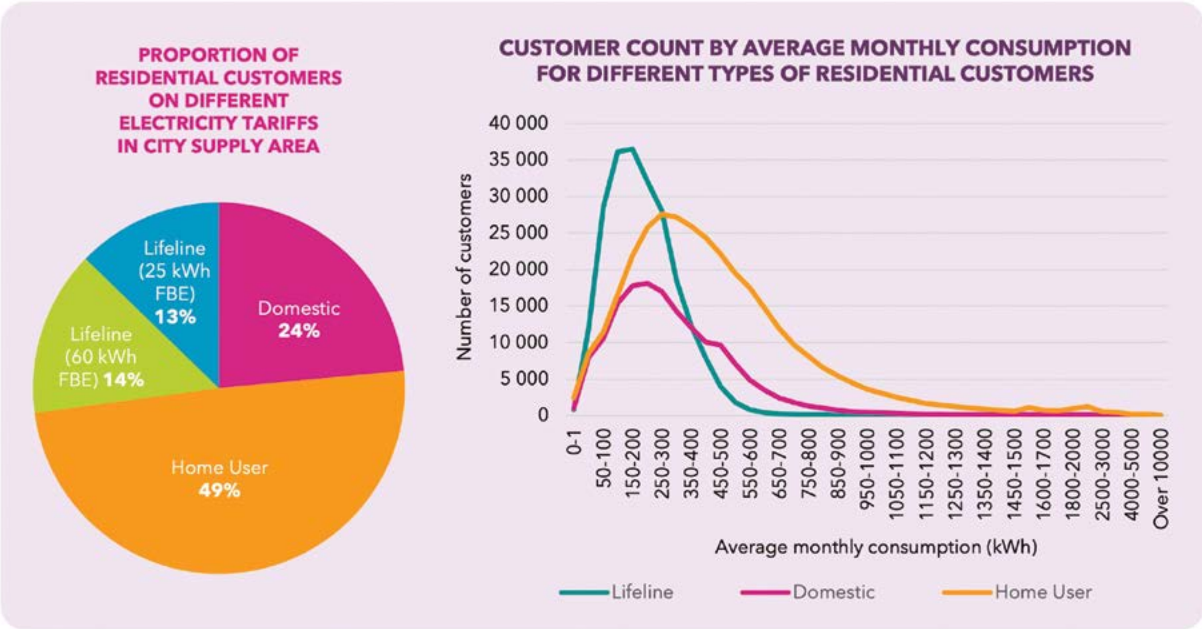


DESCRIPTION OF RESIDENTIAL ELECTRICITY TARIFFS

SUPPY AREA	TARIFF	DESCRIPTION
CCT	Lifeline (60 kWh FBE)	A special, highly subsidised tariff intended to provide relief to prepaid customers with limited means. 60 kWh of free basic electricity is allocated to customers who receive less than 250 kWh per month on average, taken over the previous 12-month assessment period, including any free electricity.
	Lifeline (25 kWh FBE)	A special, highly subsidised tariff intended to provide relief to prepaid customers with limited means. 25 kWh of free basic electricity is allocated to customers who receive more than 250 kWh, but less than 450 kWh per month on average, taken over the previous 12-month assessment period, including any free electricity.
	Domestic	Applies to customers who have a prepaid meter installed, have a property valuation between R500 000 and R1 000 000, and receive more than 450 kWh per month (calculated on a 12-month average).
	Home user	Applies to customers with a credit meter installed and a property valuation of R1 000 000 or above.
Eskom	Homelight	A suite of electricity tariffs based on the size of the supply. Provides a subsidy to low-usage single-phase residential, churches, schools, halls, clinics, old-age homes or similar supplies in urban areas. Free basic electricity is accounted for via an FBE token system that is automatically applied to the electricity supply of qualifying households. 50 kWh per month is provided free and funded by the City.
	Homepower	A suite of electricity tariffs for residential customers based on the size of the supply. May also be applied to supplies such as churches, schools, halls, clinics, old-age homes or similar supplies in urban areas with a size of up to 100 kVA.

Sources: City of Cape Town (2023c, 2025c); Stats SA (2025a)

Figure 21: Residential electricity consumption as a function of property value – City customers



Source: City of Cape Town (2025c)

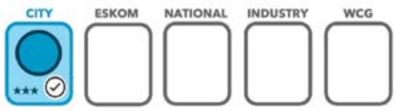
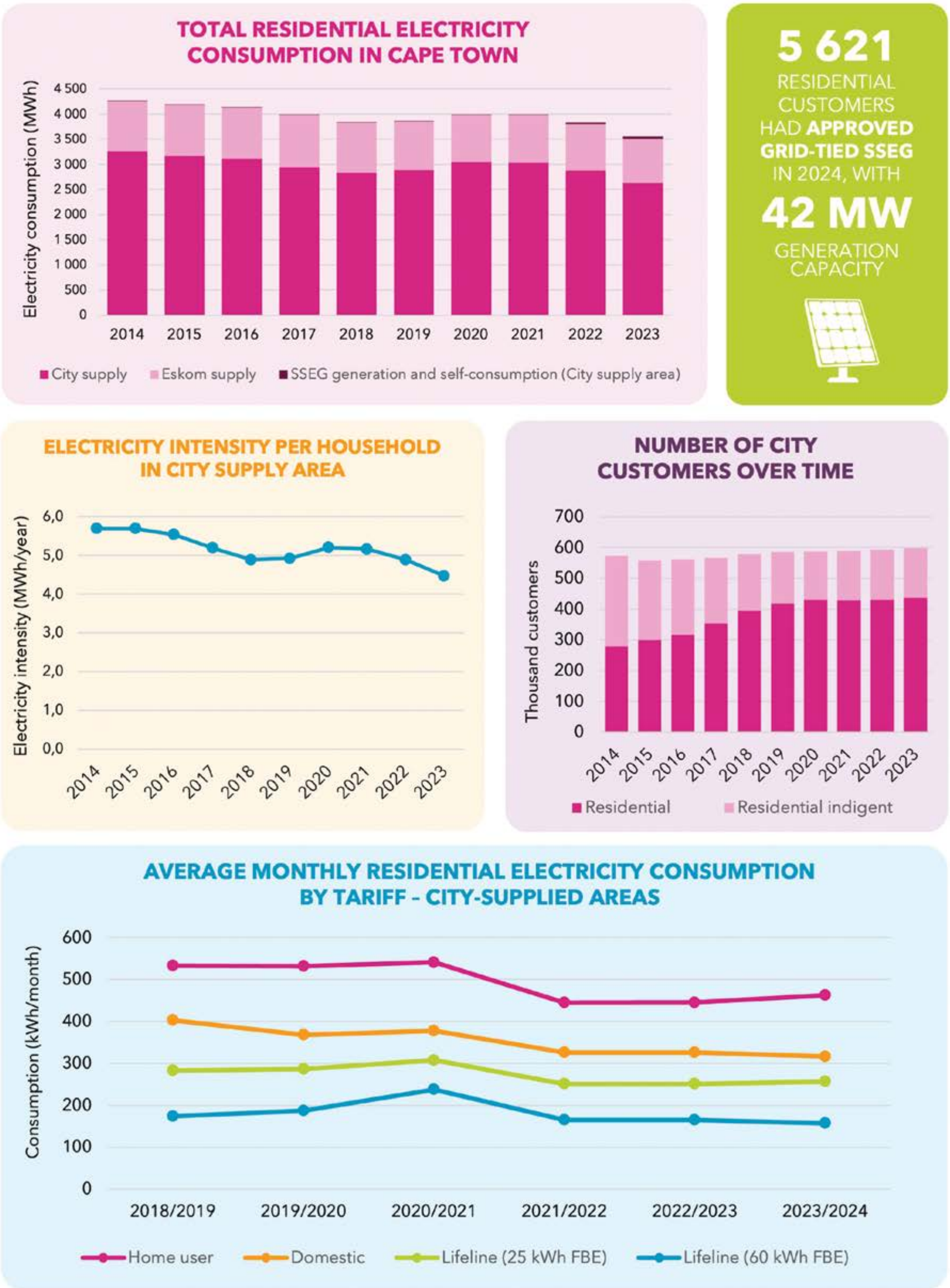


Figure 22 summarises the trends in residential consumption over the reporting period by both supply area and tariff. Total customer numbers should be viewed with caution because of the growth in housing estates and apartment blocks on commercial tariffs. The decline in the share of indigent customers reflects greater targeting to control costs (section 2.4.3.3). A general long-term decline in total and per-customer consumption is evident, but with an uptick over the Covid-19 period. By 2024, residential SSEG had reached a significant capacity of 42 MW, excluding unregistered systems, and has been one of the main drivers of the declining consumption trend.

Figure 22: Residential electricity consumption trends

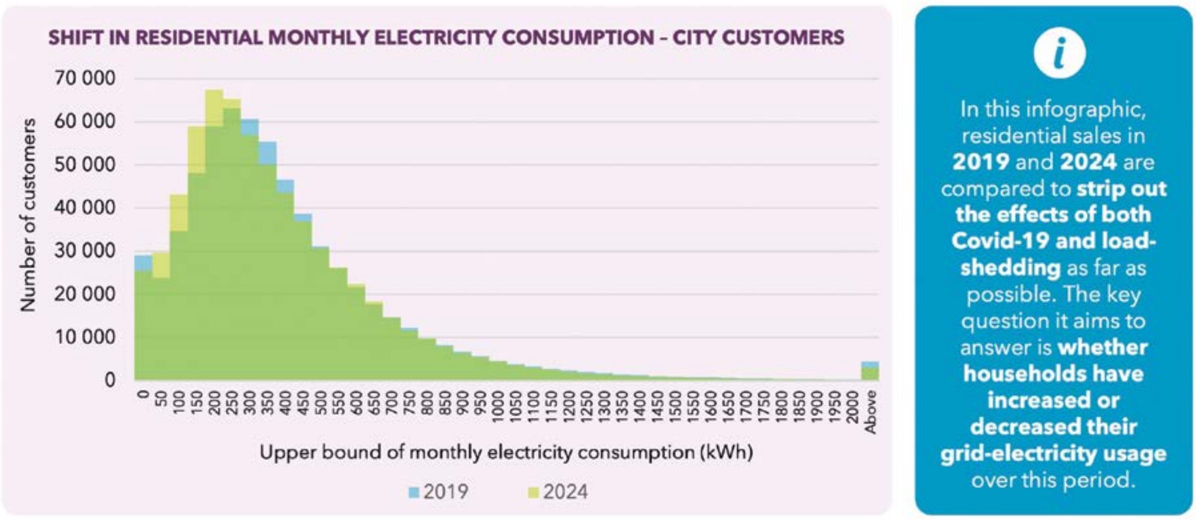


Sources: City of Cape Town (2025c); Eskom (2025a)
**Note: Excluding energy industries (Steenbras and peaking turbines), and excluding transmission and distribution losses. Residential consumption excludes estates on commercial tariffs reselling to households.*

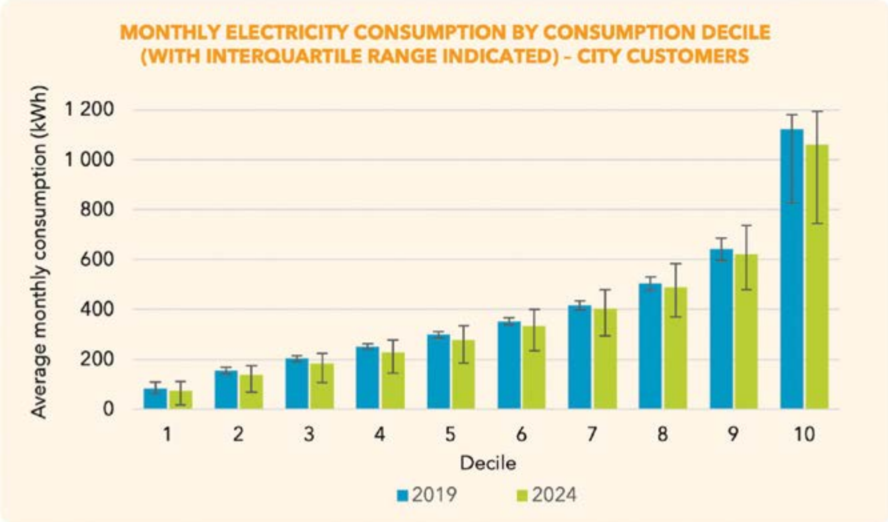
Figure 23 and Figure 24 use billing data to compare residential consumption for 2019 and 2024 at a granular level (to reduce the confounding effects of Covid-19 and load-shedding).[4] The key findings are as follows:

- Figure 23 shows that the entire distribution of residential consumption has shifted lower, indicating that the observed average residential consumption drop is caused by decreases across the whole customer base.
- Data for customer count deciles showed considerable (and unexpected) dynamism at an account level (pairwise comparison), with customers at the extremes of consumption having a high probability of shifting at least one decile in the other direction. This indicates that households readily adapt and change their consumption behaviour. For unpaired data, however, all deciles showed a reduction in average consumption over the period, with the lower-consuming deciles dropping by 8–10% and the higher-consuming deciles dropping by 3–5%.
- Figure 24 compares average customer consumption for 2019 and 2024 in valuation deciles (unpaired), as a proxy for wealth. The results show the drops in consumption of the two poorest deciles to be similar to the two wealthiest deciles (6–11%) on a percentage basis, with little change in middle-income consumption. However, customers without valuations – mostly non-ratepaying low-income households – comprised a third of the sample and showed the largest proportional drop (13%).
- Households with higher property valuations (>R2 million) showed reduced grid purchases between 2019 and 2024, but slightly increased total consumption once SSEG is added back. SSEG supplied approximately 8,5% of total electricity use for these households as a group in 2024, with estimated total residential SSEG self-generation increasing twenty-fold from 3 000 MWh to 62 000 MWh between 2019 and 2024.
- While LPG data is far less certain, adding estimated additional LPG use over the period suggests a 3-4% higher household energy demand in 2024, which is consistent with a continued rebound in hot-water use after the drought.
- Therefore, the data points to a continued decline in grid electricity sales as a result of affordability constraints at the lower end of income, and because of substitution with SSEG at the upper end. The 2021 SOEC report (City of Cape Town, 2021a) already suggested that while energy efficiency and behaviour drove rapid reductions in consumption among higher-income groups from 2008 to 2018, total consumption, including SSEG, had rebounded by 2019. This analysis now confirms that residential energy efficiency has indeed slowed down since 2018.

Figure 23: Residential electricity consumption trends among City customers, 2019 vs 2024



[4] *While there might have been residual effects of the drought on hot-water use in 2019, and residual effects of Covid-19 in 2024, they do not confound the direction of the reductions observed.*

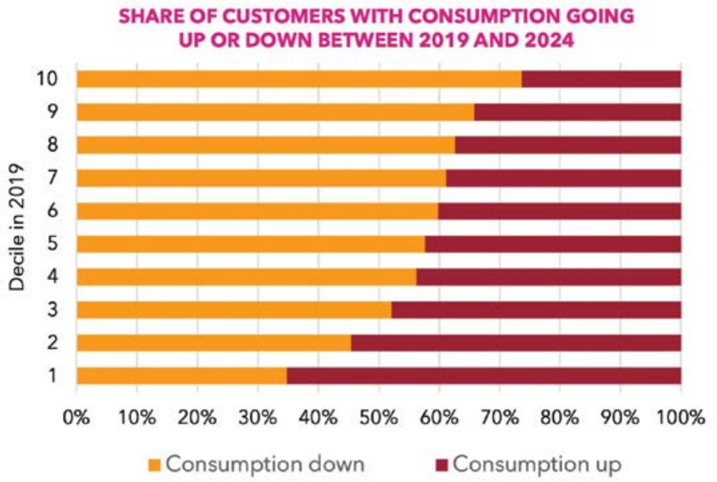


NUMBER OF CONTRACT ACCOUNTS

	PREPAID	CREDIT
2019	529 873	88 603
2024	571 796	63 255

57% households with **reduced** consumption

43% households with **increased** consumption



SHIFTS FROM 2019 TO 2024

Decile in 2024

Decile in 2019	Lower	Same	Higher
1	-	53%	47%
2	31%	29%	40%
3	41%	22%	37%
4	48%	19%	34%
5	51%	17%	32%
6	52%	17%	30%
7	53%	20%	28%
8	52%	24%	24%
9	51%	32%	17%
10	44%	56%	-

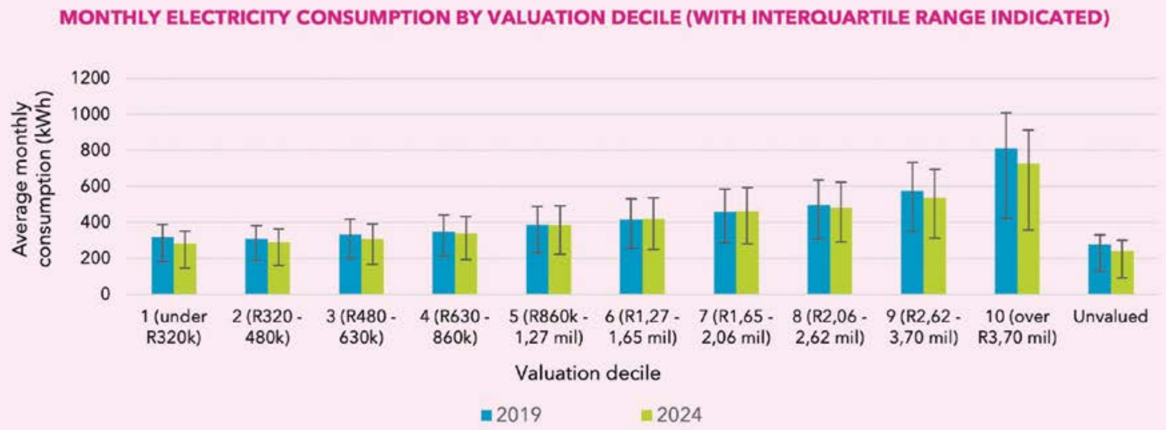
Most customers with the lowest consumption in 2019 (deciles 1 and 2) increased their consumption in 2024. On the other hand, most of the customers in upper deciles in 2019 decreased their average consumption in 2024.

WHAT is a DECILE? Deciles break up a set of data into ten equal parts. Here, for each year, customers are broken into ten equal parts according to electricity consumption in that year. The average monthly consumption decreased between 2019 and 2024 across all deciles.

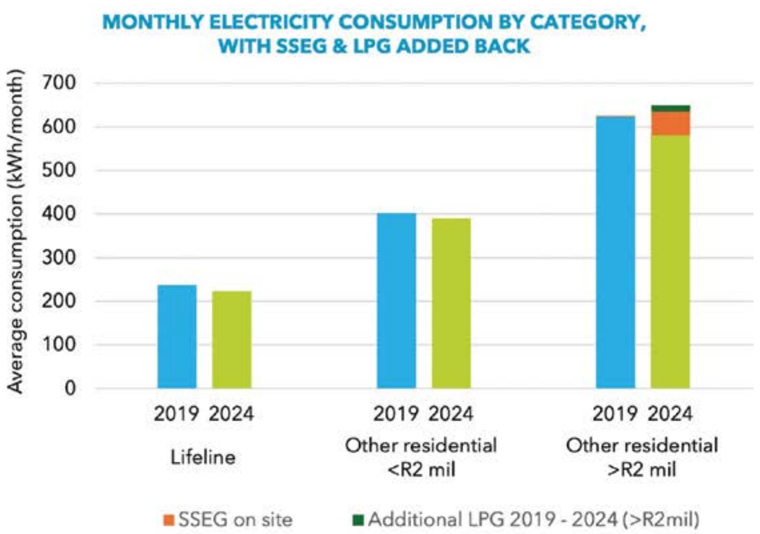
Source: City of Cape Town (2025c)

CITY ESKOM NATIONAL INDUSTRY WCG

Figure 24: Has City customers' residential consumption really declined in high-income households? Adding back SSEG self-consumption, 2019 vs 2024



Average decile size = 30 848
Unvalued group size = 157 422
*A **valuation decile** is made by dividing the customers into ten equal groups based on the value of their property.*
*The **interquartile range** shows the range of consumption for the middle 50% of the customers in a decile.*

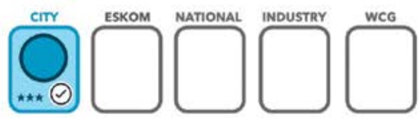


SSEG IN 2019 VS 2024

	2019	2024
Total SSEG self-generation & consumption in City-supplied areas (MWh)	3 107	61 913
Average monthly self-generation & consumption (kWh/month/customer)*	3	54
SSEG as % of average monthly consumption per customer*	0,4%	8,5%

**Total SSEG self-generation & consumption allocated across all contracts accounts for properties valued over R2 million.*

Source: City of Cape Town (2025c)



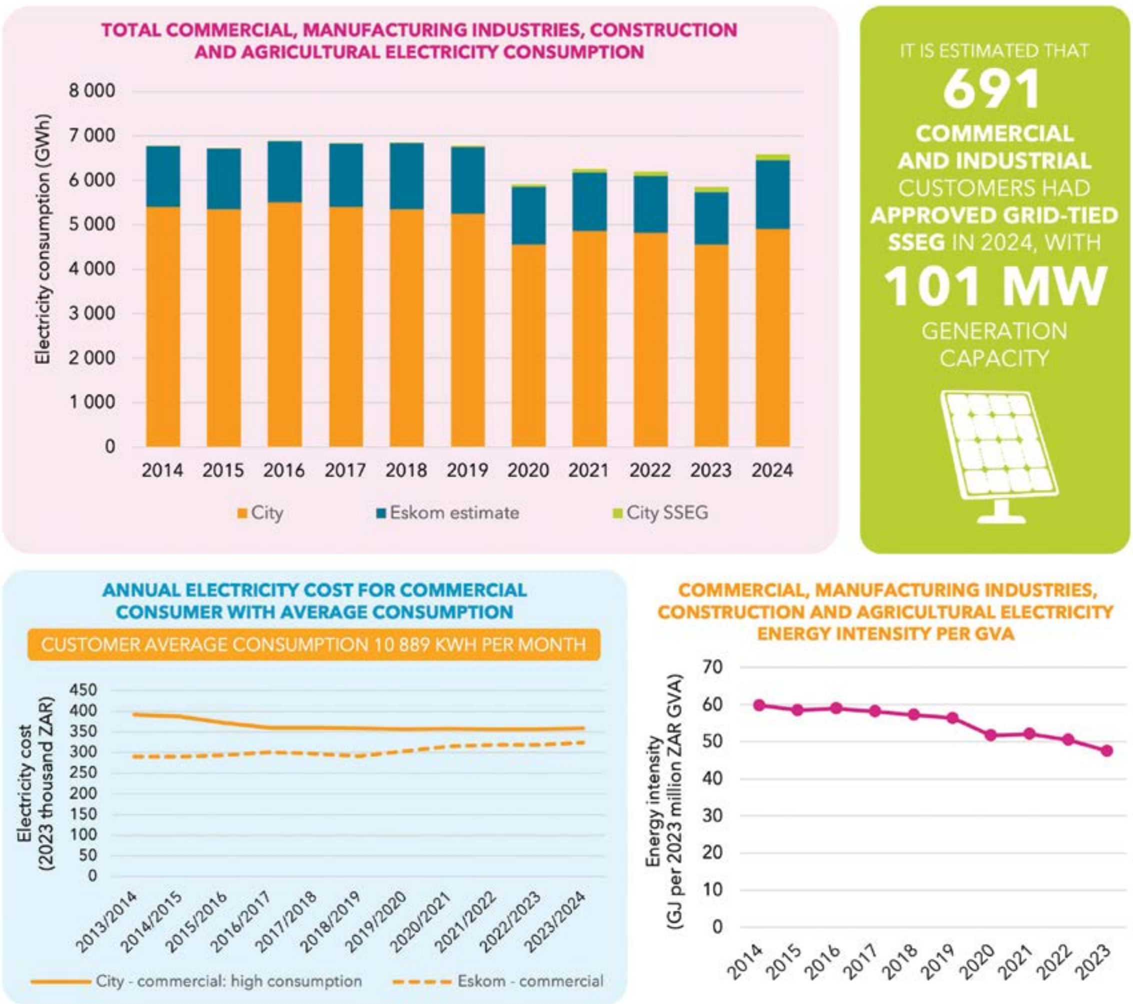
Households and businesses with the resources to invest in SSEG were able to secure viable, reliable, self-generated electricity and reduce their dependence on the grid while those facing affordability barriers were exposed to severe load-shedding in 2022–2023. As a result, similar trends in grid consumption mask vastly different lived experiences in terms of energy across Cape Town. These patterns highlight both the growing importance of decentralised generation in improving resilience, and the need for inclusive approaches that ensure that all households can access dependable and affordable energy services.

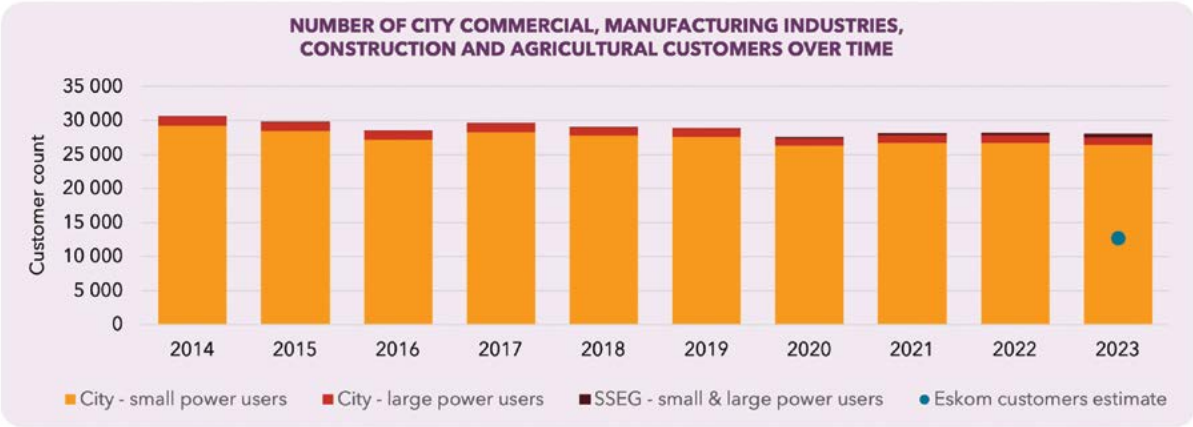
2.4.1.3. Commercial, manufacturing industries, construction and agricultural electricity consumption trends

Electricity demand from Cape Town's commercial, manufacturing, construction and agricultural sectors has declined since 2019 as a result of the economic downturn due to Covid-19 in 2020 and the impacts of sustained load-shedding in 2022 and 2023. The events constrained output, but also encouraged efficiency improvements and fuel-switching. By 2024, electricity consumption across these sectors had recovered, but remained below mid-2010s levels, with demand from agriculture representing a relatively small share compared to commercial, manufacturing and construction combined. For the commercial sector, in particular, the continued reduced demand reflects changes in work practices, particularly the persistence of hybrid and remote working arrangements (Box 2), as well as ongoing economic pressures (Box 6).

As a result of load-shedding, many commercial and manufacturing users have invested in alternative energy sources, including rooftop solar PV systems. By 2024, 691 commercial and industrial customers had approved grid-connected SSEG, amounting to more than 100 MW of capacity. Although still small as a proportion of total electricity consumption, the trend towards self-generation is visible and continues to grow, showing that businesses are increasingly investing in their own energy security.

Figure 25: Commercial, manufacturing industries, construction and agricultural electricity consumption trends in Cape Town





Sources: City of Cape Town (2025c); Eskom (2025a)

The number of City-supplied commercial and manufacturing customers trended downward from 2014 to 2019, with a sharper decline in 2020, possibly reflecting business closures, consolidation, or shifts in classification. The decline seems to have stabilised post-2021. Many businesses in commercial and manufacturing sectors are on the same City tariff, making it difficult to separate trends, although there is a decline overall across both categories. Similarly, electrical energy intensity per unit of economic output (GVA) in the commercial, manufacturing, construction and agriculture sectors has also shown a steady decline, echoing the trends in electricity usage.

Box 6: Slow recovery of the economy – a case of long Covid?

Although many economic sectors regained their pre-Covid-19 levels of activity, construction, trade and hospitality, electricity and water as well as mining remained below pre-pandemic levels by the end of 2023. Trade and hospitality, which includes tourism, has improved since 2023, and air passenger volumes have reached 2019 values, peaking at about one million passengers per month.

Construction and mining, however, remain depressed at about 75% of pre-pandemic levels. Interestingly, the economic data for electricity and water indicates that this sector has also not fully recovered, operating at around 95% of its 2019 output. It has already been speculated that the reason for this decrease is load-shedding, having driven the uptake of SSEG and a reduced reliance on utility-based services.

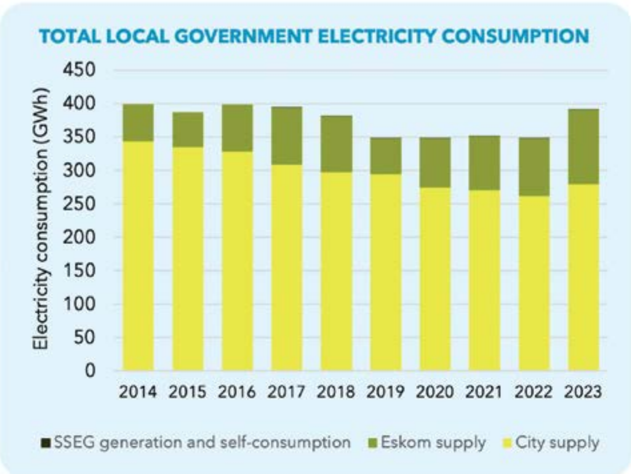
Source: City of Cape Town (2025b)

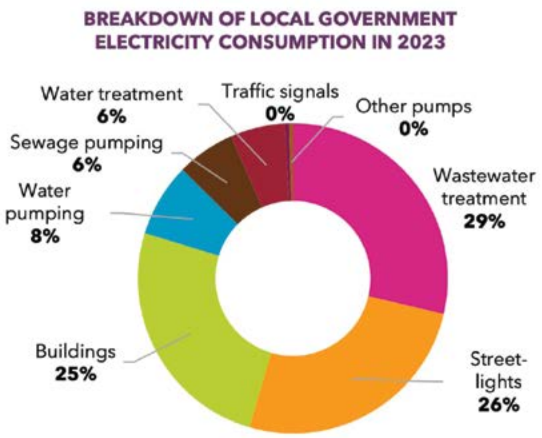
2.4.1.4. Local government electricity consumption trends

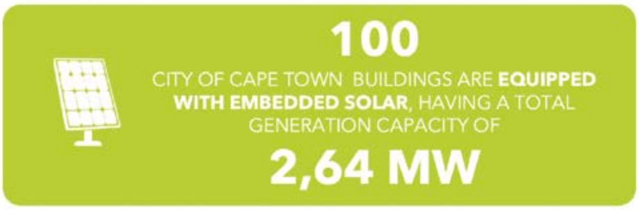
Electricity consumption by the local government sector (Figure 26) reflects the City's direct operations across a wide range of essential services and facilities. Total demand has remained relatively stable over the past decade, fluctuating between 300 and 350 GWh per year, with a slight upward trend evident in 2023. Consumption is met almost entirely through City-supplied and Eskom-supplied electricity, supplemented by a small but growing share of embedded solar generation. By 2023, over 100 City buildings were equipped with rooftop solar PV, providing a combined generation capacity of 2,64 MW and contributing to improved resilience and reduced reliance on the grid.

Electricity use in this sector is varied. Wastewater treatment plants (WWTPs) are the single largest consumer, accounting for 29% of local government demand, followed by streetlights (26%) and municipal buildings (25%), including facilities such as clinics, community centres, libraries and sports facilities. Other significant uses include water pumping (8%), water treatment facilities (6%), sewage pumping (6%) and traffic signals (less than 1%). A deeper dive into local government energy use (and associated emissions) is contained in section 4.

Figure 26: Local government electricity consumption trends

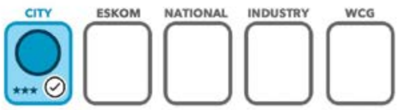






Local government covers City operations throughout Cape Town. Direct City operations include **municipal offices, fire stations, metro police, clinics, electricity, water, waste & wastewater facilities**, which keep Cape Town functioning. Indirect City operations, aimed at improving residents' lifestyles, include the running of **community centres, libraries, sports facilities and swimming pools.**

Source: City of Cape Town (2025c)



The sections that follow unpack Cape Town's electricity system in the context of reliability, affordability, carbon neutrality, and resilience. All the discussion refers to the City's performance in these areas, and electricity services as experienced by City customers. Where data is available, the discussion has been broadened to include the national picture and Eskom distribution performance and customer experiences.

2.4.2 Reliability

The reliability of electricity supply, which is defined as the availability of sufficient energy of a suitable quality when it is needed, is a critical contributor to overall energy security. Reaching high levels of reliability requires regular maintenance of, and improvements to, the grid infrastructure, ensuring a stable and constant supply of electricity, and a rapid response to any supply interruptions.

While the transmission and distribution grids have retained a consistent level of reliability over this reporting period, the loss of reliable electricity supply has overshadowed this good performance, resulting in a significant decline in the reliability of the electricity sector.

Box 7: Reliability of electricity supply

1. **Improved national plant performance in 2024:** Eskom's EAF rose to approximately 60%, supported by the Generation Operational Recovery Plan and reduced unplanned outages, but remains below the 70–75% benchmark needed to prevent widespread load-shedding.
2. **Reliance on costly diesel generation:** Eskom's continued dependence on OCGTs during shortfalls undermines financial sustainability and resilience.
3. **Steenbras hydro pumped storage scheme:** Enabled the City to cut the severity of load-shedding by up to two stages, mitigating 23% of imposed load-shedding in 2023.
4. **Sustained municipal investment:** The City allocates some 4% of electricity revenue (~R800 million annually) to repairs and maintenance, strengthening long-term reliability. The City also increased spend on replacing obsolete equipment from R14 million in 2022/23 to R40,6 million in 2024/25.
5. **High distribution reliability:** The City's average system interruption frequency index (ASIFI) has consistently remained below the maximum allowable limit since 2014.
6. **Customer satisfaction:** Surveys show that City and Eskom customers both rate fault response in the good to very good range, reflecting effective local service delivery.
7. **Uneven public perception:** While the City's service is rated 'good', ratings for streetlighting have dipped recently, signalling concerns about declining reliability.
8. **Targeted streetlight resilience:** Measures to address challenges include cable replacement and burial, reinforced conduits and proactive maintenance. City performance has fallen below the 90% functionality target, worsened by load-shedding, theft, vandalism and security risks to repair teams.
9. **Reliability challenge for consumers:** Despite the City's strong performance, Eskom-imposed load-shedding remains the single largest reliability challenge.

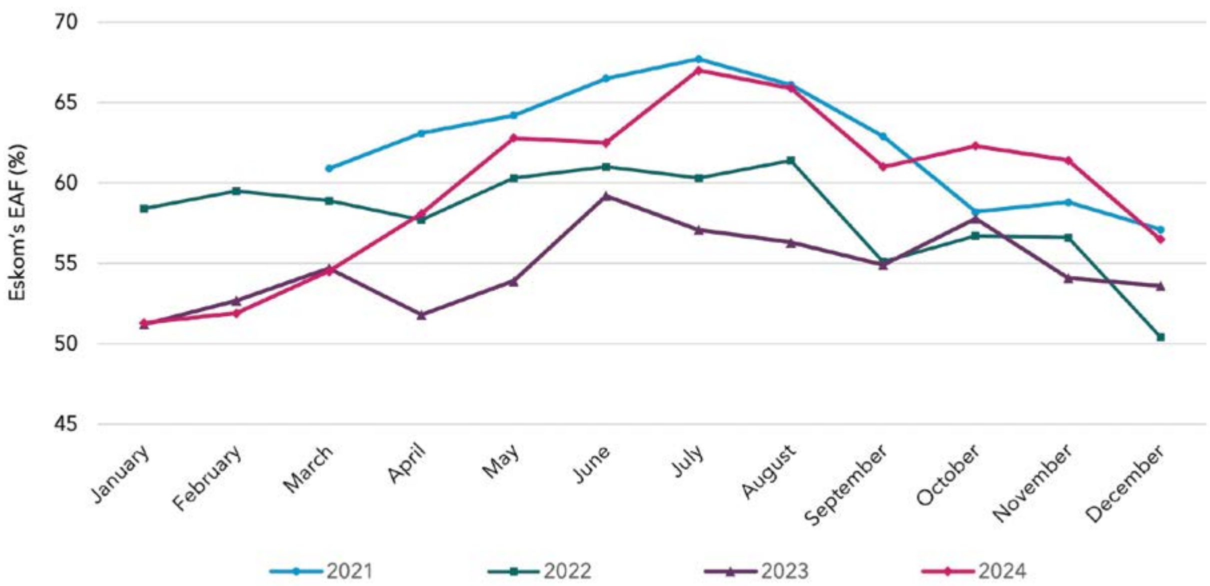
2.4.2.1 Reliability of the national grid

Eskom's energy availability factor (EAF) is a key measure of supply reliability, reflecting the share of generation capacity available to meet demand (Figure 27). Nationally, the EAF has declined from 65% in 2020 to a low of around 55% in 2023, largely due to ageing infrastructure, unplanned outages, and maintenance backlogs (Eskom, 2025a). Performance improved to an average of 60% in 2024, supported by Eskom's Generation Operational Recovery Plan (Eskom, 2024b) and a reduction in unplanned outages.

However, the EAF remains below the 70% benchmark that has been estimated to be required for the current South African power system (in terms of installed capacity to meet electricity demand) to avoid intermittent load-shedding (Eskom, 2024b).

While incremental progress in plant performance is encouraging, the system remains vulnerable, and ongoing recovery will be critical for improving reliability and reducing reliance on costly diesel generation.

Figure 27: Eskom's energy availability factor (EAF)



Source: Eskom (2025a)

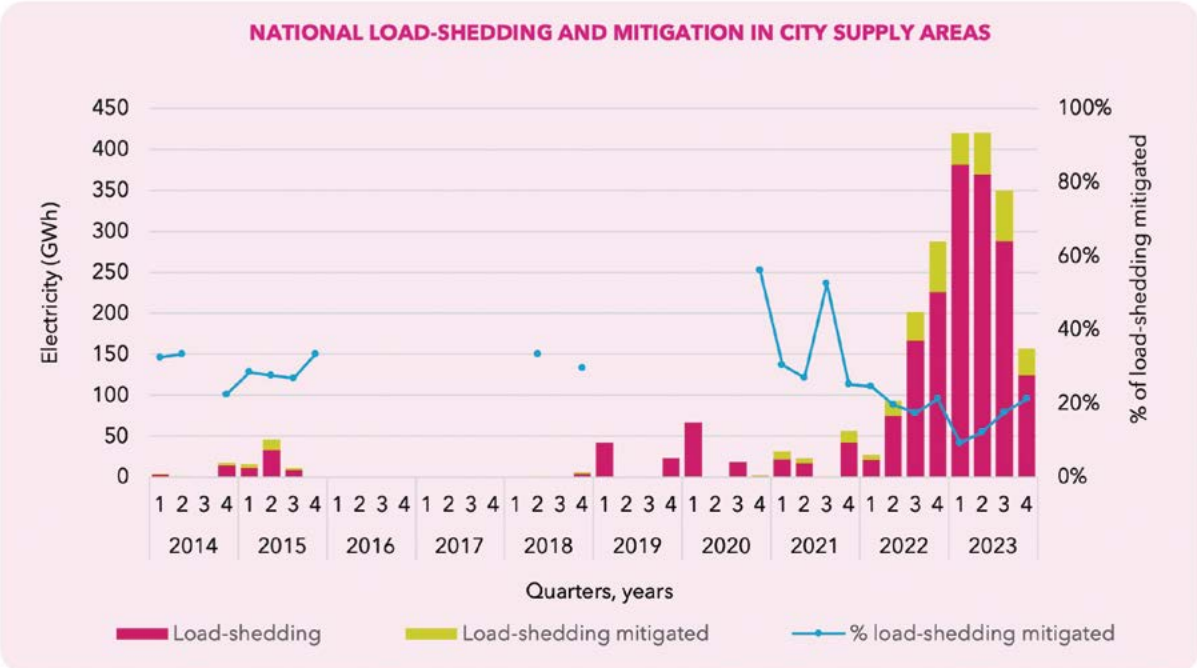
2.4.2.2 Extent of load-shedding and targeted responses

The City's distribution network has demonstrated improved reliability through a reduction in unplanned faults and system-level interruptions. However, load-shedding, as implemented at the national level, represents a major source of service disruption that lies beyond the City's control, but has a direct impact on customers' energy reliability experience.

Beyond direct service interruptions, load-shedding also creates an opportunity for vandalism and theft to escalate beyond normal levels due to the regular and publicly advertised outages. Vandalism and theft, in turn, lead to extended restoration times and increased repair costs, and further undermine overall network reliability.

In response, the City has implemented a range of targeted measures to reduce the severity and frequency of load-shedding experienced within its own supply areas.[5] Central to this response is the use of the Steenbras hydro pumped storage scheme as a dispatchable energy source, combatting load-shedding by reserving generating units specifically for load-shedding response. The scheme enables the City to reduce the impact of load-shedding on its supply consumers by up to two stages, depending on duration, as shown in Figure 28 and Figure 29 below. In other words, if City customers are zoned for stage 1 or 2 load-shedding, the municipality's Energy Directorate is able to maintain the electricity supply to City customers within the operational parameters of Steenbras hydro pumped storage scheme. Load-shedding is implemented according to a national rationalised specification whereby a 'stage' is the scheduled disconnection of 5% of load on a two-hour rotation. In Cape Town, this 5% of load is the part of the network in each of 16 designated load-shedding zones.

Figure 28: National load-shedding and its mitigation in City supply areas

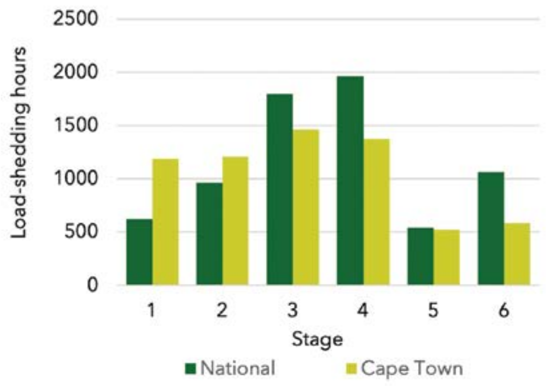


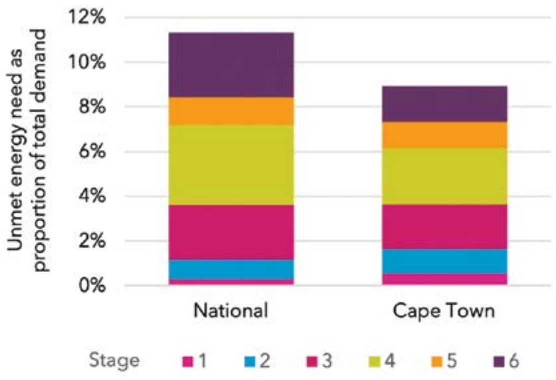
Source: City of Cape Town (2025c)

The effect of the City's mitigation efforts can be seen more clearly when looking at the levels of load-shedding experienced by City customers, and the net impact on the total electricity needs that have been shed, as shown in Figure 29 below. For instance, in 2023, City customers experienced lower levels of load-shedding and had more of their total electricity needs met (91% vs 89%) than Eskom customers.

[5] *The City's ability to mitigate load-shedding outside of its own supply areas is limited; however, any mitigation efforts undertaken have also had a broader benefit by reducing strain on the national energy supply system.*

Figure 29: Levels of load-shedding and extent of unmet needs for Eskom (national) and City customers, 2023



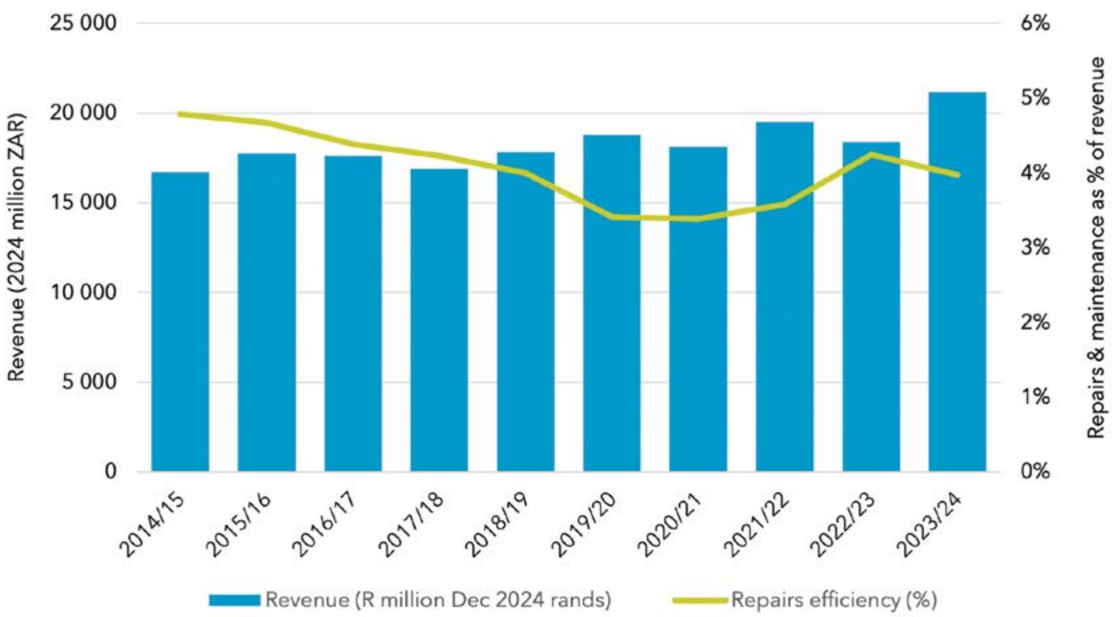


Sources: City of Cape Town (2025c); CSIR (2024)

2.4.2.3 Sustained maintenance investment

Reliable electricity requires sufficient expenditure on the maintenance of distribution infrastructure. A well-maintained electricity infrastructure is also essential for a healthy economy, as it results in service continuity, improved asset life and the avoidance of costly system failures.

Figure 30: City supply area repairs and maintenance efficiency



Source: City of Cape Town (2025c)

Fully aware of this imperative, the City has maintained a consistent annual allocation of approximately 4% of revenue (about R800 million) to repairs and maintenance, and has consequently maintained high levels of network reliability and resilience. This is supported by the City's ASIFI and ASIDI performance, which demonstrates that investment in maintenance not only sustains operational standards, but directly contributes to fewer and shorter electricity faults in Cape Town. The City also increased its spend on replacing obsolete equipment from R14 million in 2022/23 to R40,6 million in 2024/25.

2.4.2.4 City main substation load status overview (2024)

Main substations are critical nodes in the electricity network, stepping down high-voltage electricity – typically 132 kV, 66 kV or 33 kV – to 11kV for distribution to customers. Each main substation has a firm capacity, which is the maximum load it can reliably supply when one major component is out of service. This provides a standard measure of network reliability.

Each main substation supplies a specific geographical footprint, which may shift over time as loads are redistributed between substations to maintain balance and support reliability.

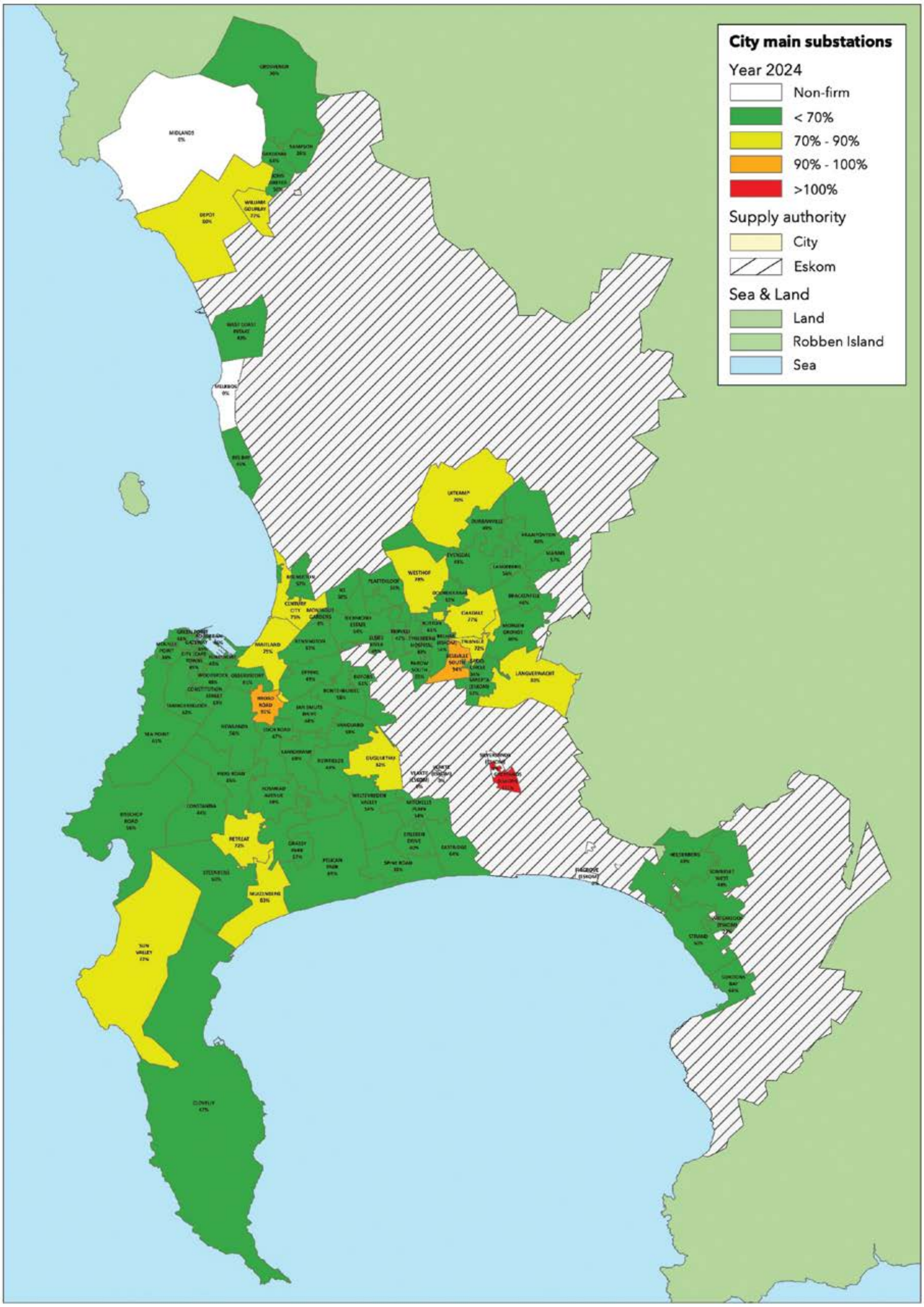
Figure 31 below shows the current main substation footprint, with 2024 peak loading expressed as a percentage of firm capacity. This indicates the level of spare capacity at each main substation and points out substations that may require future upgrades. The map legend and definitions of electrical system capacity are provided in Table 2.

Table 2: Electrical system capacity

LEGEND COLOUR	DEFINITION	CAPACITY STATUS
Green	Less than 70% of firm substation capacity	Spare firm capacity
Yellow	70% to 90% of firm substation capacity	Adequate firm capacity
Orange	90% to 100% of firm substation capacity	Risk of firm capacity being exceeded in the short to medium term
Red	Over 100% of firm substation	Existing lack of firm capacity

To effectively respond to customer demand and load growth, and given the long lead times required for substation capacity upgrades, loading should ideally not exceed 95% of firm capacity. Network development plans trigger the necessary interventions before this threshold is reached. Substations classified as red or orange warrant close monitoring to ensure that upgrade projects are implemented timeously. Currently, only one area exceeds firm capacity.

Figure 31: Load status of the City's network of main substations, 2024



Source: City of Cape Town (2025c)

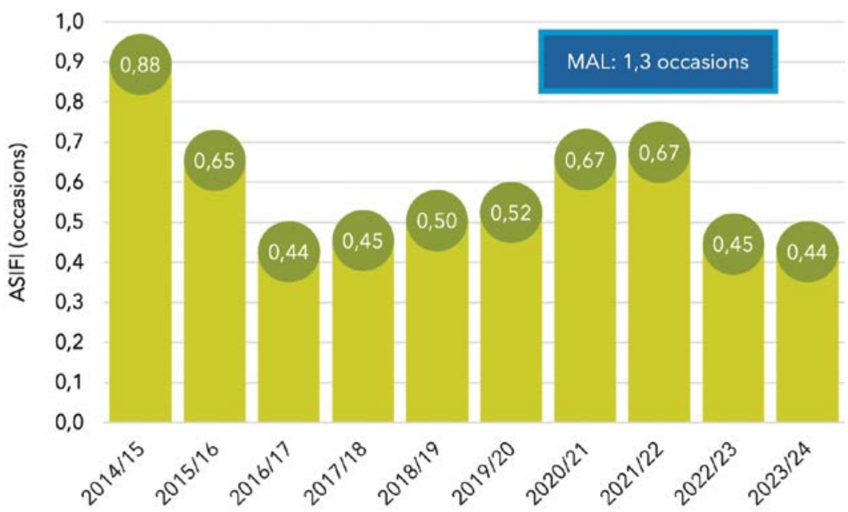
2.4.2.5 Average system interruption frequency (ASIFI)

ASIFI measures the frequency of electricity interruptions due to faults or failures, excluding planned outages or national load-shedding. It is calculated by dividing the total power capacity affected by interruptions (measured in kVA) by the total installed power in a distribution network (IEEE, 2012). The indicator is calculated on a 12-month rolling average basis.

The City applies a maximum allowable limit (MAL) of 1,3 for this indicator, and since 2014, its performance has consistently stayed below this threshold, as shown in Figure 32 below. This demonstrates that the distribution grid has not only met, but regularly exceeded its benchmark.

Overall, the performance of the network in recent years reflects consistent and sufficient investment in grid stability and improved outage monitoring, contributing to higher customer satisfaction and reduced economic disruption from power supply interruptions.

Figure 32: Average system interruption frequency index (ASIFI)



Source: City of Cape Town (2025c)

2.4.2.6 Performance of public lighting

In addition to electricity supply and distribution, reliability must also include infrastructure that supports functional public spaces and roads, contributing to the safety, visibility and mobility of residents across Cape Town. This includes streetlighting in public areas.

The City installs and maintains public lighting across both City-supplied and Eskom-supplied areas, including roads, eligible public spaces, and informal settlements. Figure 33 below indicates the percentage of functioning public, street and high-mast lighting based on a random sample, also known as the burn rate of public lighting.

While the percentage of functioning streetlights peaked in the early years of reporting, performance has since declined and is now routinely below the 90% target. The deterioration reflects the growing vulnerability of public lighting networks to theft, vandalism and operational faults; all of which have been significantly amplified by load-shedding. In addition to the challenges posed by load-shedding, maintenance teams must navigate land invasions, illegal electricity connections and security risks, which increasingly require armed escorts for inspections and repairs. These factors directly impede the City's ability to provide a safe and reliable public lighting service.

Figure 33: Burn rate of public streetlights

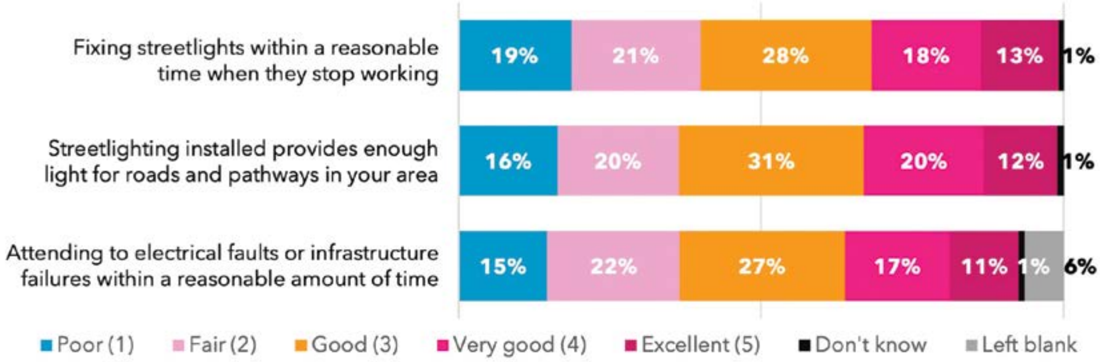
Source: City of Cape Town (2025c)

To mitigate these threats, the City has implemented several targeted measures, including scheduled repairs and maintenance, replacing stolen copper cables with aluminium alternatives both underground and overhead, burying cables deeper underground and adding protective layers to prevent tampering, and installing longer and reinforced conduits on overhead pole-mounted systems. As with other municipal services facing similar challenges, these issues cannot be addressed by the City working in isolation. Collaboration with communities, stronger support from law enforcement and greater public awareness are essential to protect and maintain public lighting infrastructure.

2.4.2.7 Public perception of energy reliability

The City conducts an annual Customer Satisfaction Survey (CSS) to gauge Cape Town residents' perception of the general quality of the range of services the municipality provides. The questions as well as the trends in the results pertaining to electricity services and streetlighting are presented in Figure 34 and Table 3 below. The survey uses a five-point scale (1 = poor, 3 = good, 5 = excellent).

Figure 34: Customer Satisfaction Survey: provision of electricity and streetlighting, 2024/25



Source: City of Cape Town Customer Satisfaction Survey (CSS) in City of Cape Town (2025c)

Table 3: Customer Satisfaction Survey: average scores for provision of electricity and streetlighting by City and Eskom

	ELECTRICITY PROVIDER	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25
Electricity provision*	CCT								3,1
	Eskom								2,7
	Average	2,9	2,5	2,6	2,6	2,7	2,9	2,9	2,9
Street-lighting**	CCT								3,2
	Eskom								2,6
	Average	3	2,6	2,8	2,5	2,8	3	2,8	2,9

Source: City of Cape Town Customer Satisfaction Survey (CSS) in City of Cape Town (2025c)
**Under electricity provision, residents assessed whether the electricity provider (Eskom or the City) attended to electrical faults or infrastructure failures in their areas within a reasonable time.*
***Under streetlighting, residents assessed whether the electricity provider had installed streetlighting that provides enough light for roads and pathways in residents' areas and fixed faulty streetlights within a reasonable time.*

While there has been variation in the CSS response on an annual basis, and the answers are distributed across the scale, the majority of respondents rate the City's electrical fault repair and streetlight service as 'good' to 'excellent'. Notably, an increase in ratings since 2018–2020 was achieved against the backdrop of Eskom load-shedding. For 2024/25, responses for City (N = 1 624 for faults) and Eskom supply areas (N = 1 153 for faults)[6] were disaggregated,[7] and showed a 12% (of scale) higher level of satisfaction among City customers for fault repairs. Streetlighting quality was similarly perceived to be better in City supply areas (15% of scale), although the municipality is responsible for this service in Eskom supply areas also. These differences were statistically significant at the household weightings for the whole of Cape Town.

[6] *N = sample size with valid responses.*
[7] *While the data disaggregation cannot be seen as an independent survey of City and Eskom supply areas, it was executed by a third-party service provider.*

However, both distributions showed a central tendency typical of this type of survey, with co-variance between streetlighting and electrical fault repair rating results and, potentially, other services as well. Although the streetlighting rating has not strongly correlated with the burn rate challenges discussed in section 2.4.2.6 above, the lowest score in 2020/21 may be the result of the movement restrictions imposed on City maintenance staff during Covid.

2.4.3 Affordability

The affordability principle of energy security assesses whether residents, especially indigent households, and businesses can pay for the energy services they need, without compromising their ability to meet other basic needs or, in the case of businesses, without undermining their viability. Affordability is driven by the price of energy services and the predictability of prices over time, the cost-effectiveness of energy services, and the ability to choose appropriate service options. Its application, therefore, extends across tariff reform, energy subsidy programmes, electrification efforts and the strategic use of a diversified supply of energy sources to reduce long-term energy costs.

Overall, the data from the reporting period indicates a worsening state of affordability in the electricity sector due to a confluence of factors, namely the national supply price increases significantly exceeding inflation, a stagnant subsidy framework that no longer meets basic needs, and growing uncertainty in pricing policy. Additionally, these all occurred during a time of multiple economic shocks and sustained economic stresses. The only improvement of affordability in the sector relates to the rapidly falling prices of decentralised technologies. Yet this benefit is captured predominantly by higher-income residential and commercial customers, having little to no impact on alleviating energy poverty.

Box 8: Affordability of electricity

1. **Targeted social support:** The City provides free basic electricity (FBE) to its supply customers and reimburses Eskom for FBE supplied in their areas, providing critical relief for vulnerable households.
2. **Incentives for SSEG:** National rooftop solar rebates, municipal feed-in tariffs and zero registration fees lower costs for households and businesses.
3. **Declining technology costs:** PV and inverter prices have dropped significantly, with the levelised cost of energy (LCOE) for small-scale solar projected to fall to R500/MWh by 2035.
4. **Financing innovations:** Lease-to-own, concessional debt, wheeling and power purchase agreements (PPAs) reduce upfront cost barriers and make SSEG more accessible to businesses and higher-income households.
5. **Electricity prices rising faster than inflation:** Since 2014, tariffs have grown by ~190%, compared to ~60% CPI growth, placing growing pressure on households and businesses.
6. **Persistent energy poverty:** Despite high electrification, 3,3% of households still rely on candles/paraffin for lighting, signalling affordability gaps.
7. **Safety risks from alternatives:** Continued paraffin and candle use exposes vulnerable households to fire, health and safety hazards.
8. **Barriers for low-income households:** High upfront costs (approximately R150 000 for a 10 kWp solar-plus-storage system) keep SSEG and batteries out of reach for most.
9. **Behind-the-meter storage costly:** Residential batteries remain 35–70% more expensive per kWh than grid power.
10. **Cost recovery challenges:** Declining sales from SSEG adoption raise fixed-cost recovery issues if not addressed through tariff restructuring.

Energy affordability can only be achieved if:

- economically vulnerable households can better meet their energy needs; and
- the impact of energy price increases and volatility on households and businesses is limited as far as possible.

The indicators below reflect key metrics used to assess electricity affordability in Cape Town, with this 2025 SOEC analysis providing a baseline for future interventions.

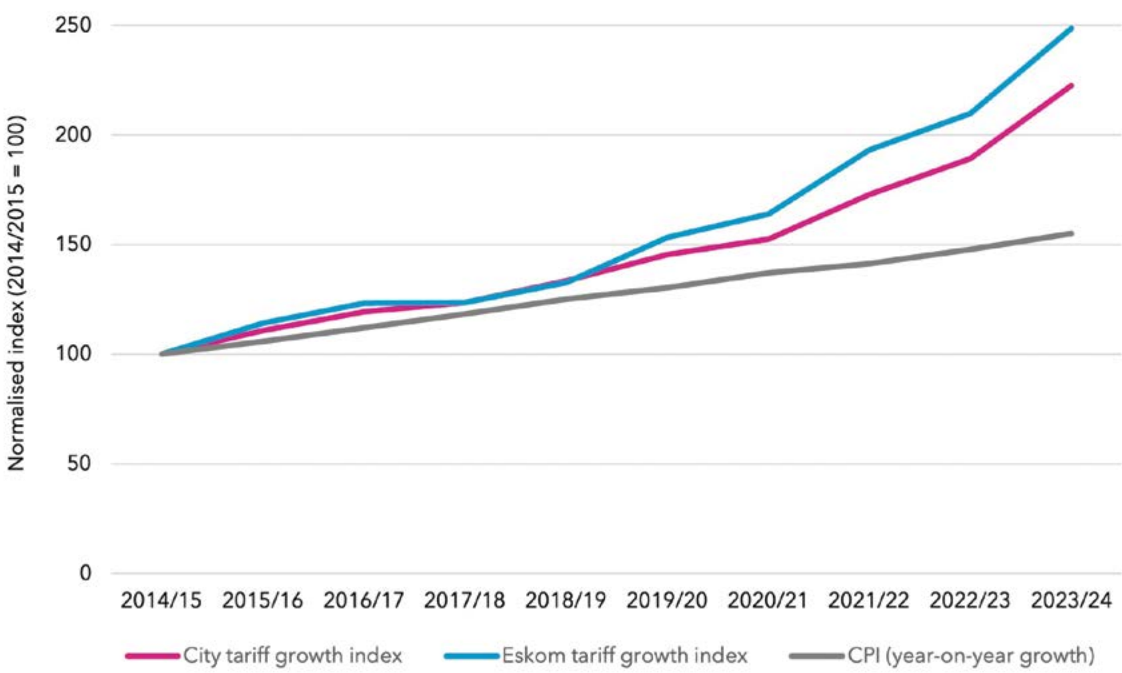
Where energy is unaffordable, there is a greater likelihood of households experiencing energy poverty, which has a harmful impact on not only those households, but also the city more broadly. Energy poverty, which is defined as "a lack of access to clean, safe and affordable energy, leading to severe social and economic consequences" (City of Cape Town, 2023d), is also often a symptom of broader economic hardships faced by households. Energy poverty is still prevalent in Cape Town even though household electrification rates in the city are high and most of these households receive the energy social package. The City is committed to leveraging existing and new mechanisms in the energy sector to reduce energy poverty in Cape Town over time. To this end, tracking the internal and external factors that influence energy affordability is crucial.

The City provides an energy social package to qualifying households, whether directly or via Eskom, depending on the supply area. The package consists of subsidised grid connections and electricity available at a subsidised tariff, which is combined with an FBE allocation.

2.4.3.1 Electricity tariff trajectory and affordability implications

Figure 35 shows the indexed electricity tariff increases charged by the City and Eskom over a ten-year period compared to the consumer price index (CPI).

Figure 35: Cumulative tariff growth vs CPI, 2014/15–2023/24



Source: Stats SA (2025b)

Since 2014/15, electricity prices have risen at more than double the rate of general inflation. This trend is consistent with national-level findings: The Council for Scientific and Industrial Research (CSIR) reports that average electricity tariffs have increased by 190% since 2014, compared to CPI growth of roughly 60% (CSIR, 2024), while Stats SA data shows electricity prices rising at an average of 10,5% per year, which is more than double the average inflation rate of 5% (Stats SA, 2025b). For the Western Cape, between June 2014 and June 2025, water supply cost inflation was 24% higher, food cost inflation 16% higher and rental inflation 4% higher than general national inflation (Stats SA, 2025b). The pressure on the consumer as a result of the steep price hikes for electricity and other necessities led to an **estimated 10,6% drop in local real GDP per capita between 2014 and 2023**,[8] reflecting a likely proportional drop in average real incomes.

The gap between the electricity price and CPI has widened significantly since 2018/19. Several underlying factors drove this divergence, and Eskom's steep above-inflation increases – particularly in 2021/22 (17,8%) and 2023/24 (18,5%) – have raised the cost of bulk supply to municipalities. Because bulk purchases form the largest component of the municipal tariff, these increases are largely passed on to consumers. In addition, as households and businesses install rooftop solar, purchase backup generators or invest in energy efficiency interventions, kWh sales have fallen. That means that the fixed costs of running the network must be recovered from a smaller consumption base, which increases the per-kWh price. The unregulated portion of the energy charge, inclusive of streetlighting levies, has also accounted for a growing share of the tariff, adding to headline increases without directly reflecting Eskom's own cost structure. These dynamics pose a persistent affordability challenge for households and businesses, as electricity costs are rising faster than general inflation, and are consuming a larger share of monthly expenditure and of businesses' operating costs.

The City's tariffs show a strong correlation with Eskom's increases. Between 2014/5 and 2023/4, Eskom's average tariff rose by around 250%, and the City's by 225%. The City has consistently maintained compliance with the National Energy Regulator of South Africa (NERSA) guidelines for determining cost-reflective tariffs using a cost-of-supply model, with the lower rate of escalation in local distribution network costs reflected in lower-percentage increases.

Meanwhile, targeted capital investments – such as rooftop solar at municipal facilities, upgrades at Steenbras hydro pumping scheme, and the Atlantis solar PV plant – aim to reduce future reliance on Eskom supply, demonstrating the City's commitment to balancing cost recovery with social equity as electricity consumes an ever-larger share of household income. In Figure 35 above, the City line tracking slightly below Eskom's after 2020/21 indicates some absorption of price increases by the municipality, without negatively affecting the margin on sales. In essence, therefore, the City's distribution efficiency has improved over the period.

2.4.3.2 Energy affordability gaps reflected in primary lighting and cooking sources

Access to electricity is fundamental to improving quality of life, and universal access to electricity is a core target of sustainable development goal 7 (UN General Assembly, 2015). Despite high electrification rates, many households in Cape Town's informal settlements are not connected to the grid (see section 3.4.3.4 for further details on the City's electrification process). Energy affordability and security are increasingly shaped not just by infrastructure rollout, but by the lived realities of residents, who often adapt to gaps in service delivery by resorting to alternative, and sometimes hazardous, sources of energy. This dynamic landscape underscores the importance of monitoring patterns in household energy use, both to inform policy

[8] *S&P Global Market Intelligence, 2025*

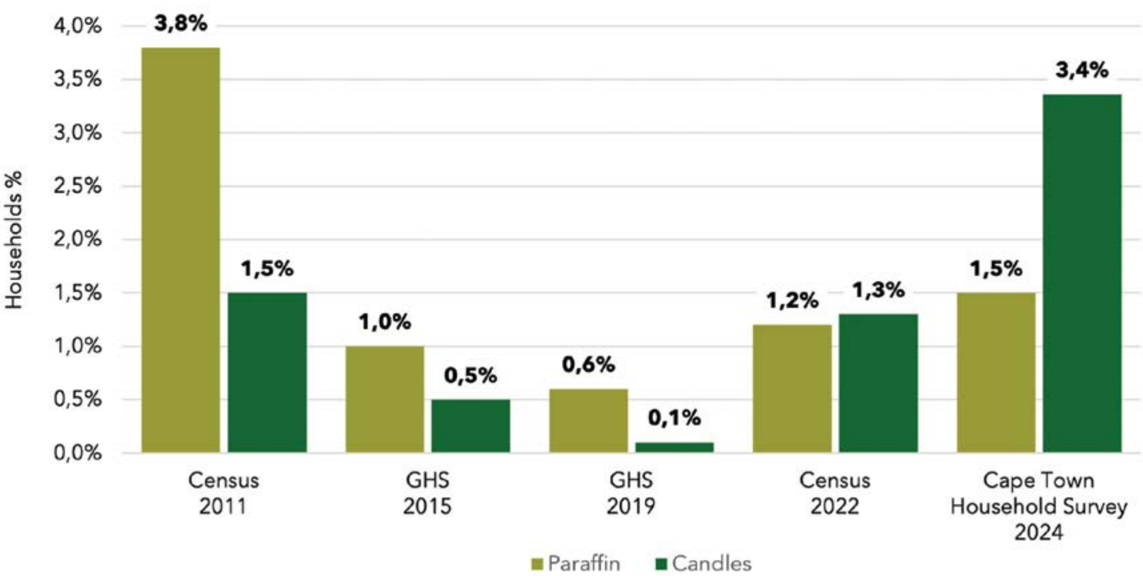
interventions and to target support for those most at risk of energy poverty.

Data on sources of energy at the household level is obtained from the 2024 Cape Town Household Survey, the first of which was conducted between February and October 2024, involving 8 318 households. The results show that across all dwelling types, electricity remains the most commonly used source for all energy needs, followed by gas. Paraffin use is less common overall, but is highest among households living in informal dwellings.

A comprehensive view of energy poverty benefits from detailed household expenditure data. While such data exists (Stats SA, 2023; 2025a), it is not always available with the frequency or granularity needed for city-level energy affordability tracking. Given these constraints, the data discussed below tracks the use of candles and/or paraffin as a primary energy source, as a proxy indicator of energy poverty characteristics. This is consistent with international energy access frameworks (such as the World Bank's multi-tier framework)[9] that classify candles and paraffin as lowest-tier energy sources. It also aligns with South African urban energy research that links primary reliance on paraffin and candles to affordability constraints and severe energy deprivation (e.g. Tait, 2013; Louw, 2008; Bekker, 2008). Section 2.5.1.3.1 expands this analysis with estimates of residential fuel energy consumption based on the usage reported in the Cape Town Household Survey. It also augments the picture with additional survey data, and assesses the trajectory of electrification rate and energy poverty.

The Cape Town Household Survey revealed that 4,9% of all households used either paraffin or candles as their primary sources of lighting in 2024, with candles being more prevalent than paraffin. Although the trend is difficult to interpret with confidence (see Figure 36),[10] the continued reliance on these energy sources for basic lighting does point to a persistent form of energy poverty affecting households. This highlights that affordability and reliability remain key determinants of household energy choices.

Figure 36: Proportion of Cape Town households using paraffin or candles as their main energy sources for lighting

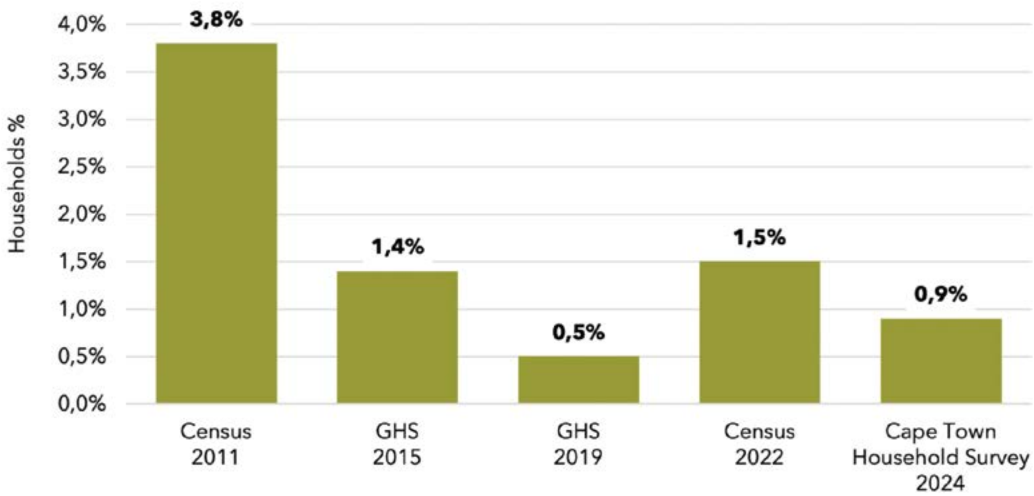


Sources: City of Cape Town (2012, 2023a, 2023c, 2024f); Stats SA (2025a)

[9] *While the World Bank's multi-tier framework provides a useful global benchmark, recent research (Kersey et al., 2025) suggests that the framework may underestimate energy poverty in urban contexts, where households may be formally connected to electricity, yet remain energy-poor due to affordability constraints, energy stacking and inadequate service conditions.*
[10] *Considering that Census 2011 and 2022, General Household Survey 2015 and 2019 and the 2024 Cape Town Household Survey differ in scope, definitions, reference periods, as well as assumptions on the share of informal households in the city.*

In the Cape Town Household Survey, 0,9% of households reported using paraffin as their primary cooking fuel (Figure 37). This reflects a continued decline in paraffin dependence among lower-income households for cooking – a favourable trend in terms of health and safety given the high incidence of fires, respiratory hazards and injury associated with paraffin use.

Figure 37: Proportion of Cape Town households using paraffin as their main source of energy for cooking



Sources: City of Cape Town (2012, 2023a, 2023c, 2024f); Stats SA (2025a)

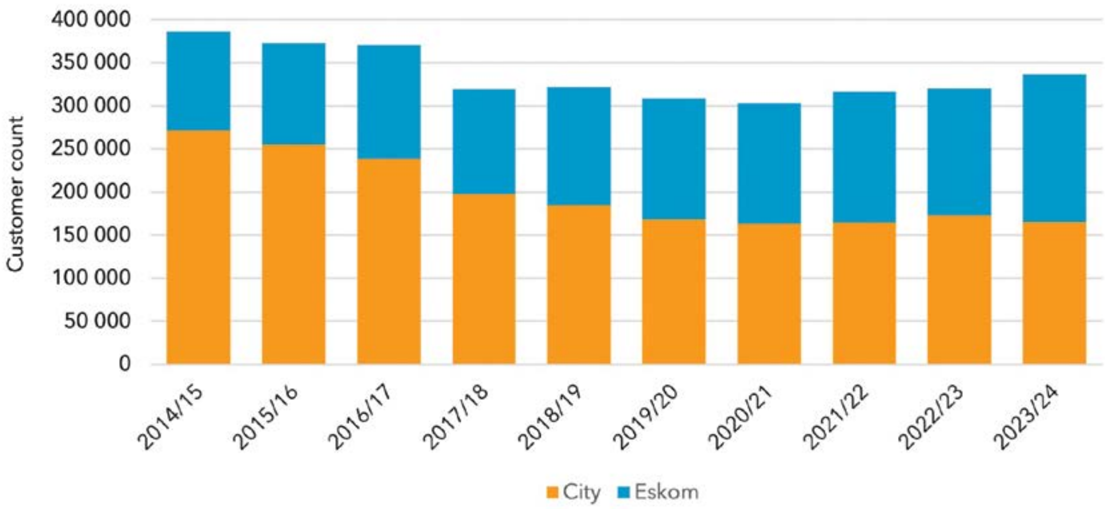
In summary, energy poverty linked to the growing unaffordability of safe energy as well as a lack of energy access in un-electrified areas and backyards remains a challenge in Cape Town. The City continues to monitor and address this through targeted interventions, including electrification programmes and research into alternative energy solutions. The continued use of candles and paraffin emphasises the need for affordability measures, supported by ongoing monitoring of households' energy choices and the factors that influence these choices. Progress towards universal electrification is hampered by an increase in households located on land that cannot be serviced. While the Cape Town Household Survey will help, determining an accurate enough figure to track electrification progress has been challenging due to the nature of these settlements, the shrinking sample sizes of the GHS, and a Census undercount. As traditional, unsafe and carbon-intensive fuels persist in some households, the transition to safer and cleaner energy sources becomes increasingly urgent. This challenge underscores the need for comprehensive electrification and targeted support to improve energy affordability and protect the most vulnerable households, ensuring that all residents can meet their basic energy needs safely and reliably.

2.4.3.3 Targeting free basic electricity (FBE) to support household affordability

As electricity prices continue to rise faster than general inflation, they place an increasing burden on vulnerable households. The national FBE policy, introduced in 2003, requires the allocation of a minimum of 50 kWh per household per month to all indigent households connected to the national electricity grid. This amount was based on the Electricity Basic Service Support Tariff Study, which established that 56% of households in Eskom-supplied areas consumed no more than 50 kWh per month, which was within the range of 35–60 kWh deemed sufficient for (basic) "lighting, media access, and some cooking" (Earthlife Africa, 2010; DME, 2003).

Eskom customers in the Cape Town municipal area who pay specific Homelight tariffs and purchase less than 250 kWh/month on average receive 50 kWh per month free of charge, funded by the City. The FBE programme for City-supplied customers has become progressively more targeted, with the flat-rate subsidy replaced in July 2013 with a consumption-based tiered structure. City customers on the Lifeline tariff receive either 60 kWh per month (if their average consumption over the previous 12 months was less than 250 kWh/month) or 25 kWh per month (if their average consumption was between 250 kWh and 450 kWh/month). The qualifying criteria for receiving FBE in City supply areas are based on a combination of average monthly electricity consumption and property value (as a proxy for income). These criteria are reviewed annually and approved by Council by way of the Tariff Policy. Households' eligibility is also reviewed regularly to ensure adherence to these criteria.

Figure 38: Number of residential customers receiving FBE in City and Eskom supply areas



Sources: City of Cape Town (2025c); Eskom (2025a)

As is evident from Figure 38 above, the number of indigent City customers started declining after 2014/15, reflecting the impact of periodic policy adjustments introduced since 2013/14. In 2015/16, the City's Lifeline tariff was restricted to households with properties valued under R300 000. While prepaid customers already on the tariff before July 2014 were allowed to remain, the intent was to target benefits to genuinely vulnerable households. Prior to this, many mid-income to high-income households with efficient energy use, part-year occupancy or rooftop solar still qualified based on low usage alone. After the valuation process in 2018, the municipality expanded the FBE qualifying threshold, increasing the property valuation limit to less than or equal to R400 000. Customers with homes valued at more than R400 000 were moved off the Lifeline tariff, which meant that they lost automatic access to FBE, unless they applied to be registered as indigent based on income. In 2023/24, the City again adjusted its FBE eligibility to account for property market inflation, raising the Lifeline property value limit from R400 000 to R500 000.

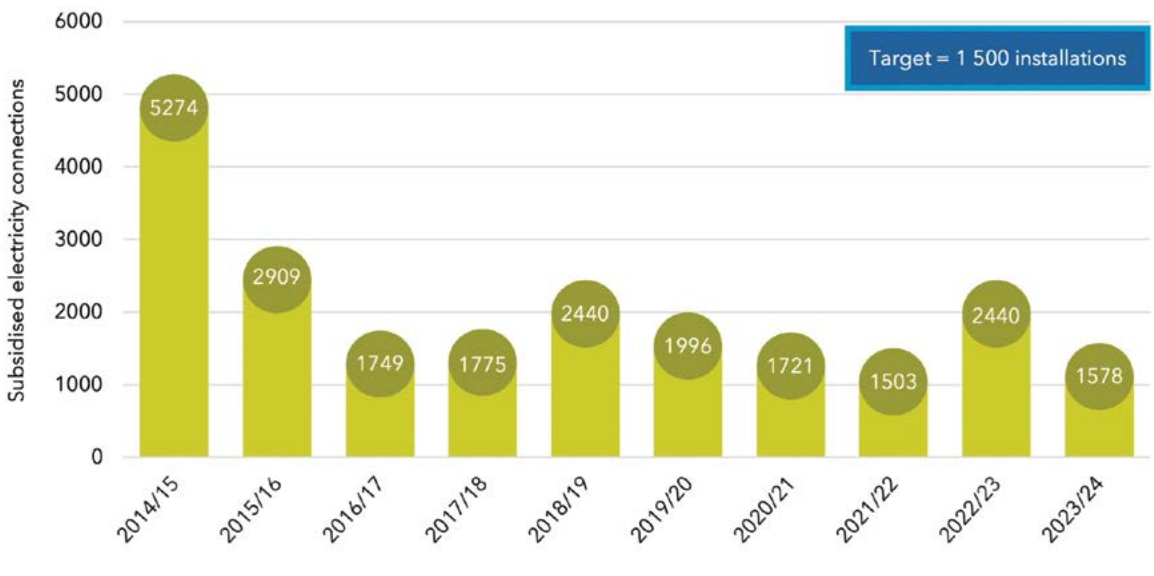
These more targeted measures tightened FBE access, making the assistance programme more sustainable and better geared towards assisting those the policy was initially designed for. This has somewhat contained the indigent subsidy bill for City customers in persistent adverse economic conditions. However, the number of indigent households in Eskom-supplied areas, where there are higher rates of low-income urbanisation and corresponding electrification, have increased over the past four years.

It is important that all households who are eligible for FBE and subsidised services receive access to the energy social package to improve their ability to participate in the economy and enhance their quality of life. As the FBE subsidy is currently allocated through a metered electricity connection in City-supplied areas, the electrification and metering of all households is essential to further alleviating energy poverty in Cape Town. Therefore, where electrification is possible, households in informal settlements and in backyards on City-owned land continue to be provided with a metered electricity connection. This is described in the section below.

2.4.3.4 Expanding access via subsidised electricity connections

The City runs a range of programmes to provide stable electricity access to informal settlements, backyard dwellings on public land and, with the necessary permission, on land not owned by the City, as well as subsidised housing developments. These initiatives include new connections, meter relocations and electrification projects, all of which rely on ongoing infrastructure upgrades, maintenance and replacements. Since 2014/15, the City has maintained its own annual target of 1 500 subsidised connections, as shown in Figure 39.

Figure 39: Subsidised electricity connections installed



Source: City of Cape Town (2025c)
**The data for 2014/15 and 2015/16 is not directly comparable due to a change to the data specifications in 2016.*

The process for a subsidised connection begins with a request for electrification, followed by an electrification feasibility assessment. If the informal settlement is deemed electrifiable, a beneficiary list is sourced and the project is initiated and added to the project schedule. If the informal settlement is considered un-electrifiable (located on a wetland, within a servitude or on unsuitable land, or the landowner refuses permission), the residents in that area are notified of the factors preventing electrification. If the area is electrifiable, but requires intervention, the City's electricity utility engages various internal and external stakeholders to address permissions or overcome obstacles for providing safe and legal electrification.

The subsidised connections are distributed across a wide geographic area, often in challenging environments. Prior to the Covid-19 pandemic, the City had successfully electrified all informal settlements that were listed on the official informal settlements database and fell within the designated electricity supply areas. As a result, the focus shifted from large-scale electrification to more targeted infill projects, extending existing electrical infrastructure to address small gaps or support incremental growth in already electrified settlements. In addition, the City initiated the backyarder programme in 2014, aimed at providing electricity connections to backyard dwellings situated on Council-owned properties, such as rental housing units.

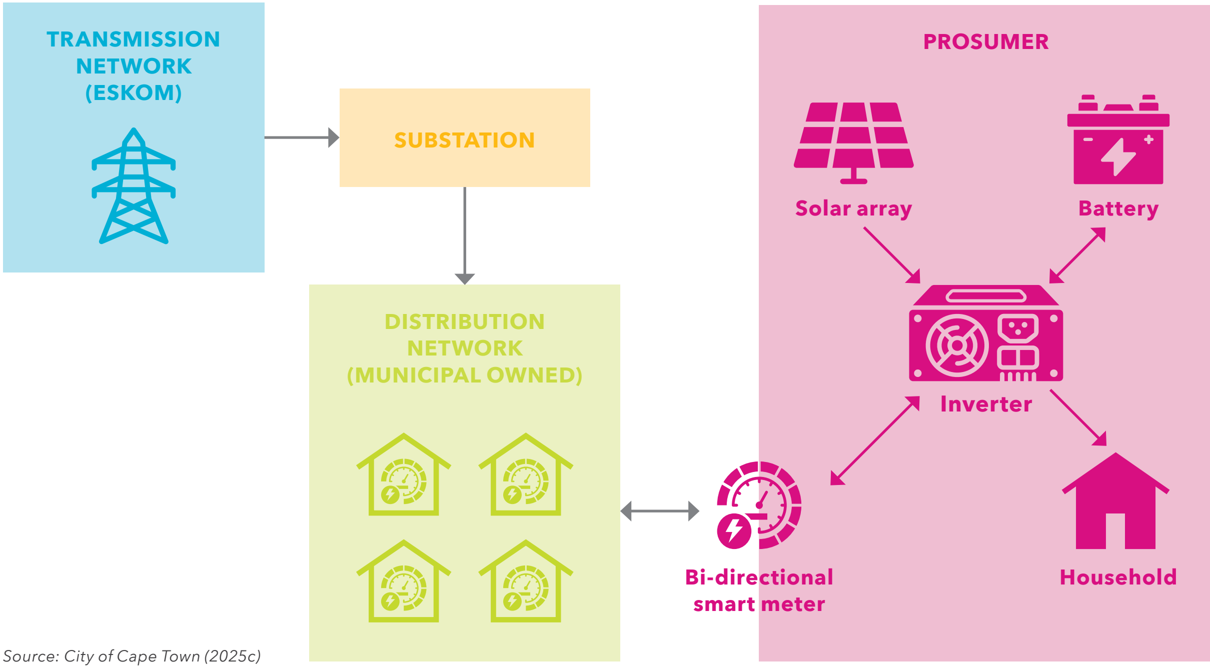
The onset of the Covid-19 pandemic significantly changed the context. Increased urban migration and socioeconomic pressures led to a rapid rise in the formation of new informal settlements, many of which are located on privately owned or encumbered land. These are areas that often face unresolved zoning, tenure or ownership issues, which require formal consent from the landowners, multi-stakeholder engagements and the finalisation of the required legal processes before electrification can proceed.

In recent years, the process of electrifying informal settlements has become significantly more complex due to a growing number of dependencies that must be addressed before implementation can begin. Even when all policy criteria are met and projects are approved in principle, many of the identified sites are no longer as accessible or straightforward to service as they once were. One major factor is increased settlement density. In many cases, structures are built extremely close together, making it difficult to access space for infrastructure. For example, to install a mini-substation, existing structures often need to be shifted or temporarily relocated – something that was far less common a few years ago. In addition, logistical and technical constraints, such as access routes for construction vehicles, safety clearances, and the need for space to safely lay underground cabling, further complicate delivery timelines. These dependencies have introduced delays and require coordination across multiple departments and stakeholders, including community representatives, planning units and private landowners.

2.4.3.5 Affordability of SSEG and battery storage

SSEG has emerged as a defining feature of South Africa's electricity landscape. Driven by persistent load-shedding, rising grid electricity costs and falling technology prices, installed capacity across the country reached an estimated 3,4 GWp by the third quarter of 2023, with at least 1,54 GWp concentrated in the country's major metropolitan areas (SALGA, 2023; SAPVIA, 2023). SSEG systems consist of three essential components, namely the solar PV array, battery storage and an inverter, with the latter linked to the household electricity network. The relationship between the City's utility grid and the SSEG can take two different forms: grid-tied systems (either with or without feed-in) or grid-tied hybrid, which can disconnect the incoming supply and connect the load to the PV or storage system. The standard grid-tied SSEG configuration is shown in Figure 40 below.

Figure 40: Standard configuration of grid-tied SSEG



Source: City of Cape Town (2025c)

Affordability has been a key driver of SSEG growth. Global supply chains, manufacturing scale and steady advances in technology have pushed down the costs of PV panels and inverters, while local incentives have improved payback periods. The 25% rooftop solar tax rebate for households installed between March 2023 and February 2024 (capped at R15 000), combined with the City's municipal feed-in tariffs and zero registration fees, further lowered the effective cost of installations. On a levelised cost of energy (LCOE) basis, small-scale PV with storage now averages about R700/MWh, with projections suggesting that this could decline to around R500/MWh by 2035 (IRENA, 2024).

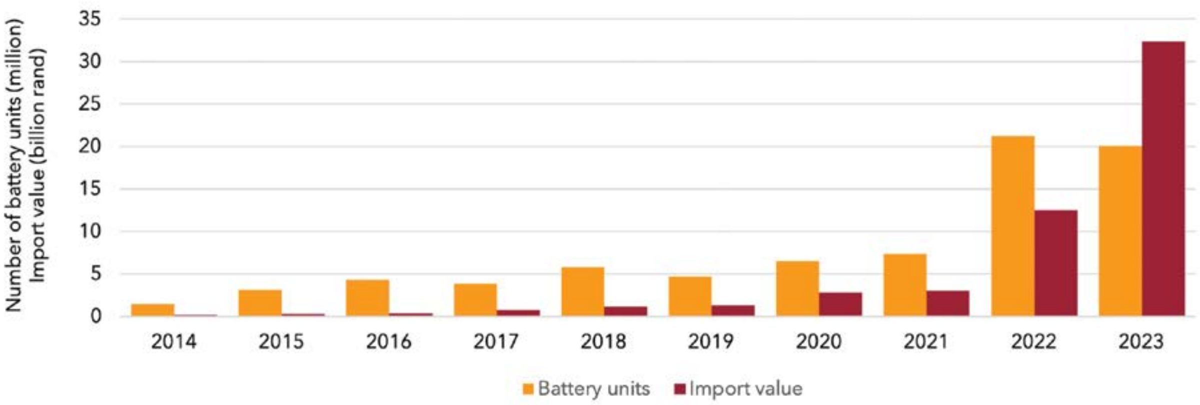
Battery storage costs have also fallen materially in recent years. According to Lazard's (2025) levelised cost of storage (LCOS) analysis, the LCOS for commercial and industrial lithium-ion systems (1 MW, two-hour duration) ranges from $319 to $506/MWh (R5,90–R9,40/kWh), reflecting a steady decline from earlier cost benchmarks. GreenCape (2025) reports typical installed battery costs of R6 000–R10 000 per kWh and LCOS values of roughly R3,50–R6,50 per kWh for smaller behind-the-meter lithium-ion systems, well above prevailing grid tariffs. When combined with an upfront investment of around R150 000 for a 10 kWp solar-plus-storage system, these factors place such systems beyond the immediate reach of most households (GreenCape, 2025).

By contrast, commercial and industrial users whose demand aligns more closely with daytime PV generation are often better positioned to reach cost parity, particularly when supported by favourable financing structures and additional value-stacking (e.g. peak-shaving, load-shifting). It is also important to recognise that without cost-reflective, unbundled tariffs that recover the full cost of distribution network services, the current return on investment for behind-the-meter systems appears overstated.

Indeed, financing innovation has played a critical role in expanding uptake. Lease-to-own agreements, concessional debt and PPAs allow consumers to bypass upfront capital costs and rather spread investment over 10–20 years. For commercial users, these options can undercut grid electricity prices, especially when combined with revenues from feed-in tariffs and energy trading. Together, declining technology costs and financial innovation are narrowing the gap between renewable self-generation and conventional supply, making solar-plus-storage increasingly viable across income groups and business models.

The rapid rise in lithium-ion battery imports into South Africa illustrates this transition (Figure 41 below). Imports have surged in recent years, reflecting both commercial-scale procurement and the sharp increase in residential adoption of storage to complement rooftop solar as well as favourable exchange rates. While still concentrated among higher-income households and businesses, the growing affordability of batteries is expanding access and enabling more consumers to manage load-shedding, shift consumption patterns and improve resilience. Battery imports slowed in 2023 due to the unfavourable exchange rate, but remained high.

Figure 41: Lithium-ion battery imports into South Africa



Source: SARS (2025a)

This shift is not only about affordability – it is transforming the structure of electricity markets. As more consumers become 'prosumers', both producing and consuming their own electricity, demand patterns are changing. Peak loads on utilities are reducing, wholesale electricity prices during solar hours are compressed, and the need for new regulatory frameworks is increasingly urgent. Distributed solar and storage enhances the resilience of individual homes and businesses by mitigating outages. Where access to these systems is provided to the distribution utility, they can also improve system flexibility and defer costly network upgrades. In Cape Town, these trends are reshaping the local grid, fostering a decentralised, cost-competitive energy future that supports both climate goals and energy security.

2.4.4 Carbon neutrality

Carbon neutrality, or net-zero carbon, is defined as a state in which carbon-dioxide emissions from anthropogenic activities equal carbon-dioxide removal, and is an essential component of South Africa's broader climate action agenda. Under the Paris Agreement, the country has set its net-zero commitments with a view to 2050 and is currently updating its long-term low emissions development strategy, detailing how net zero will be achieved.

Overall, the data for this period indicates a gradual but slow trend towards carbon neutrality in the Cape Town electricity sector. Coal-fired power plants are expected to continue dominating national generation supply for decades, given delayed decommissioning schedules and the completion of megaprojects Kusile and Medupi. While the technology to decarbonise electricity generation is already available – unlike in some other sectors – the pace of decarbonisation needs to accelerate significantly beyond that observed over the period 2019–2023 to align with both the City's and national GHG emissions reduction goals for 2050.

Box 9: Carbon neutrality in the electricity sector

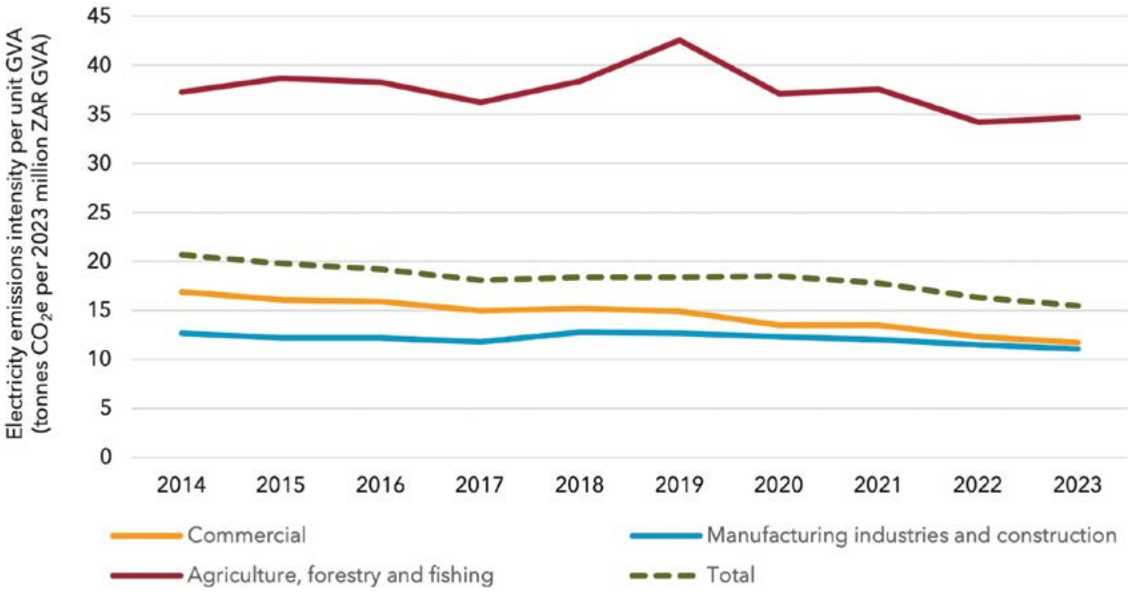
1. **Falling grid emission factor:** Eskom/City grid emission factor has edged down (from approximately 1,0 to <0,9 kg CO_2e/kWh) as renewables/nuclear share rises.
2. **Lower electricity intensity of the economy:** Electricity per unit GVA has dropped by about 20% since 2014, reflecting efficiency and structural shifts.
3. **Rapid SSEG uptake:** Strong growth in rooftop PV in Cape Town puts city ahead in the Western Cape; residential share especially high, building a cleaner, more distributed supply base.
4. **Municipal leadership:** Over 100 City buildings with SSEG (approximately 2,64 MW; 4,22 GWh/year) and ongoing LED/HVAC retrofits deliver verified savings.
5. **Enabling municipal regulation:** Feed-in tariffs, wheeling on the City grid and streamlined registration unlock private renewables investment.
6. **Strategic commitments:** Net-zero carbon buildings pledges (municipal by 2030; all new by 2030; existing by 2050) keep momentum and focus.
7. **Coal-heavy national fleet persists:** Eskom performance swings (EAF) and plant efficiency dips can lift the grid factor (peaks near 1,07 kg CO_2e/kWh).
8. **SSEG still small in the mix:** Despite fast growth, embedded generation supplies about 1,5% of total city demand, which is insufficient to shift citywide emissions quickly.
9. **Uneven access to clean tech:** High upfront costs for PV and storage limit adoption in low-income areas, slowing equitable decarbonisation.
10. **Load-shedding side-effects:** Diesel peaking and backup generators raise local emissions intensity during shortages.
11. **Data and compliance gaps:** Under-registration of PV and limited end-use data hinder accurate accounting and targeted interventions.
12. **Long asset cycles & retrofit pace:** Deep retrofits across existing private building stock and industry are capital-intensive and slow to scale.

2.4.4.1 Overall emissions intensity of electricity use in Cape Town

In countries with more advanced economies, four major trends are shaping national electricity systems: First, these systems are growing because of a shift from gas to electricity use. Second, electricity generation is becoming less emissions-intensive (kgCO_2 per kWh) as the proportional contribution of renewable energy rises. Third, systems are becoming more energy-efficient, partly because of a shift of energy-intensive primary industries to countries with emerging economies. Finally, electricity systems are becoming more decentralised, with a growing contribution from distributed generation such as rooftop solar and storage.

Similar trends are apparent in Cape Town. Emissions intensity, measured as GHG emissions per unit of GVA, has fallen by 20% since 2014, as shown in Figure 42.

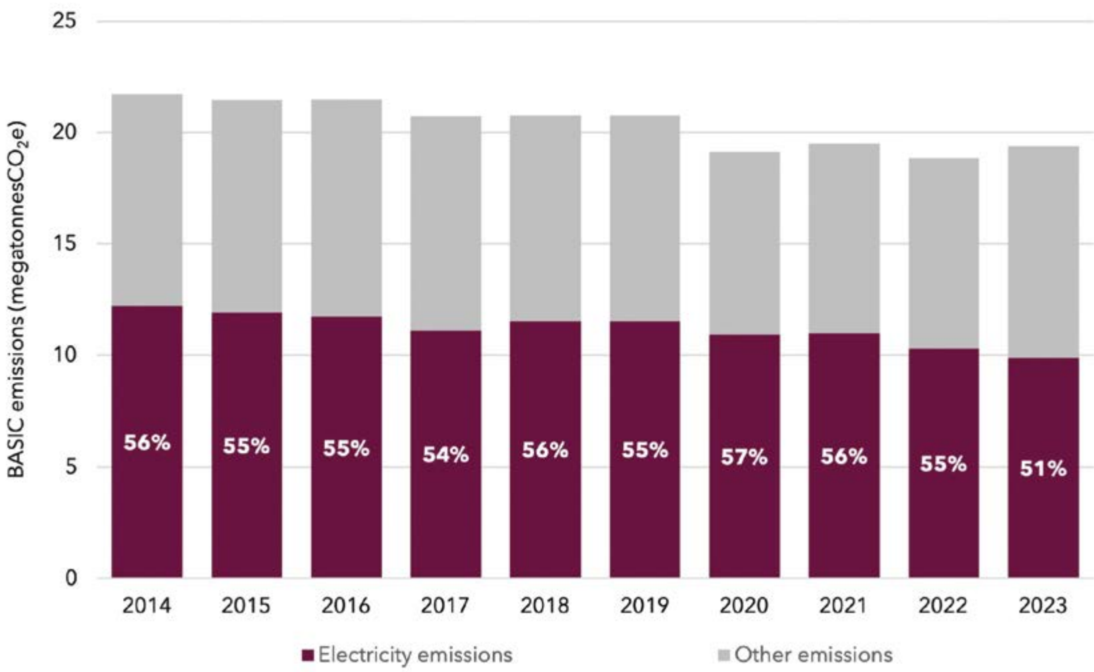
Figure 42: Electricity-related GHG emissions intensity per unit of GVA in Cape Town



Sources: City of Cape Town (2025c); Eskom (2025a); Stats SA (2025b)

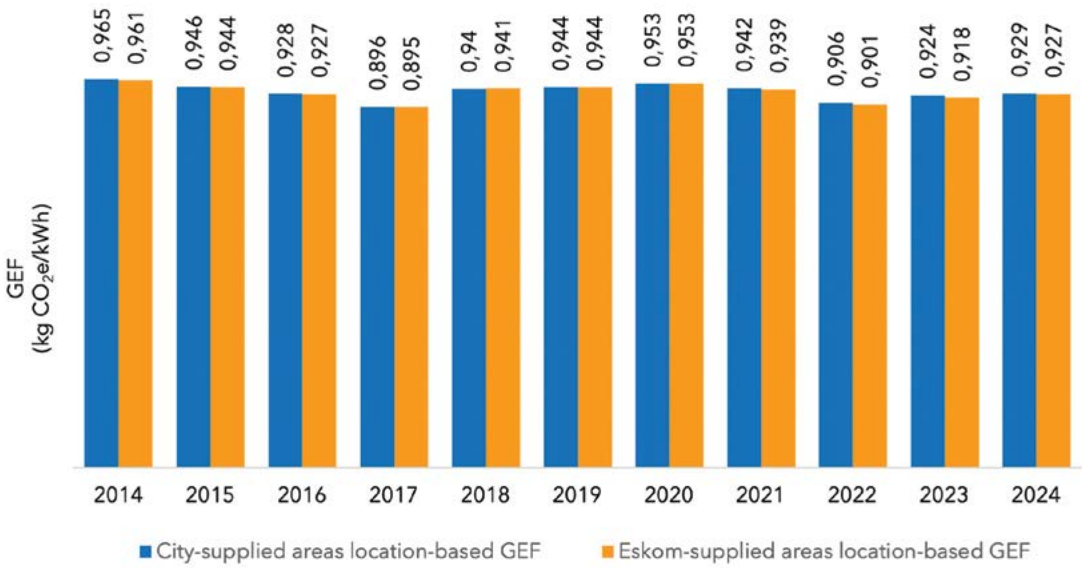
The overall share of emissions associated with electricity consumption has remained above 50% over time (Figure 43). The noticeable decline in 2023 can be attributed to reduced electricity consumption across all sectors as a result of load-shedding as well as customers' adoption of alternative electricity supplies to grid electricity. This electricity-related emissions trend is further reflected in the GEF trend (Figure 44).

Figure 43: Share of emissions from electricity consumption over time



Sources: City of Cape Town (2025c); Eskom (2025a)

Figure 44: Grid emission factor (GEF) for Eskom-supplied and City-supplied areas



Sources: AFREC (2024); City of Cape Town (2025c); DFFE (2025a); Eskom (2025a)

The national GEF reflects the full national supply mix, including Eskom generation, IPP contributions, and imports/exports. Therefore, the national GEF is still heavily tied to Eskom generation performance. Over the period 2013/14 to 2023/24, Eskom's generation emission factor has fluctuated between a low of 0,96 kg CO_2e/kWh in 2017/18 and a high of 1,07 kg CO_2e/kWh in 2023/24. These differences were largely driven by operational efficiency at coal plants. Improved plant performance and lower utilisation (because of load-shedding in 2017, 2022 and 2023) reduced the Eskom generation emission factor and, therefore, the national GEF, while declining efficiency and higher reliance on older units pushed it back up.

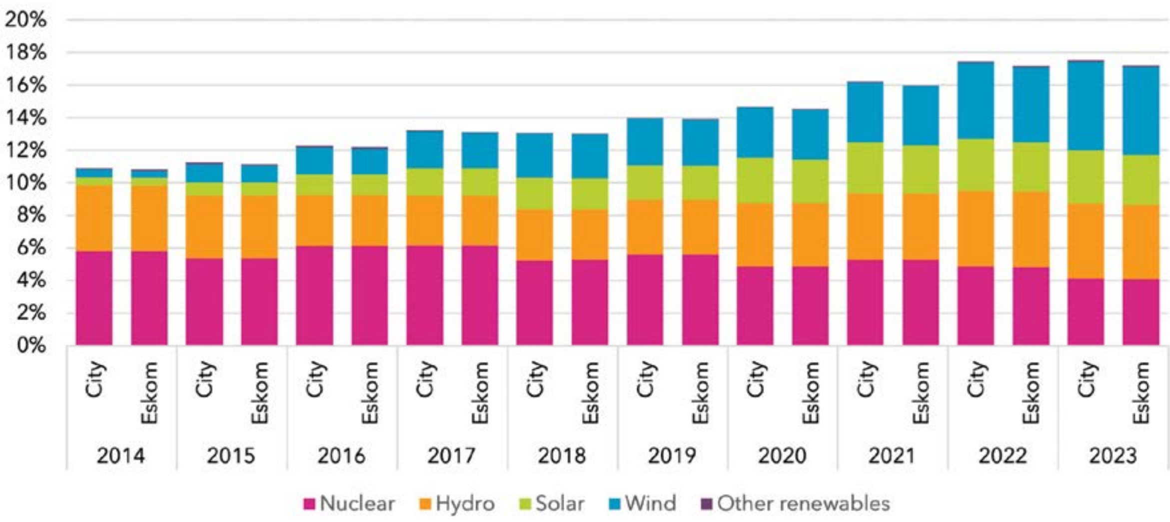
The percentage of renewables and nuclear in the national grid (Eskom-supplied areas) and City-supplied areas is shown in Figure 45 below. Since 2014, the contribution of renewable energy (wind and solar) to the total supply has grown due to the national Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), albeit from a low base and at a slow pace. Between 2014 and 2023, the amount of electricity from renewable IPP sources increased from 2 TWh to 18 TWh[11] (Eskom, 2025a).

The GEF for City-supplied areas is consistently slightly higher than in Eskom-supplied areas across all years. This is a result of the energy losses associated with pumped storage at Steenbras, which the City operates extensively to moderate the cost of electricity as well as stave off load-shedding. Because pumped storage consumes more electricity in pumping than it generates, it increases the relative share of non-renewable electricity in the City's grid supply. While increasing SSEG fed into the City's grid expands the share of renewables, this is not enough to counteract electricity losses associated with Steenbras pumped storage.

Together, these trends highlight the complex interplay between GEFs, structural reliance on Eskom generation, and the City's unique operational role.

[11] *Data on IPP purchases prior to 2018 was obtained from the CSIR's report Utility-scale power generation statistics in South Africa of 2024.*

Figure 45: Percentage of nuclear and renewables in the Eskom and City grid



Sources: City of Cape Town (2025c); DFFE (2025a, 2025b); Eskom (2025a)

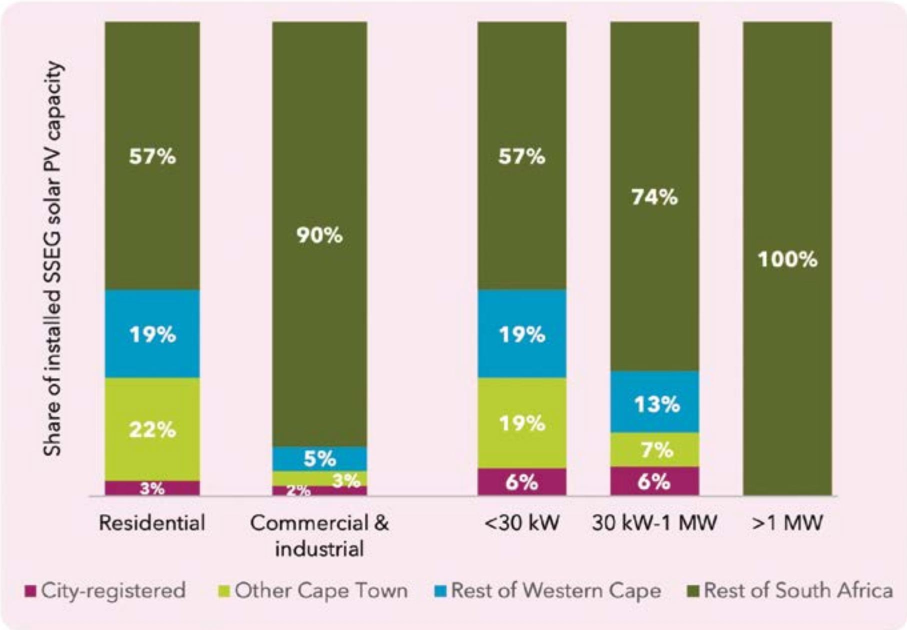
2.4.4.2 Small-scale embedded generation in the city

As discussed in previous sections, SSEG, particularly rooftop solar PV, is becoming an increasingly important component of Cape Town's electricity landscape. Figure 46 highlights the significant contribution that Cape Town already makes to installed SSEG capacity relative to both the Western Cape and the rest of South Africa.

In the residential sector, Cape Town accounts for a quarter of the country's visually detected installed SSEG capacity, while only accounting for 8% of the national population, which reflects the strong uptake of household solar. The trend is even more pronounced in the commercial and industrial sector, where Cape Town installations represent around 5% of the national total. While modest at the national scale, these systems play a critical role in the city context, supporting business resilience in the face of rising tariffs and load-shedding.

With regard to system sizes, Cape Town's contribution is visible in both the <30 kW residential and small-business sector, where it represents 25% of capacity, and in terms of medium-scale installations (30 kW–1 MW), with Cape Town making up 13% of the national total. Large-scale embedded generation (>1 MW) remains dominated by installations outside the city. Nevertheless, Cape Town's cumulative installed capacity positions it as a leader and a key urban driver of decentralised renewable energy, with tangible contributions to both carbon neutrality, affordability and resilience.

Figure 46: SSEG capacity in Cape Town, the Western Cape and South Africa, 2023



Sources: Eskom (2024a); IPP Office (2023); GeoTerra Image & SAPVIA (2024); City of Cape Town (2025c), WCG (2025a)

2.4.4.3 Total capacity of approved, grid-tied, and commissioned SSEG installations

The total capacity of approved, grid-tied and commissioned SSEG installations in the City-supplied electricity distribution areas has increased exponentially over the period 2014 to 2024. The trend reflects an accelerating shift towards decentralised renewable energy solutions in residential and commercial buildings, the concerns for business continuity and disruption in household activity due to load-shedding, and attractive payback periods for commercial-scale systems. Importantly, the majority of these are very small systems installed on higher-income residential properties, with fewer but significantly larger systems installed at commercial properties. An interesting phenomenon in Cape Town as well as South Africa more broadly is that load-shedding has accelerated the pairing of SSEG systems with batteries to mitigate load-shedding outside of solar generation time periods.

Under the Mayor's priority programme titled "Energy security for economic growth", a number of activities have supported further SSEG uptake in the city, including awareness campaigns, registration streamlining, technical readiness, tariffs and metering. Registered SSEG customers are placed on the appropriate tariff and may choose to sell excess electricity to the grid, which is then credited to the customer on a net billing basis.

Figure 47: Approved, grid-tied and commissioned SSEG – cumulative capacity

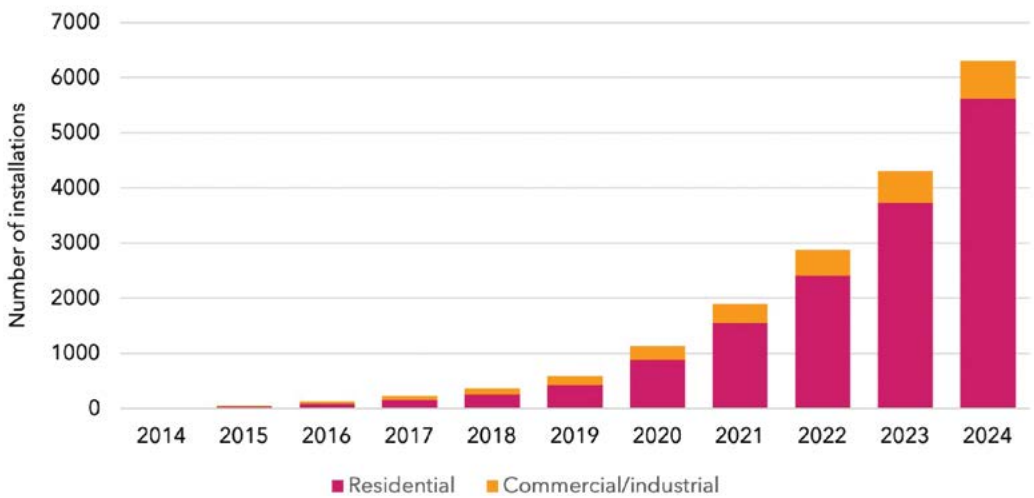
Source: City of Cape Town (2025c)
**Includes approved, grid-tied and commissioned installations as well as legalised grid-tied installations.*

2.4.4.4 Total number of approved, grid-tied and commissioned SSEG installations

A similar trend in SSEG is seen from the total number of approved grid-tied installations among the City's commercial and residential customers. However, since residential systems are on average 14 times smaller than commercial systems (112 kWp vs 8 kWp), there are many more residential SSEG systems than commercial ones.

Despite the increase in installations, though, the contribution of SSEG to Cape Town's total electricity demand is relatively small (1,5%). Yet the landscape is changing rapidly. In 2024, several companies began offering energy deals in which consumers can purchase renewable energy at a significantly lower price compared to utility-based suppliers.

Figure 48: Approved, grid-tied and commissioned SSEG – number of installations



Source: City of Cape Town (2025c)
**Includes approved, grid-tied and commissioned installations as well as legalised grid-tied installations.*

2.4.5 Resilience

The City defines energy resilience as an energy system that is increasingly capable of restoring or adapting system functionality in the event of, and is less exposed to, shocks and stresses. Overall, the resilience of the electricity system has been strengthened through City-implemented initiatives, with some of these gains undermined by external events, such as severe load-shedding. This has resulted in variable resilience performance for the reporting period.

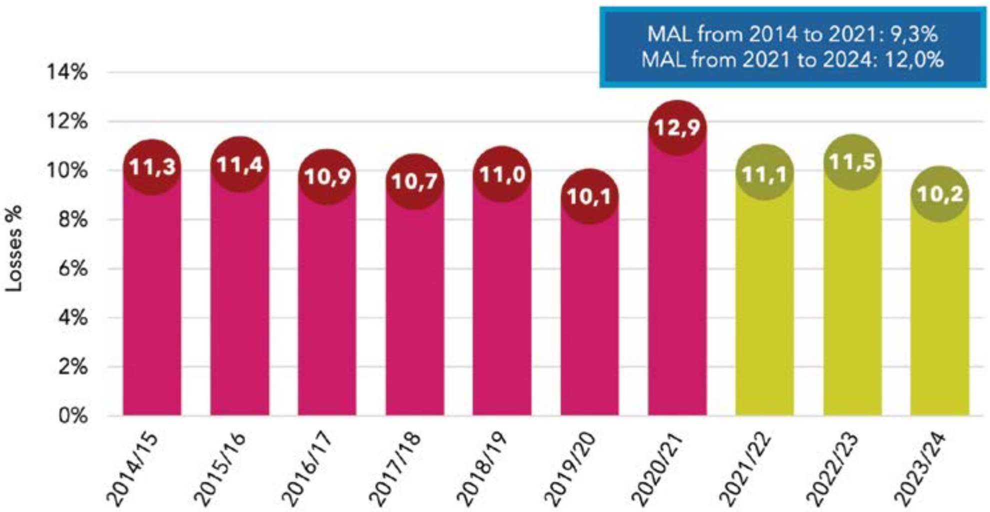
Box 10: Resilience of the electricity sector

1. **Declining electricity losses (%):** Percentage losses have trended down, reflecting improved operational efficiency and revenue protection, despite rising financial costs.
2. **Expanded prepaid coverage:** Share of prepaid residential and small commercial customers grew from 76% (2012/13) to 87% (2023/24), strengthening revenue collection and reducing non-technical losses.
3. **Supply diversity emerging:** City's supply shifted from 100% Eskom to approximately 99% Eskom, with incremental growth in City-owned and alternative generation sources.
4. **Municipal generation capacity:** Steenbras hydro storage, gas turbines and new solar projects provide local backup, flexibility and peaking support.
5. **Managed frequency of interruptions (ASIFI):** Frequency of faults remains low and within targets, even though duration per event has risen.
6. **High cost of losses:** R914 million lost in 2023/24 despite percentage declines, reflecting the impact of high tariffs on the financial burden.
7. **Theft and vandalism:** Growing risks to cables, transformers and streetlighting networks undermine resilience and raise restoration costs.
8. **ASIDI increases:** Duration of outages rose to 2,9 hours in 2021/22 before easing, showing vulnerability to longer events.
9. **Limited supply diversity:** Despite new initiatives, the grid remains almost entirely dependent on Eskom supply, keeping risk exposure high.
10. **Streetlighting deterioration:** A burn rate consistently below 90%, worsened by vandalism and theft, undermines reliability of public services.

2.4.5.1 Total electricity losses

As introduced in Box 4 and illustrated in Figure 18, distribution losses include both technical and non-technical components, and occur across the electricity flow from supply to end use. Figure 49 below shows how these losses have evolved within the City's network, as well as their implications for resilience and cost recovery.

Figure 49: Percentage technical and non-technical losses



Source: City of Cape Town (2025c)

Losses are calculated over a 12-month period to account for billing and usage timing differences, and represent the difference between electricity purchased or generated and the amount of electricity sold. While some losses are unavoidable due to the nature of power distribution infrastructure, a portion stems from non-technical losses, including tampering, bypassing, illegal connections, and metering inaccuracies.

Between 2014/15 and 2019/20, total electricity losses generally remained close to or just above 10%, slightly exceeding the City's target of no more than 9,3% for that period. In 2020/21, losses rose sharply to 12,9%, surpassing the target and highlighting the growing challenges in containing non-technical losses during a period of heightened system strain.

From 1 July 2021, the City adopted the national benchmark of 12,0% as its new target for the 2021/22–2023/24 period. Since then, reported losses have moderated, falling to 11,0% in 2023/24. The financial impact of these losses remains substantial: In 2023/24, they were valued at over R914 million, up from R767 million in the previous year, although this increase reflects rising electricity prices rather than an increase in the volume of losses. While the monetary value of losses has risen, the percentage losses themselves have declined, suggesting improvements in overall system performance.

Strengthened revenue protection efforts and the City's meter replacement programme have helped contain non-technical losses. For example, the share of residential and small commercial prepaid customers rose from 76% in 2012/13 to 87% in 2023/24, improving revenue assurance and reducing the risk of tampering.

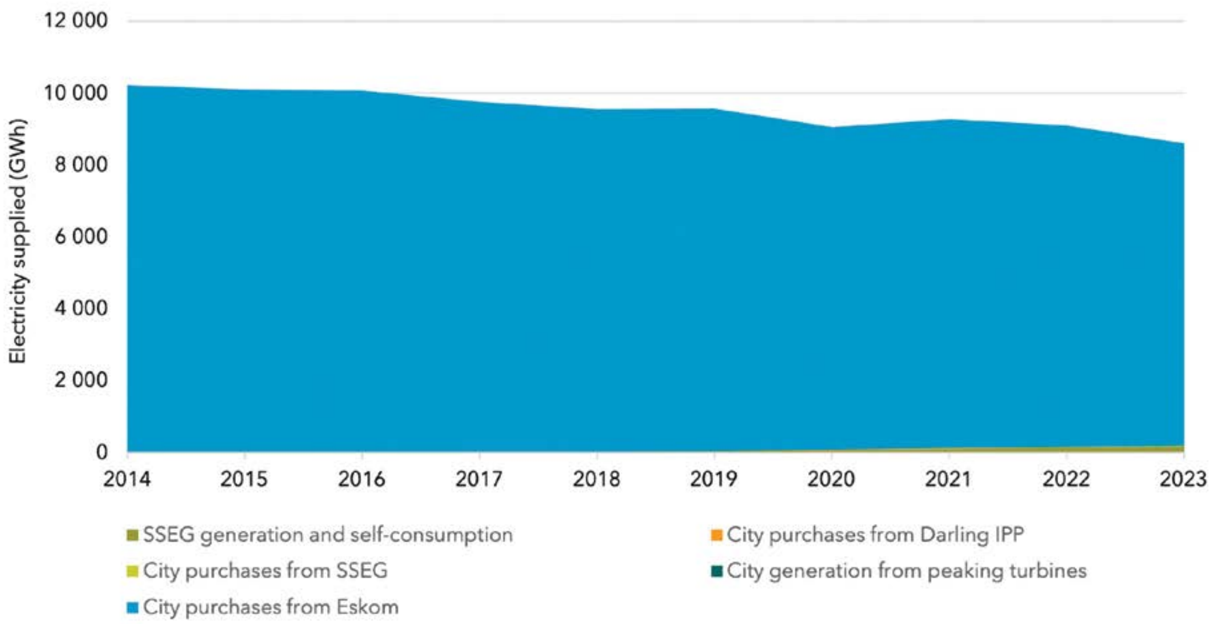
Overall, the City has made progress in controlling electricity losses, especially in the past two financial years. The consistent reduction below the 12% target reflects a combination of system efficiencies and tighter operational controls.

2.4.5.2 Diversity of Cape Town's electricity supply

Diversity is a critical concept in the literature on resilience: A system's ability to adapt or respond to shocks and stresses is generally improved when relying on multiple sources rather than only one. In the electricity context, this translates to having a diversity of suppliers (not relying on Eskom alone), a diversity of electricity sources, as well as diversity in demand. This reduces the risk exposure from any one entity and allows for quicker restoration of supply, as the utility can switch to another supplier more easily. Figure 50 shows the full electricity supply mix entering the City's distribution grid, which is still dominated by Eskom bulk purchases. Alternative sources such as SSEG feed-in, municipal peaking generation and the Darling supply are present, but appear very small. Overall, the City's supply mix has changed from being 100% reliant on Eskom to 98,97% Eskom-supplied.

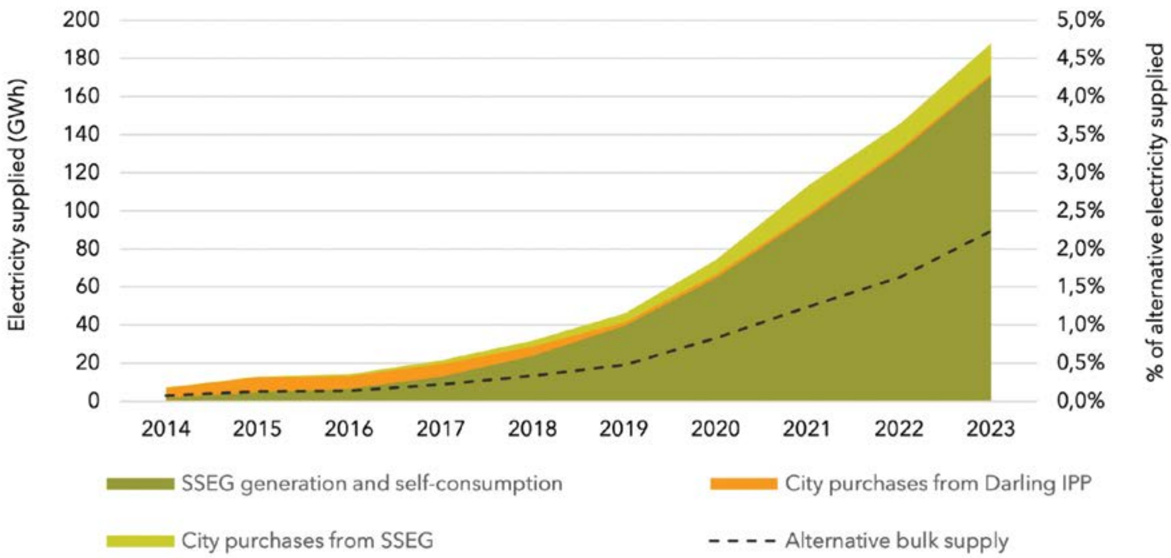
Figure 51 provides a view of the same alternative components, excluding Eskom bulk supply. This highlights the rapid rise in SSEG generation and self-consumption since 2020, as well as increasing SSEG feed-in. The dashed line shows the share of total electricity in City supply areas coming from these alternative sources, which increased to about 2,2% in 2023.

Figure 50: Suppliers of electricity into the City distribution grid



Source: City of Cape Town (2025c)

Figure 51: Alternative suppliers of electricity in City supply areas



Source: City of Cape Town (2025c)

Although they still constitute only a fraction of total consumption, the increase in alternative electricity sources post-2020 signals a gradual shift as a result of investments made by both private and public stakeholders in City supply areas. A list of City-owned generation/storage sources is shown in Table 4 below.

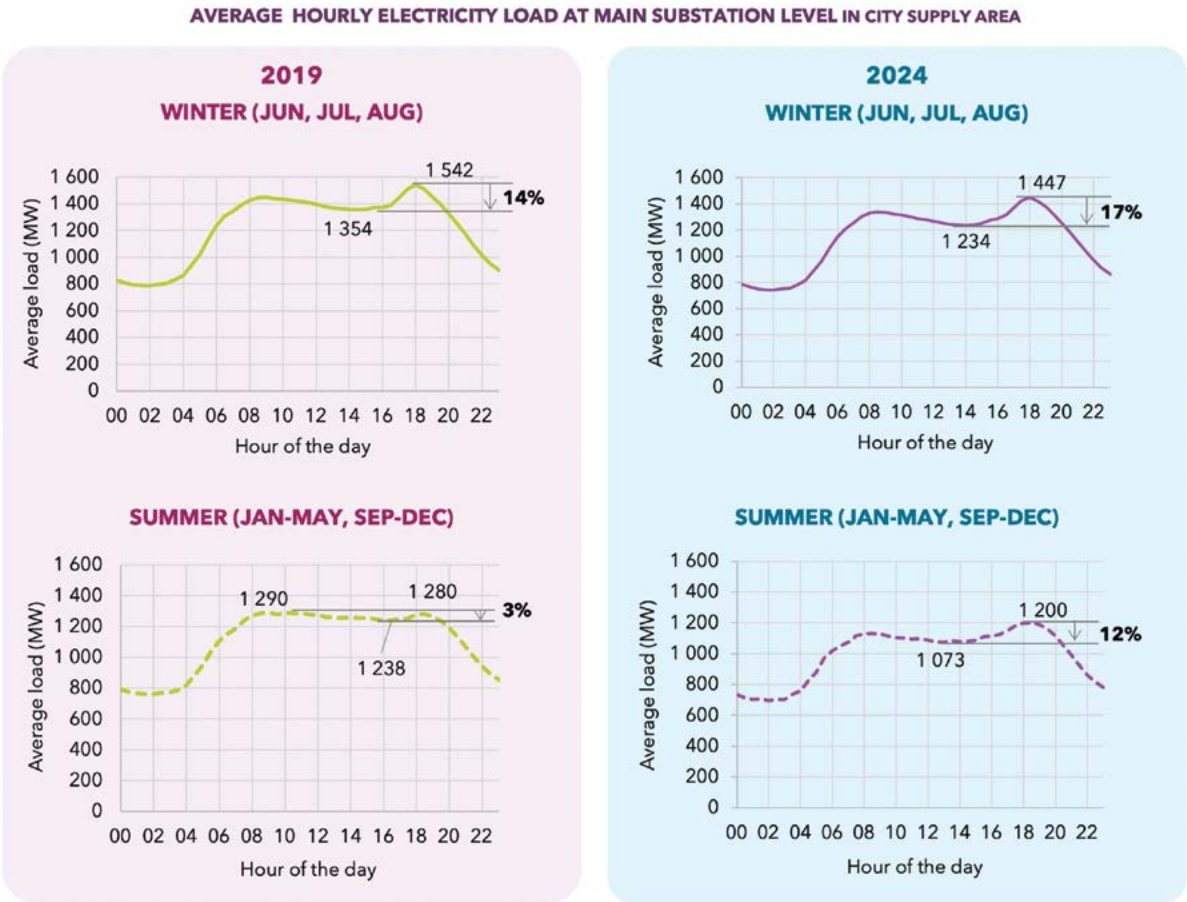
Table 4: City-owned electricity generation/storage facilities

SOURCE	DATE COMMISSIONED	CAPACITY (MW)
Steenbras hydro pump storage scheme	1979	172
Athlone gas turbine (now mothballed)	1973	36
Roggebaai gas turbine	1982	42
Atlantis solar PV plant	Under construction	7
Paardevlei solar PV plant	Development phase	70

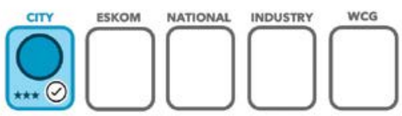
2.4.5.3 Shifts in weekday load profile, and implications for network resilience

Figure 52 shows the average hourly electricity load measured at main substations in City supply areas for a typical weekday in winter and summer, comparing 2019 and 2024. Total load decreased over all hours of the weekday profile in both winter and summer. The baseload and peak-load consumption reduced in ranges of 4–6% in winter and 6–13% in the low-demand season. The higher difference between daytime peak and trough in 2024 may be due to a higher capacity of solar PV SSEG installed as a response to heavy load-shedding experienced during 2022–2023. This is supported by the much larger difference between the 2019 and 2024 summer peak-to-trough ratios. The 2024 summer pattern indicates the early development of a slight duck-curve effect, which is expected in systems with a growing share of solar PV generation. From a resilience perspective, lower baseloads and peak loads reduce strain on network infrastructure and operating capacity, which helps maintain service levels during periods of system stress. At the same time, the widening peak-to-trough difference suggests that future flexibility in managing evening demand may become increasingly relevant as behind-the-meter generation continues to grow. The increased summer air-conditioning load expected from climate change locally, along with EV charging, could introduce additional network management challenges.

Figure 52: Comparative weekday load curves for winter and summer periods, 2019 vs 2024



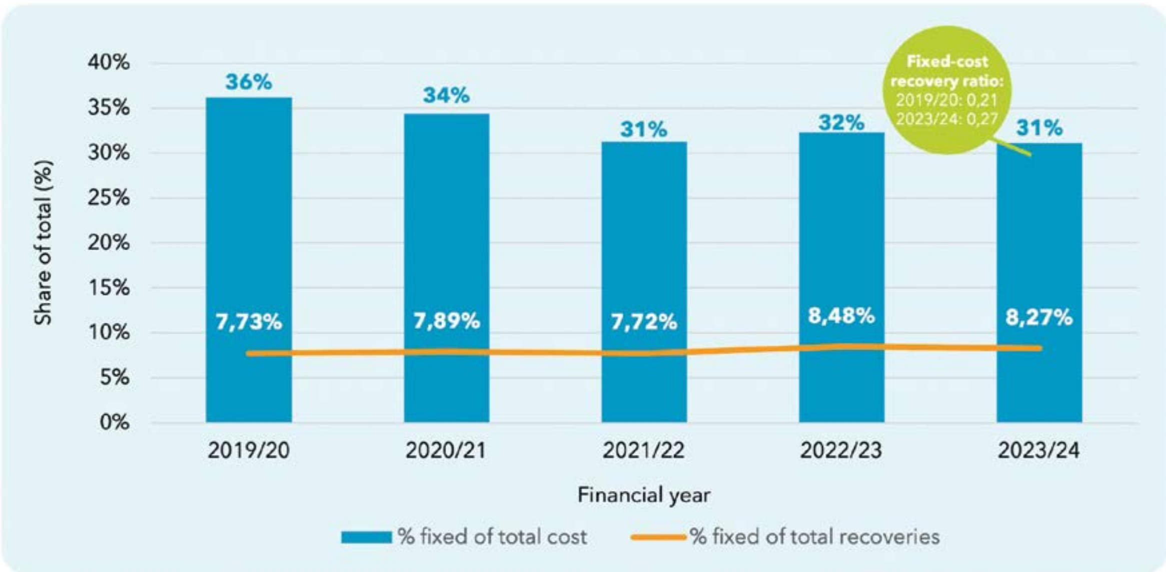
Source: City of Cape Town (2025c)



2.4.5.4 Financial resilience of the electricity utility

Figure 53 below highlights the relationship between the City's utility cost structure and the way in which revenue is recovered through tariffs. Over the past five years, fixed costs have made up approximately one third (31–36%) of total costs, representing essential and ongoing expenses required to provide the electricity service, such as network capacity, administrative support and metering. Over the same period, around 7–8% of total revenue was recovered through fixed charges, meaning that only a quarter of total fixed costs was recovered through the tariff. This highlights the limited role that fixed charges have played in cost recovery to date, and the need to rebalance tariff structures to improve financial sustainability. To ensure a working electricity service, it is not sustainable to rely on unpredictable electricity sales alone.

Figure 53: Strengthening cost-reflectivity in the electricity tariff: fixed costs vs fixed revenue



Source: City of Cape Town (2025c)

This pattern reflects a tariff structure that has, to date, placed a greater emphasis on energy-based (variable) charges. While this approach has supported consumption-linked pricing, it also means that a relatively small portion of unavoidable fixed costs is recovered through fixed charges. As customer consumption patterns evolve – including increased energy efficiency, embedded generation and a more competitive electricity market – a stronger link between fixed costs and fixed charge recovery will support the utility's long-term financial sustainability and fairness across customer categories.

2.4.5.5 Average system interruption duration index (ASIDI)

The ASIDI of a distribution network measures the total duration of sustained power interruptions experienced by a connected load over a year. Because customer-level outage information is not yet utilised, the City determines this metric by means of the formula shown below.

$$\text{Annual network ASIDI (medium + high-voltage)} = \frac{\text{Sum network MVA hours lost (medium + high-voltage)}}{\text{Average installed capacity}}$$

Supply-point outages originating from Eskom, including load-shedding, are excluded, as these fall outside the operational control of the municipal network. Re-interruptions are also omitted to avoid double-counting. The ASIDI is widely recognised as a key indicator of system resilience, as it provides insight into a utility's ability to restore network functionality following a fault.

Over the past decade, the City has achieved a substantial reduction in ASIDI. The index reached a low of 1,3 hours in 2016/17, but then gradually increased to around 2,9 hours in 2021/22, during which ASIFI (as shown in Figure 32) was stable (i.e. fewer interruptions), but interruption events were of a longer duration, causing ASIDI to spike. Importantly, even as ASIDI indicates increased duration in some recent years, the frequency of supply interruptions to connected load has been effectively managed within the target of less than three hours, with ASIDI returning to approximately 2,2 hours in 2023/24.

Figure 54: Average system interruption duration index (ASIDI)

Source: City of Cape Town (2025c)

As Cape Town moves towards an electricity future that is increasingly distributed, bidirectional and diverse, the metrics of reliability, affordability, carbon neutrality as well as resilience will play a critical role in guiding the City's programmes and objectives.

2.4.6 Summary of electricity use trends

Figure 55 below summarises the dynamics affecting the supply and demand of electricity.

Figure 55: Key dynamics affecting electricity supply and demand

COVID-19 DOWNTURN	LOAD-SHEDDING IMPACT	TARIFF PRESSURES	SSEG GROWTH
Sharp dip in 2020; commercial and manufacturing still below pre-pandemic levels	Demand suppressed by supply constraints in 2022 and 2023	Rising costs reinforcing need for supply diversity, efficiency and low-income subsidy	Rapid uptake across households, commerce and industry – reshaping usage patterns

RESIDENTIAL: Largest consumer, but per capita use declining

COMMERCIAL: Recovery slowed by reliability and changing work patterns

LOCAL GOVERNMENT: Stable, with solar starting to offset on-site demand

SSEG: Still small overall share, but exponential growth is building resilience in high-income residential and commerce sectors

Overall, Cape Town's electricity profile reflects the following:

- In contrast to the ongoing growth seen in industrialising economies, total electricity consumption has been dropping since 2007, despite high in-migration. Commercial and industrial electricity demand declined sharply during Covid-19 and remained depressed under load-shedding due to supply constraints, while per capita electricity use has fallen by around 30% over the past decade.
- The decline in electricity sales – driven by price response, efficiency gains and SSEG uptake – is reducing the capacity for cross-subsidisation and for cost recovery by the capital-intensive wires business. Additionally, the City's electricity utility must, within a short space of time, adapt to a changing customer base, restructure its business lines, and accommodate new services, such as wheeling, at scale. At the same time, it must diversify its supply options to hedge against price and supply risk through own builds, PPAs with IPPs and licensed traders, and trade in the imminent South African Wholesale Electricity Market.
- The 2022–2023 period saw supply interruptions of unprecedented duration and severity, with load-shedding in 2023 occurring over 75% of the time at some level, and 30% of the load (stage 6) disconnected for nearly one in every eight hours. This had long-lasting impacts on electricity demand, economic output and confidence, the regulatory and trading landscape, and energy behaviour across households and businesses.
- High-income households are increasingly offsetting grid electricity through efficiency measures, LPG and SSEG, which expanded rapidly between 2019 and 2024. Low-income households remain largely grid-dependent, constrained by affordability and limited access to resilience options.
- Severe load-shedding redefined SSEG for residential, commercial and industrial customers from a simple business decision to reduce grid electricity costs, to contributing to system resilience and customer self-sufficiency. The City extended its additional feed-in incentive and established a Cash for Power programme to compensate feed-in beyond just offsetting grid electricity bills.
- Continued high urbanisation by low-income households, particularly in expanding informal settlements on contested land, presents an electrification challenge. Balancing the rate of in-migration with sustained support for the vulnerable through FBE and subsidised tariffs in an increasingly constrained economic climate is proving difficult.

2.5 Solid, liquid and gaseous fuels

Unlike electricity, which the City distributes directly and, therefore, has a clear mandate to plan for, manage and regulate, solid, liquid and gaseous fuels fall outside the City's control. Supply, pricing and quality standards for petrol, diesel, LPG and other fuels are governed at the national level. Local governments have limited influence on the supply side beyond monitoring trends. However, on the demand side, they have an important role in shaping the future of energy services that currently use these fuels, including through the electrification imperative and harnessing improved technology.

2.5.1 Overview of fuel use

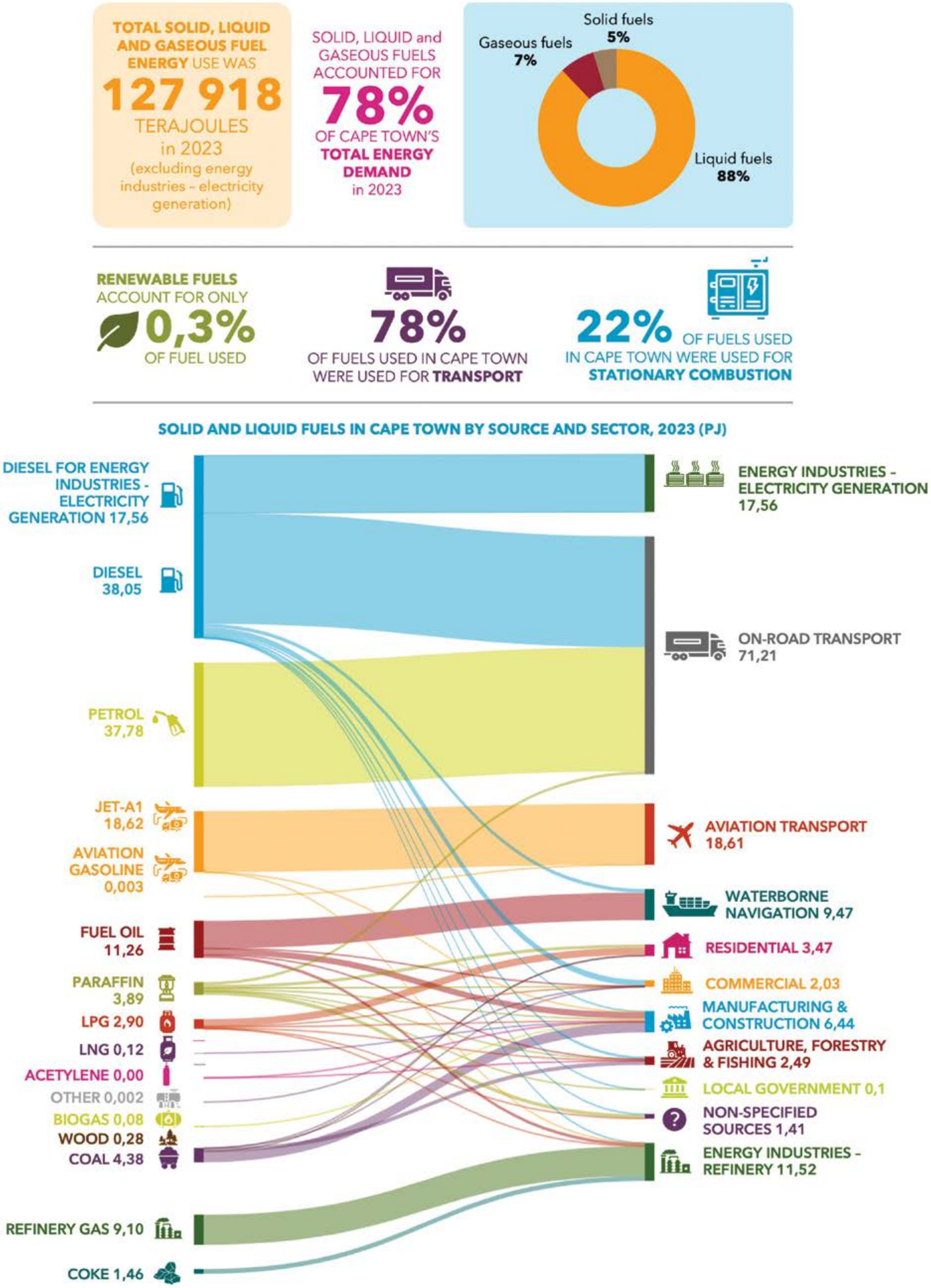
Solid, liquid and gaseous fuels remain central to Cape Town's energy system, accounting for 78% of the city's total energy demand in 2023 (127 918 terajoules (TJ), excluding utility energy generation) (Figure 56). Over 99% of this energy is fossil fuels, such as coal, petrol, diesel, paraffin and LPG, with only a tiny fraction of renewable wood and biogas consumed. For direct combustion of fuels, typically a third to two thirds of the energy is lost to waste heat, depending on the process. For fossil-fuelled derived electricity imported into the city, this has already happened at the power plant outside the city and the processes consuming electricity are generally very efficient. Taking these losses into account, electricity therefore contributes a similar proportion of overall useful energy to the economy as liquid fuels while offering a much greater diversity of applications. Nevertheless, these fuels remain essential for transport, industrial processes and many household energy needs. Critically too, large liquid fuel volumes incur significant foreign financial outflows subject to extremely volatile prices over the last twenty years (see Section 2.5.3.1).

In total, liquid petroleum fuels make up 88% of all solid, liquid and gaseous fuels used in Cape Town, with diesel (38,1 PJ) and petrol (37,8 PJ) leading the mix. Jet fuel contributes 18,6 PJ, highlighting the significance of Cape Town's role as an aviation hub, while paraffin[12] (3,9 PJ), fuel oil (11,3 PJ) and much smaller quantities of aviation gasoline (3,1 PJ) add further diversity. Typical of most cities without concentrated heavy industry, the transport sector is by far the largest consumer of liquid fuels, responsible for 78% of demand in the solid, liquid and gaseous fuel category, and 62% of total energy demand. On-road transport absorbs the majority of diesel and petrol consumption, while aviation and shipping/bunkering – key to important regional transport and tourist hubs – add further demand through jet fuel and heavy fuel oil.

Stationary energy use accounts for the remaining 22% of solid, liquid and gaseous fuel demand, supplying energy to industrial, commercial and residential applications. Coal, coke, refinery gas, LPG and smaller volumes of paraffin are important contributors. Coal remains an important heating fuel in specific manufacturing and food processing industries, though its role is steadily declining because of efficiency measures and fuel-switching. Biogas and wood also appear in the fuel mix, but together make up only 0,3% of total demand. Manufacturing, construction and food processing represent major stationary uses. Residential use of paraffin, LPG, coal and diesel (in generators during load-shedding) is modest in absolute terms, but remains important for energy access in unelectrified areas, as well as for affordability and resilience.

[12] *Paraffin is not a transport fuel, but its presence in the transport fuel mix is attributed to the illegal adulteration of diesel fuel.*

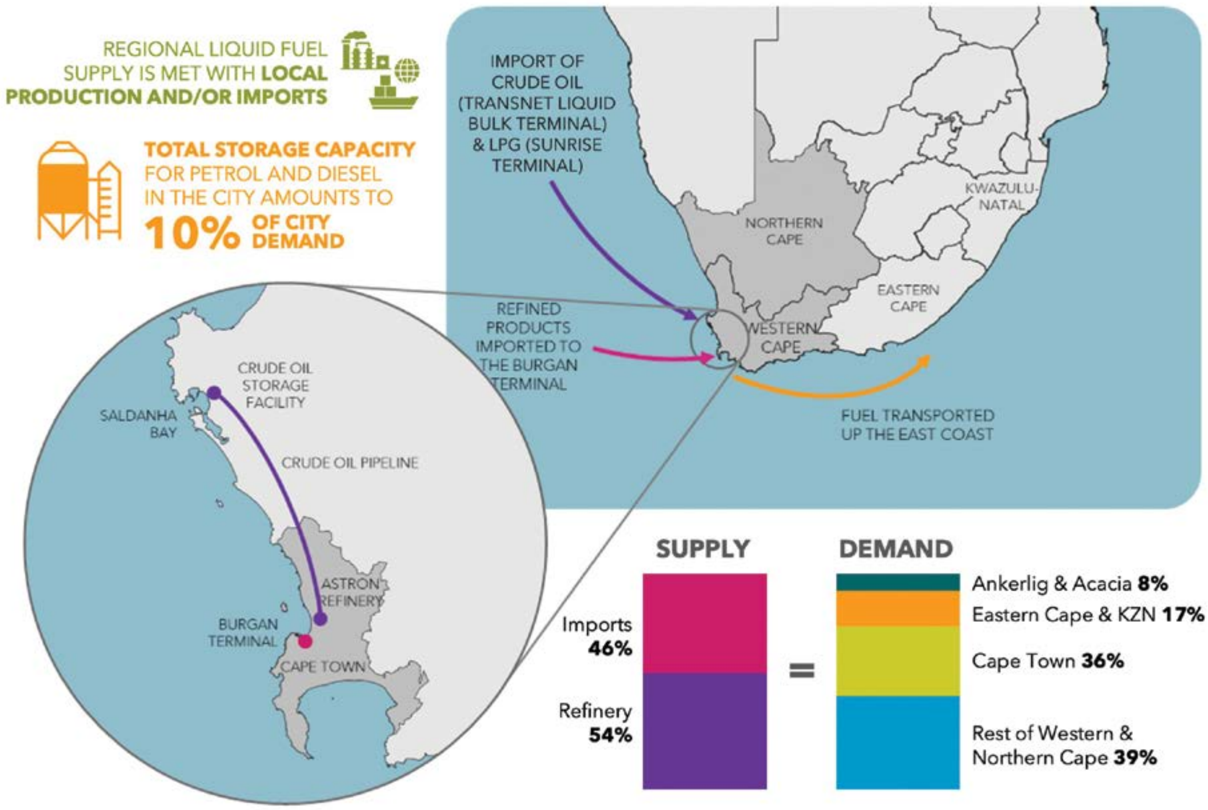
Figure 56: Solid, liquid and gaseous fuels in 2023: powering Cape Town's mobility and more



Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); Transnet (2025)

Figure 57 shows the regional petroleum fuel supply system, with a particular focus on petrol and diesel. Understanding the regional dynamics of supply is essential for determining an energy balance for the city. Most of the imported or locally refined petrol and diesel is consumed in Cape Town, the rest of the Western Cape as well as the Northern Cape, although some is also transported up the east coast to supply the Eastern Cape and KwaZulu-Natal markets. Petroleum fuels are supplied through local refining and imports. The Astron refinery in Milnerton, one of only two remaining refineries in South Africa, has a nameplate capacity of 100 000 barrels per day. This is equivalent to daily production[13] of around 4,3 million litres of petrol and 4,7 million litres of diesel, exceeding Cape Town's demand. Crude oil is received via tanker in Saldanha Bay and transported to the refinery by pipeline. Imports of refined products, particularly diesel, arrive through the Burgan Cape terminal[14] in the Cape Town harbour, while LPG imports are received via the Sunrise terminal[15] in Saldanha Bay.

Figure 57: Regional petroleum fuel supply and 2023 balance



[13] *Exact refinery production is not publicly reported due to commercial sensitivity. Production is flexible and follows market dynamics, including demand changes, crude oil price and other factors.*

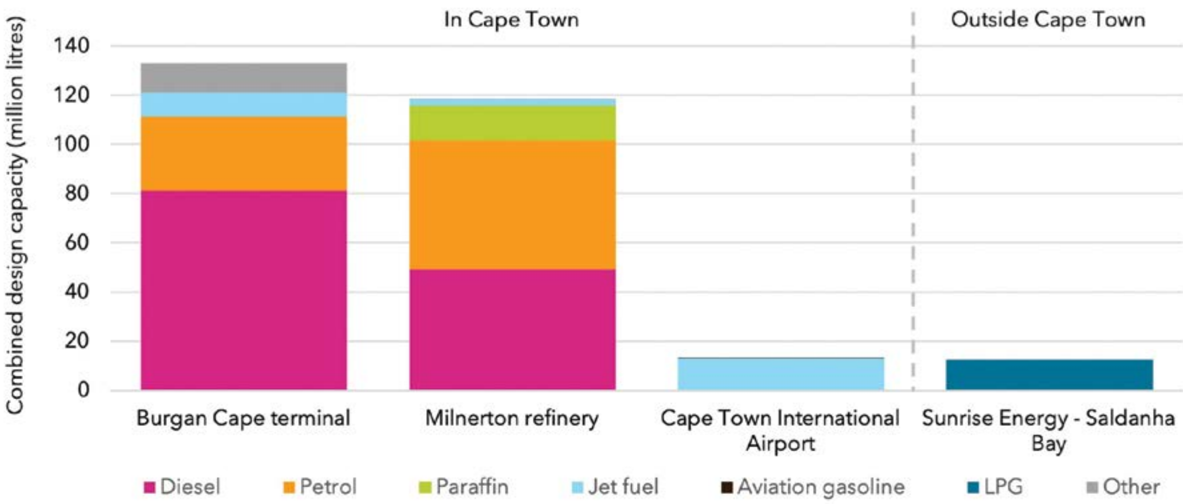
[14] *Burgan Cape terminal is jointly owned by broad-based black economic empowerment (B-BBEE) companies Thebe Investment Corporation and Jicaro, which each owns a 15% stake, and global storage and terminal operator VTTI, which owns a 70% stake.*

[15] *Sunrise Energy operates the LPG import terminal under exclusive concession from Transnet National Ports Authority.*

Sources: ACSA (2025); Chetty & St Leger (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); SARS (2025a); Transnet (2025)

Cape Town's liquid fuel storage capacity shown in Figure 58 below has played a central role in supporting security of supply in the face of the recent shocks shown in the timeline above. Major storage infrastructure is located at the Burgan Cape terminal, the Astron refinery and at the depots operated by fuel wholesalers and retailers. Combined storage at Burgan and Astron is sufficient to meet approximately 48 days of diesel demand and 27 days of petrol demand at a citywide scale. Additional storage includes jet fuel infrastructure at Cape Town International Airport and LPG storage at the Sunrise terminal. Storage capacity for petrol and diesel represents around 4% and 11% of national storage respectively (NERSA, 2024). Storage for other fuels, including fuel oil and LPG, within the city is more limited, increasing exposure to potential shortages during refinery shutdowns or shipping delays.

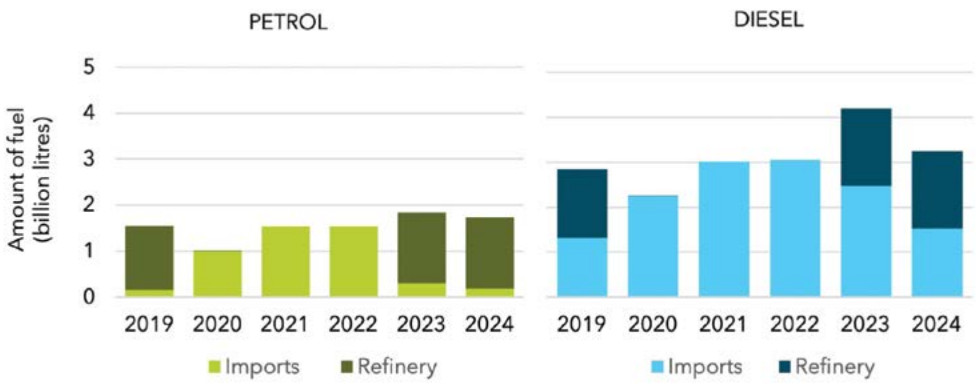
Figure 58: Liquid and gaseous petroleum fuels storage capacity within Cape Town and Saldanha Bay



Source: NERSA (2024)

Petroleum fuel flows varied significantly between 2019 and 2023 due to pressures on both the supply and demand sides. On the supply side, the extended shutdown of the Astron refinery was the most significant factor. After routine maintenance, which was initiated in February 2020, an incident occurred upon restart in July 2020, resulting in a prolonged closure until November 2022. During this period, refinery production of petrol and diesel ceased entirely, and Cape Town depended on imported product to meet demand. The resulting shift in refinery output and import volumes is presented in Figure 59.

Figure 59 : Imports vs refinery outputs of petrol and diesel



Sources: Imports data (2019–2023): SARS (2025a)
Refinery production data (2019–2023) – indicative data only: Astron Energy personal communication

On the demand side, fuel use fluctuated in response to broader economic and system-level conditions. Covid-19 lockdowns in 2020 led to reduced mobility and lower economic activity, resulting in a marked decline in petrol and diesel consumption. In contrast, diesel demand increased in 2023 due to intensified load-shedding, which raised diesel consumption for utility-scale and distributed generation, as well as in the industrial, commercial and residential sectors. These disruptions resulted in substantial year-to-year variation in fuel dynamics across the 2019–2024 period.

2.5.1.1 Special data considerations and limitations

Understanding regional fuel dynamics is important for allocating supply between local consumption, regional use, and transfers to other provinces. Additionally, allocating local consumption to end uses such as transport improves systems understanding and integrated planning. However, unlike data for utilities such as electricity, fuel metering data is not unified and tracked. As data sources have changed, a synthesis of bottom-up and top-down methods has been required, even just to determine the aggregate demand within Cape Town's municipal boundaries. Special data considerations and limitations include the following:

- There is no direct tracking of inter-provincial or inter-municipal fuel movements. As a result, local supply must be estimated using the increasingly outdated method of a survey of the sales of oil majors by the Department of Electricity and Energy (DEE).[16] While this used to provide good insight into regional supply, it is increasingly confounded by the growth of un-surveyed independent wholesalers. These wholesalers generally, though not certainly, appear in the survey as clients of an oil major for the full volume traded, and tend to report sales linked to their domicile, which may not correspond to the area of actual supply. While the survey attempts to capture sector, this issue further exacerbates the already uncertain allocation to even high-level end uses such as transport, or stationary use inherent in the survey data.
- Covid-19 caused unpredictable and long-lasting shifts in travel patterns, freight movement and economic activity, complicating year-on-year comparisons after 2020.
- Load-shedding presented unprecedented calculation challenges with allocating diesel to end uses.
- Data quality has improved through the Eskom data portal (launched in 2020), which provides detailed monthly fuel use information for Ankerlig and Acacia, offering greater insight into major stationary fuel consumption.
- In recent years, reporting requirements under the National Greenhouse Gas Reporting Regulations have strengthened the reliability and completeness of fuel use data from the bottom up for energy-intensive corporates and industries. This data, however, can be subject to 'head-office error', where all of a national corporate's consumption is attributed to the head-office region.
- Retail fuel sales are not disaggregated by end use. Therefore, household consumption estimates rely heavily on survey data that typically records a primary fuel and under-captures fuel-stacking (simultaneous use of multiple fuels).
- Inconsistencies between survey methodologies, and the use of household counts as a proxy for consumption, create a population-correlated output, restricting robust long-term trend analysis.
- The scale of small petrol or diesel generator use at household level during load-shedding is largely invisible in official statistics due to limited disaggregation.

The sections that follow analyse trends for transport (mobile) and stationary fuel use respectively for the period 2014–2023.

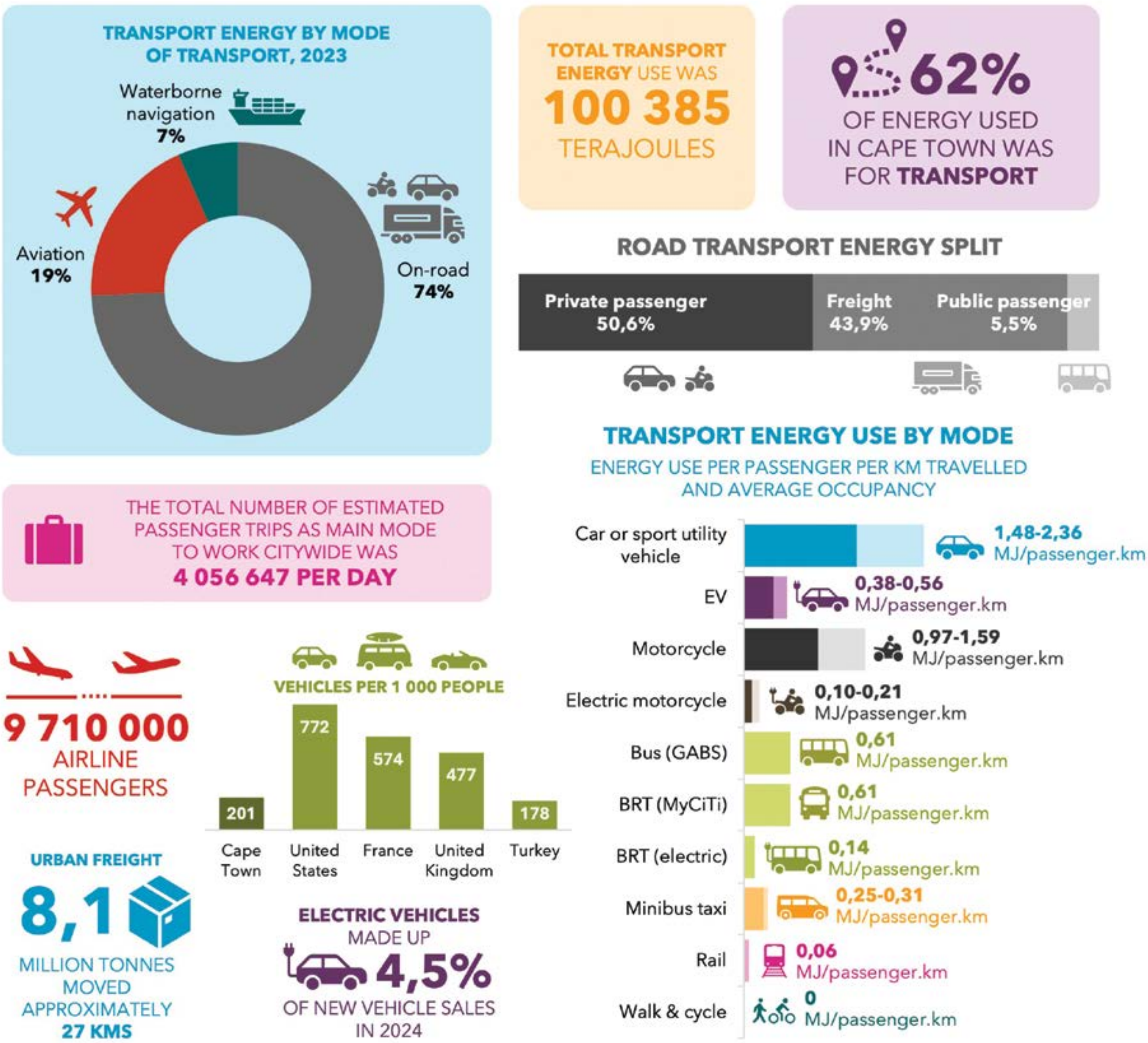
[16] *The DEE inherited this instrument from the industry association after a Competition Commission ruling in 2008.*

2.5.1.2 Transport fuel use

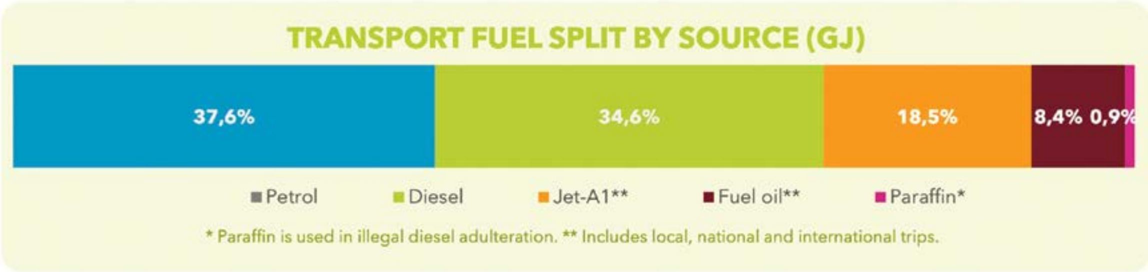
Transport remains the single largest energy-consuming sector in Cape Town. This is not surprising, as the city is a tourism and logistics hub without a concentration of heavy industry. Figure 60 below presents key sector and subsector data, including the following headlines:

- Transport accounted for an estimated 62% (100 385 TJ) of total energy demand in 2023, down from 67% in 2018.
- Petrol (37,6%) and diesel (34,6%) combined account for more than 70% of Cape Town's total transport energy use, with paraffin, while not a transport fuel, at just below 1% due to its illegal use in diesel adulteration (SARS, 2025b).
- Jet fuel (18,5%) and heavy fuel oil (8,4%) are essential inputs to aviation and waterborne navigation (port activities, port-to-port freight, and bunkering of cargo and passenger vessels with various destinations).

Figure 60: Transport energy use in Cape Town, 2023



Sources: ACSA (2025); City of Cape Town; DMRE; UCT, SEA (2011); Eskom; GreenCape (2023); Lightstone; Merven (2012); Transnet; Western Cape Government (2024b)
**Note: In this section, the terms 'energy' and 'fuel' are used interchangeably, as the analysis is based primarily on liquid fuel use. Electricity consumption for transport – such as rail and EV charging – has not been quantified due to data limitations.*



2.5.1.2.1 Road transport fuel use trends

Road transport accounts for approximately 74% of Cape Town's total transport energy demand. In a certain sense, this is the same driver of carbon-intensive fossil fuel dependence seen almost everywhere else. Viewed differently, though, this demand for mainly petrol and diesel has historically provided the economy of scale that enables fuelling of the myriad smaller but critical uses in a reliable and affordable global energy system, including household energy, aviation, shipping and industrial heating from oil. However, climate change means that the social costs of this system are no longer affordable.

Road transport demand is split between private passenger vehicles (mostly petrol-driven), public passenger services, and freight (largely diesel). Private vehicles are the single largest contributor, responsible for 50,6% of on-road energy use, reflecting the city's high reliance on low-occupancy passenger cars. This, combined with the city's spatial form (see section 2.5.3.4), drives a persistently high demand for transport fuels. Freight transport, moving an estimated 8,1 million tonnes of goods across an average distance of 27 km within Cape Town's boundaries (WCG, 2024b), follows closely at 43,9%, while public transport sits at only 5,5%. An overview of the trends in road transport energy use and transport modes is shown in Figure 61.

As shown in Figure 60, the energy intensity of different passenger transport modes varies markedly. Electric rail is the most energy-efficient mode, followed by electric buses. Diesel buses and minibus taxis are relatively efficient, while private cars and especially heavier sport utility vehicles are the least efficient due to inevitably low occupancy. All modes are occupancy-sensitive, however.

Therefore, the shifts in passenger mode share listed below (City of Cape Town, 2025d), and technology changes within those modes, are a major driver of energy demand:

- Rail declined from 18% in 2013 to zero in 2021. With a restoration programme led by the Passenger Rail Agency of South Africa (PRASA), rail rose again to 1,3% in 2023, and by June 2025, monthly ridership was up 62% year on year.[17] This has helped rebuild public confidence and shift the rail narrative from one of decline to one of renewal. At the same time, it holds out the prospect again of an integrated public transport system for Cape Town that combines modes optimally.
- While both public bus utilities' mode shares were diluted, Golden Arrow Bus Service (GABS) had 77 electric buses in operation by the end of 2025, supported by 50 chargers (Venter, 2025b; TopAuto, 2025). The City has also awarded a tender for delivery of 30 MyCiTi 12 m low-entry battery-electric buses in 2027.
- Minibus taxis expanded to 22,4% of commuting trips, largely absorbing the demand lost from rail.
- Private-car mode share increased to 57,5%. This is underpinned by Cape Town's vehicle ownership level of 201 vehicles per 1 000 people in 2023, which is still moderate by global standards, and has seemingly levelled off

[17] *Since rail operations resumed in 2022, passenger numbers have steadily increased from a low base. Between April 2024 and March 2025, the network carried over 25,5 million trips, followed by 13,8 million trips in the first four months of 2025/26 alone, representing an increase in monthly trips of about 2,1 to 3,4 million (PRASA, 2025).*

after decades of growing at a rate faster than the population.[18]

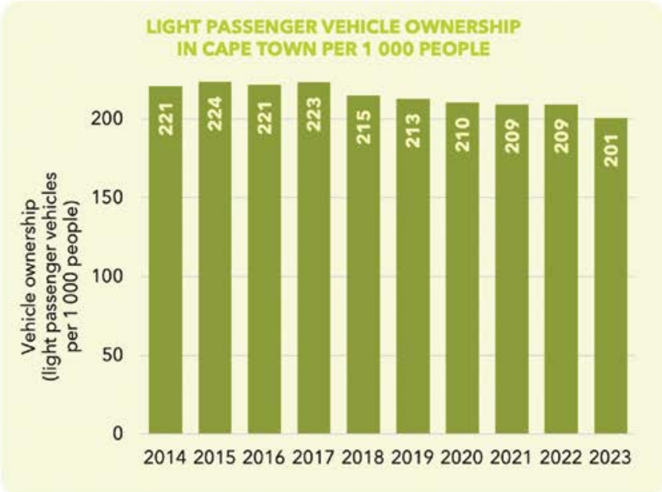
- EV uptake in the private-car segment is emerging (see section 2.5.4.1), with 4,5% of new passenger vehicle sales in 2024 being battery-electric or plug-in hybrid (double the 2023 share). Crucially, Chinese entrants to the market have recently brought significantly lower prices (Taylor, 2025). While EV uptake is still too small to shift the city's fuel mix, faster growth – supported by falling EV prices – could place substantial demands on local grid infrastructure and electricity supply capacity.
- E-hailing and metered taxis reached 2,2% of mode share.
- Non-motorised transport grew slightly to 9,8%.
- The share of public mass transit dropped from 38% in 2013 to 31% in 2023.[19]
- Road-based public transport (including e-hailing), however, increased from 20,3% in 2013 to 31,5% in 2023.

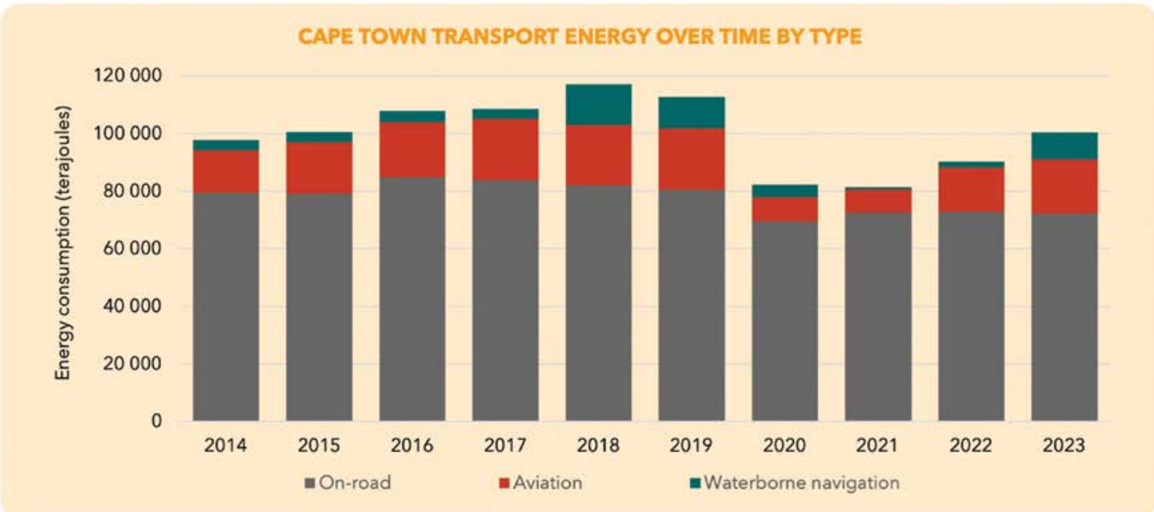
Figure 61: Road transport energy use trends

PUBLIC TRANSPORT MODE SHARE CHANGE IN CAPE TOWN (WORK TRIPS)

MODE	2013	2018		2023
Rail	18%	7,1%	↓	1,3%
Bus (GABS)	6%	5,8%	↓	5,4%
BRT (MyCiTi)	2%	1,8%	↓	1,5%
Minibus taxi	12%	17,2%	↑	22,4%
Metered taxi & e-hailing	0,3%	1,3%	↑	2,2%
Private car	53%	57,2%	↑	57,5%
Walk and cycle	9%	9,6%	↑	9,8%

The most significant change in public transport in Cape Town is the decline in rail's modal share, dropping from 18% in 2013 to 0% in 2020, and then recovering to **1,3% in 2023, with a high rate of growth thanks to a restoration programme.**





Sources: City of Cape Town (2025d); NaTIS

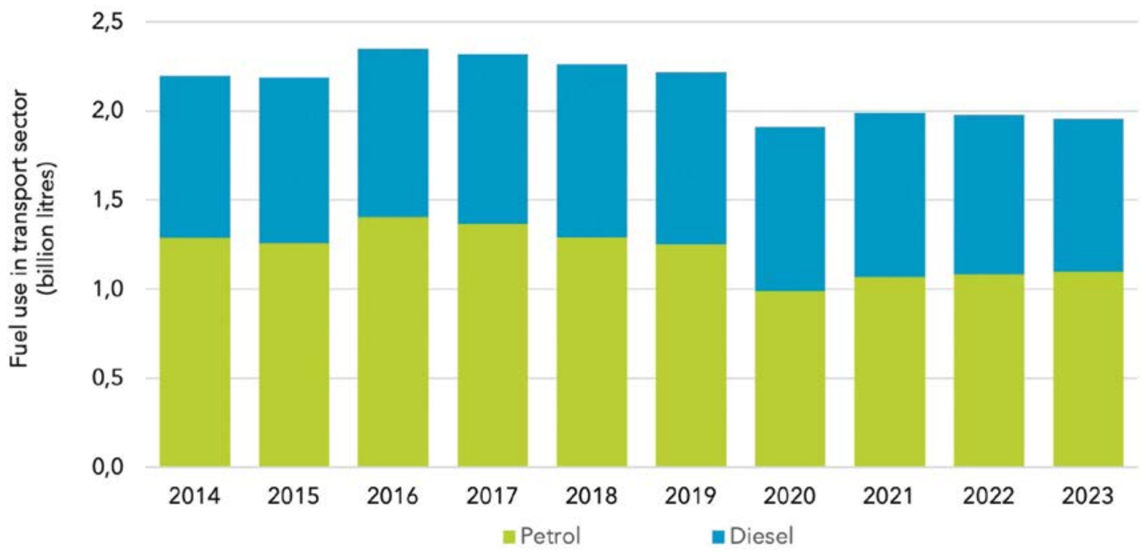
[18] *Per capita vehicle ownership is not decreasing for the Western Cape as a whole, however. The difference could be the result of a higher rate of low-income urbanisation for Cape Town, or a data error, as city-level vehicle registration data has no metadata or technical support and is no longer available online.*

[19] *The National Department of Transport's policy goal is a 20:80 modal split between private and public transport.*

Even with the increased modal share of private vehicles and road-based public transport, transport fuel use has declined since 2017 (Figure 62). Per capita petrol and diesel consumption fell by 24% from 516 L/person/year in 2017 to 394 L/person/year in 2023. This change is almost equally split between petrol and diesel, suggesting that some drivers affect both passenger and freight transport. Possible drivers are listed below, although detailed attribution was beyond the scope of this report:

- Improved vehicle fuel efficiency: Global historical fleet fuel economy improvements suggest that a 1–2% improvement per annum is typical of the last 20 years, which would attribute 6–13% of the per capita change to improved efficiency (GFEI, 2023; IEA, 2019).
- Rising fuel prices reducing demand: Oil was on average 58% more expensive in real rand terms in 2023 than in 2017.
- Shifts in work and travel patterns persisting since Covid-19 lockdown (see Box 2).
- Economic stagnation on a per capita basis reducing consumption (freight) and discretionary trips (passenger).
- Population growth by immigration, which includes a higher share of households without access to private transport than the existing baseline.

Figure 62: Trends for petrol and diesel fuel use in road transport

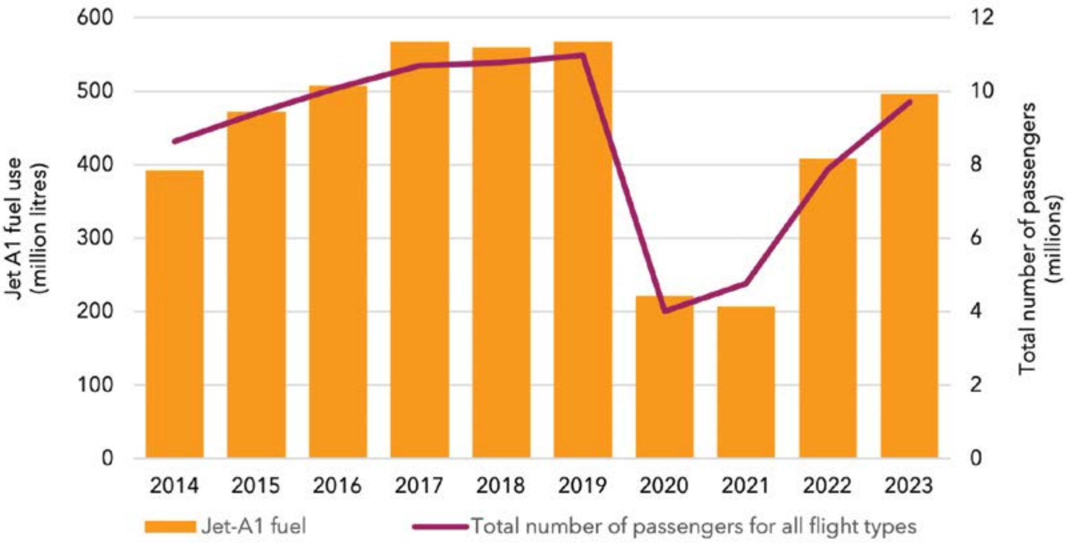


Sources: Calculated from DEE (2023); Eskom (2025a); City of Cape Town (2025c); DFFE (n.d). Diesel pre-2019: Scaled from 2019 based on transport sector GVA. Transport diesel also includes residential diesel demand for generators, which could not be accurately quantified. Petrol all years: DEE (2023); City of Cape Town data: Petrol sales not to City operations.

2.5.1.2.2 Aviation fuel use trends

In 2023, more than 9,7 million airline passengers moved through Cape Town, driving a 19% share of transport fuel use. Recently, however, while on-road transport was marginally supressed and rebounded quickly, the impact of Covid-19 on air travel was far more severe. Aviation fuel consumption fell by around 60% during the pandemic – a trend that correlates closely with passenger counts, as shown in Figure 63.

Figure 63: Aviation fuel use (scope 1 and 3) and air travel passenger count



Source: ACSA (2025)

2.5.1.2.3 Waterborne navigation fuel use trends

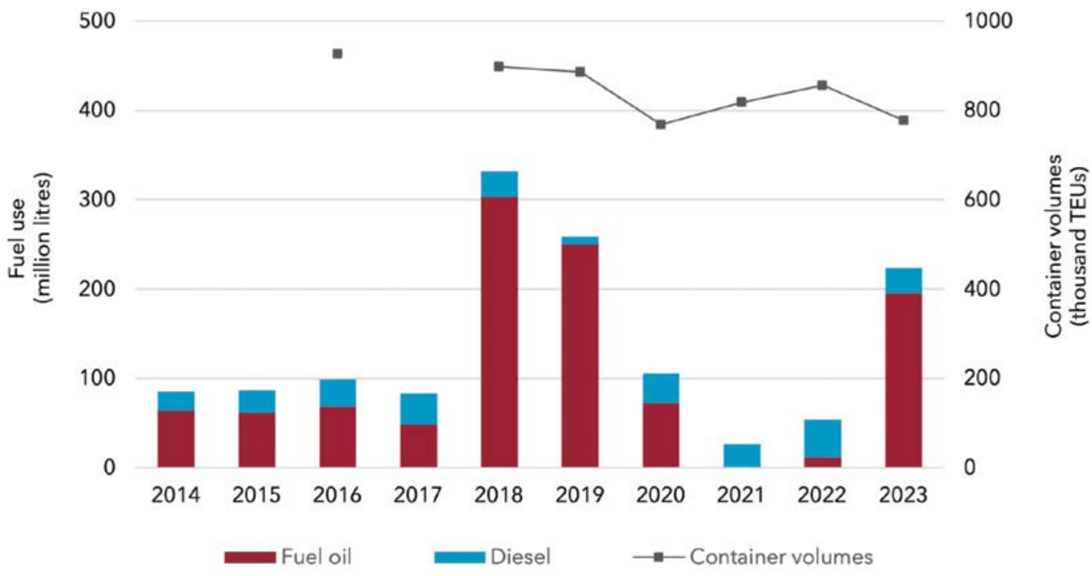
Fuel oil and diesel use for waterborne navigation (9% of transport fuel use in 2023) is shown below in Figure 64. Volumes are driven primarily by discretionary demand for fuel oil bunkering services by international vessels, indirectly by freight handled at the Port of Cape Town, or by internal port services that are economically critical, but use relatively little energy at city scale. Bunkering accounted for 87% of waterborne navigation fuel consumption in 2023 and reflects variable global maritime dynamics rather than port-handled volumes (IBIA, 2024).

Key influences on recent trends include the following:

- Global rerouting of shipping in 2023, as vessels avoided the Red Sea due to security incidents, which increased calls and bunkering demand at South African ports (IBIA, 2024).
- The Astron refinery shutdown, which constrained local fuel oil supply and reduced bunkering capacity until late 2022 (IBIA, 2024). Therefore, the reduced demand observed for this period may not be strongly Covid-related.
- Historically unreliable pre-2018 bunkering data, contributing to low reported values in earlier years (IBIA, 2024).
- Cape Town and Durban's earlier role as major bunkering hubs until 2008, when higher port charges and regional competition reduced volumes (IBIA, 2024).

In contrast to the resurgence of bunkering services, freight volumes handled at the Port of Cape Town have been declining since 2016, which does have an ultimate knock-on effect on subsidiary industries, including bunkering. The decline in freight has been attributed to port congestion, underinvestment, poor infrastructure availability, management challenges and wind-related disruptions. These issues prompted the formation of a local task team in 2019 and, more recently, the National Logistics Crisis Committee. Despite these interventions, however, port inefficiencies persist and continue to constrain throughput and local economic activity (World Bank, 2024).

Figure 64: Waterborne navigation fuel use



Sources: Fuel oil and diesel local use: DFFE (n.d)
Fuel oil (bunkering): Transnet (2025)

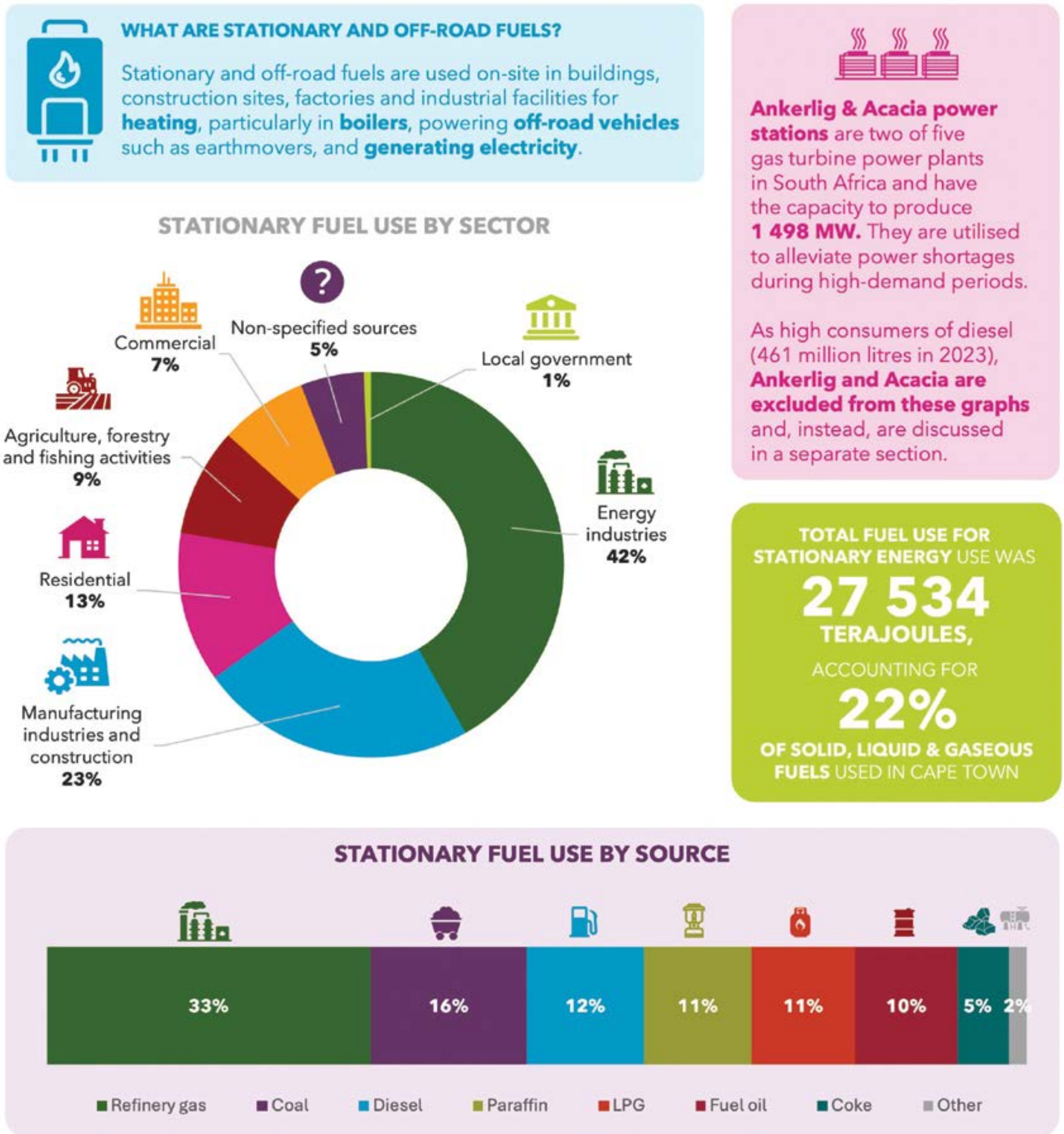
2.5.1.3 Stationary (and off-road) fuel use

Stationary[20] fuels form an important part of Cape Town's energy system and provided 27 534 TJ in 2023 – equivalent to 22% of all solid, liquid and gaseous fuel use in the city. Stationary fuels are used on-site in buildings, construction sites, factories and industrial facilities for heating, particularly in boilers, powering off-road vehicles such as earthmovers, and generating electricity. A breakdown by sector and fuel source for 2023 is presented in Figure 65 below, with the following being key features of the data:

- Ankerlig and Acacia power stations are excluded from energy industries. Since they use significant amounts of diesel in years of supply constraint, such as 2023, including them would obscure the other sectors and fuels.
- The industrial end uses of oil refining (energy industries) and manufacturing and construction dominate, accounting for 65% of stationary fuel demand. Residential end uses (13%) represent a smaller share, but remain significant and important for access in certain communities.
- Stationary uses require a diverse mix of fuels to be traded, distributed and stored.

[20] *It was not possible to disaggregate fuel consumption by off-road vehicles, including those operating at airports, ports and farms, from stationary uses.*

Figure 65: Stationary fuel use in Cape Town, 2023



Sources: City of Cape Town (2023c, 2025b, 2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d)

2.5.1.3.1 Residential stationary fuel use and trends

Section 2.4.3.2 assesses electricity affordability through the surveyed use of paraffin and candles as alternatives. This section deepens that analysis with estimates of residential fuel energy consumption based on the usage of energy carriers reported in the Cape Town Household Survey. It also augments the picture with additional low-income unelectrified survey data, and assesses the trajectory of electrification rate and energy poverty in Cape Town.

In 2023, households in Cape Town consumed an estimated 3 474 TJ (12,6%) of stationary fuels, representing 12,6% of total stationary solid, liquid and gaseous fuel use. As shown in Figure 66 below, the residential fuel mix is dominated by LPG (64%), followed by paraffin (28%), wood (8%) and coal (1%). LPG is widely used across income groups because of its relative efficiency, ease of use, capacity for storage, reliability of supply, and safety. Being price-controlled (officially), paraffin remains important for lower-income households, particularly where alternatives are less accessible.

Household energy end-use behaviour must be inferred from survey data (see section 2.5.1.1 for limitations), which enables the following correlation with dwelling type (see Figure 20 for definitions of the different dwelling types) (City of Cape Town, 2024d):

- Formal dwellings (approximately 67% of households; almost universally electrified) account for the majority of LPG (62%), coal (61%) and wood (74%) consumption, but for only 25% of paraffin use.
- Informal dwellings (some 18% of households) consume over 60% of all paraffin, but less than a third of LPG, coal and wood, which is consistent with many informal-settlement residents' restricted access to grid electricity and safer fuels.
- A very small subset of informal structures (approximately 0,7% of the total stock) consume more than 11% of coal, indicating significant vulnerability.
- Informal backyard units/accessory dwellings – informal (ADIs) (some 14,7% of dwellings) show limited coal and wood reliance, but account for 13% of paraffin and 9% of LPG consumption.
- Informality is strongly correlated with paraffin use.

The extent to which households of any type purchase and use small-scale diesel or petrol generators in response to access issues or load-shedding is invisible in official data sources, and was not estimated for this report. Figure 66 below illustrates the estimated residential fuel consumption trends possible within the limits of the survey-based estimates noted in section 2.5.1.1 above. It essentially interpolates between major surveys 12 years apart, so Covid and especially load-shedding impacts are not visible. However, the long-term dynamics are as follows (see also Figure 36 and Figure 37 in section 2.4.3.2):

- The share of households using LPG for cooking likely tripled from the 7,5% estimated for the 2011 Census to the 21,1% estimate of the 2024 Cape Town Household Survey (Census 2022: 34%).
- Conversely, the share of households using paraffin for cooking dropped markedly in the long term from 15,80% estimated by the 2001 Census, to 3,8% in the 2011 Census, and 0,9% in the 2024 Cape Town Household Survey (Census 2022: 1,5%) (City of Cape Town, 2024f, 2023c).

The scale of electricity price increases over the past 20 years relative to oil makes it likely that consumers have been progressively pushed towards alternatives, particularly for cooking and space heating. While electrification is near universal, low-income households in particular struggle to afford sufficient grid electricity, even with FBE and subsidised tariffs (City of Cape Town, 2024d).

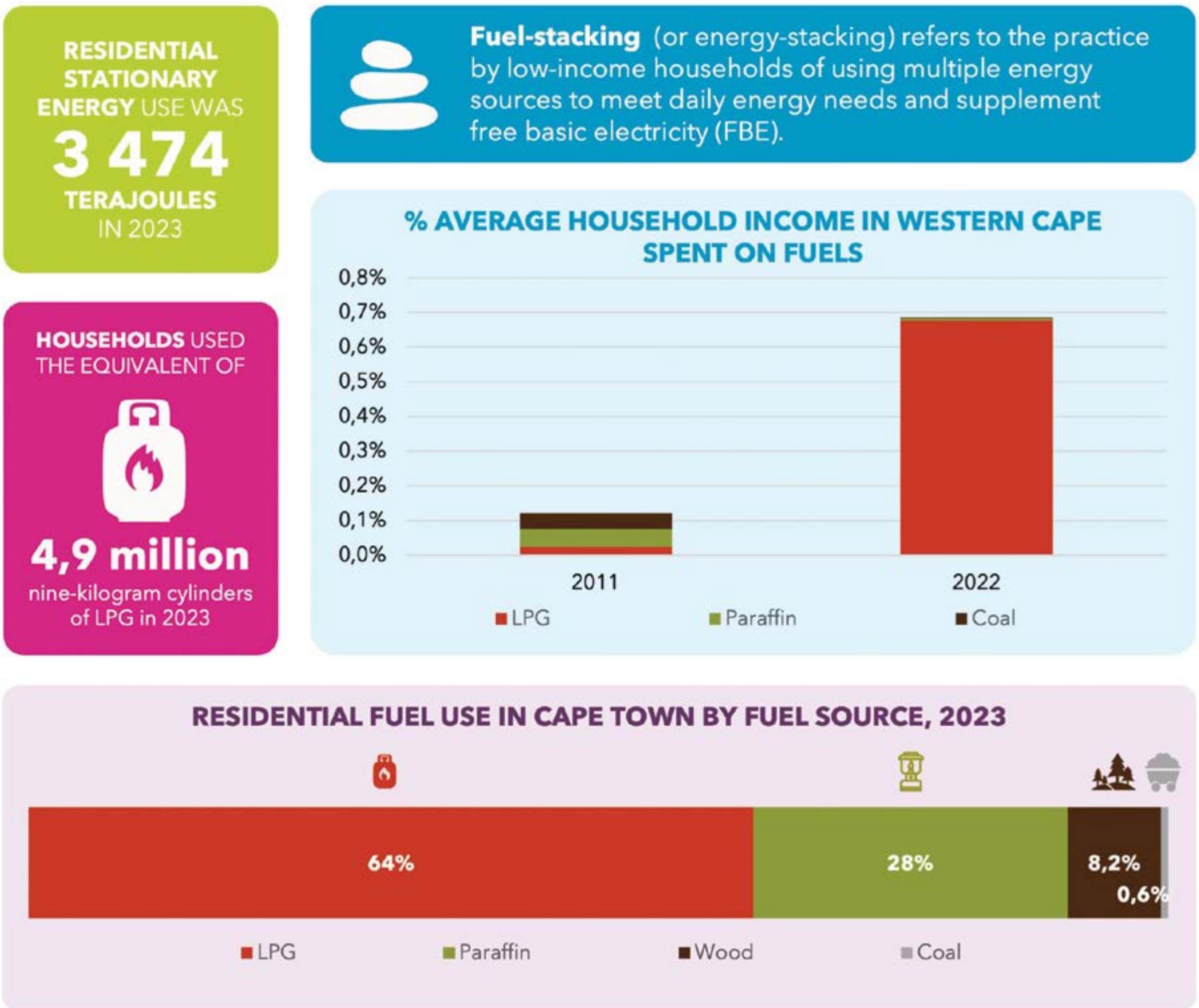
Data presented in section 2.4.1.2 suggests that informal growth far exceeds current rates of electrification. It is known that low-income, especially unelectrified, households employ fuel-stacking, combining electricity with paraffin, coal, wood, candles and other fuels to cope with affordability and access challenges. A 2023 survey of 750 unelectrified residents from across Cape Town (City of Cape Town, 2024f) revealed the following:

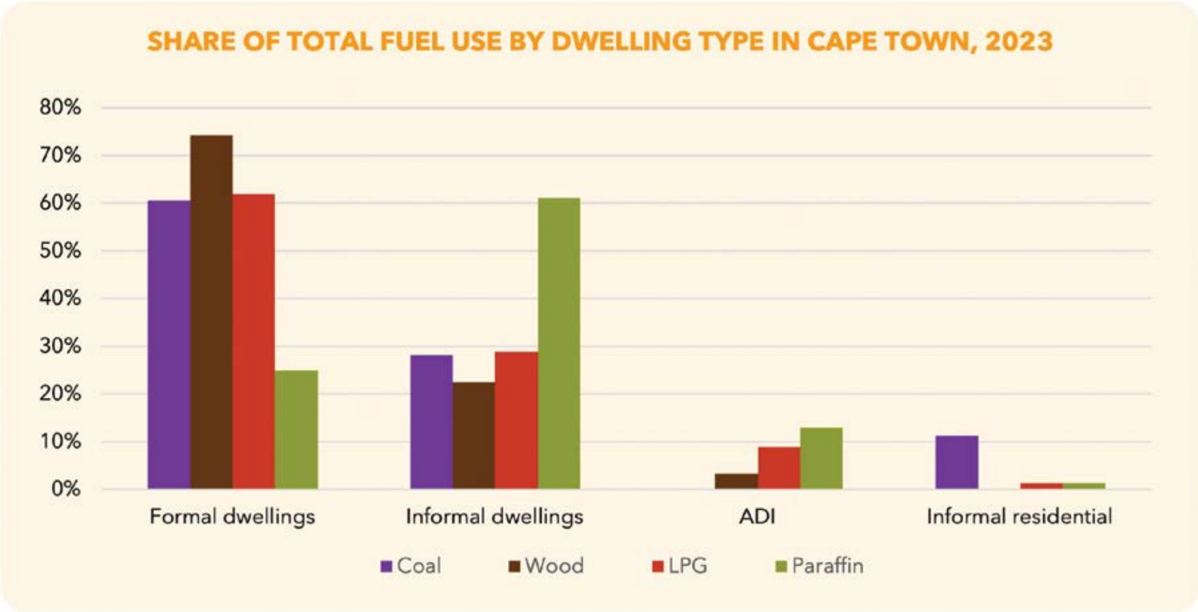
- LPG was highly accessible, and was preferred by the sample: Some 74% reported using it, and 57% declared it as a main energy source.
- While informal electricity connections were quite prevalent (34%), only 19% of the sample declared it as a main source of energy.
- Approximately 14% of the sample used paraffin as a main source, but it was also an important secondary source for 24% of the sample. Candles were also declared a secondary source by 24% of the sample, although both groups noted the risks that candles posed.
- Where one of the three most common energy sources – LPG, informal electricity, and paraffin – was preferred there was generally also significant use of the other two.
- Firewood was used by 16% of the sample, but was uncommon as either a main (4%) or even a secondary source (3%).

Both candles and paraffin present a fire risk, especially in informal areas, and paraffin poses a poisoning risk to children. Coal and biomass use can degrade indoor air quality and increase respiratory risk, particularly for children and the elderly. Unlike many regions in sub-Saharan Africa, however, wood and charcoal are not the dominant non-electric fuel sources in Cape Town. At 98,3%, the city's reliance on clean cooking fuels is substantially higher than national and international averages. According to the World Health Organisation, an average of 96,5% of Cape Town's urban households have access to clean fuels and technologies, compared with 89,8% for the rest of the country, and just 24% across Africa (WHO, 2023).

While Cape Town households' reliance on harmful fuels for energy has declined substantially since 2001, a significant number of vulnerable households continue to depend on stacking multiple energy sources, including paraffin, candles and wood. The data in sections 2.4.1.2, 2.4.3, 2.5.1.3.1 and 2.5.3 shows that rapid urbanisation, pressure on subsidies as well as rising energy prices will make it difficult to maintain the current electricity access rate, with growing energy poverty also a possible outcome.

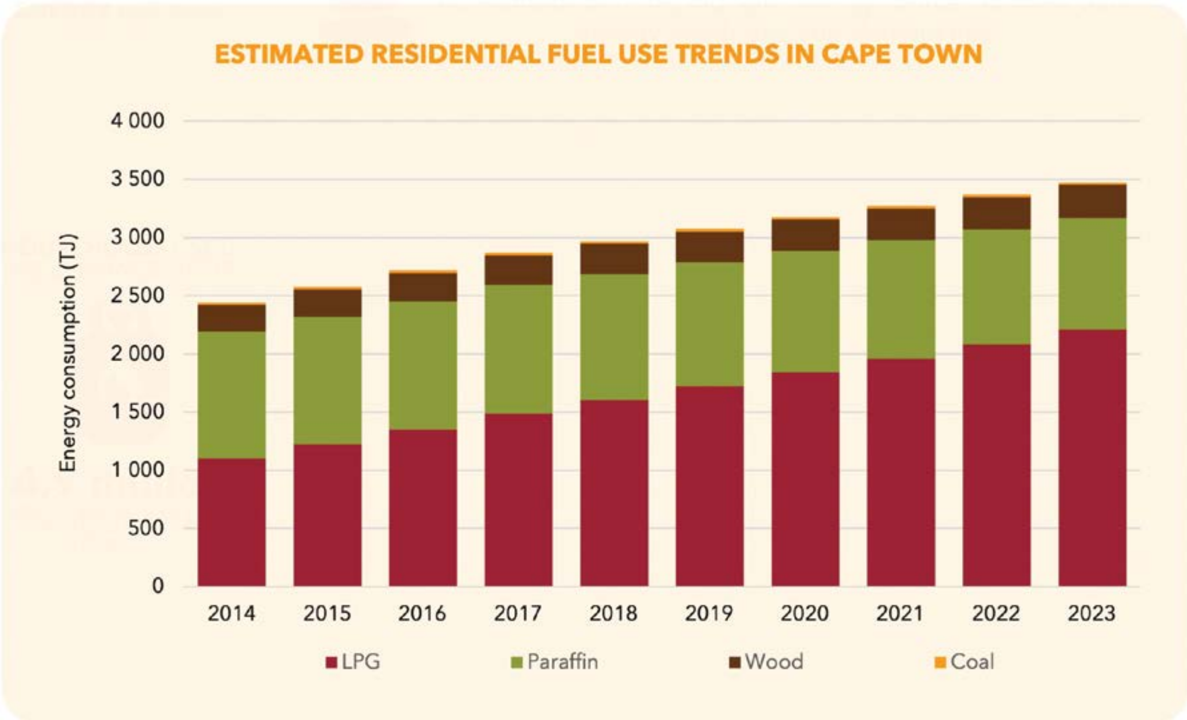
Figure 66: Residential fuel use in Cape Town, 2023





Sources: City of Cape Town (2023a, 2023c, 2025c); LEAP model; Stats SA (2012, 2023)
**Note: See Figure 20 for a description of dwelling types.*

Figure 67: Estimated residential fuel use trends



Sources:
Fuel use (2014–2023) modelled using 2011 Census and 2024 Cape Town Household Survey interpolated shares for main fuel use, City of Cape Town LEAP model household energy intensities, and City of Cape Town population and household estimates. Therefore, the intervening Covid and load-shedding shocks are invisible to this methodology.

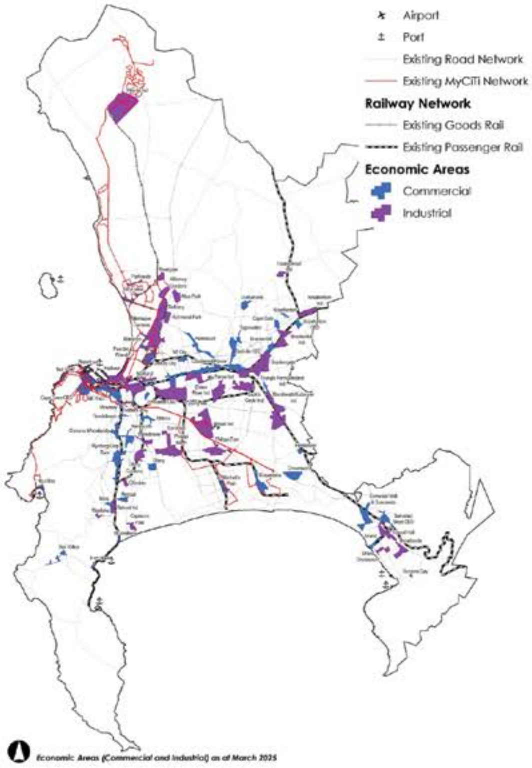
2.5.1.3.2 Commercial and industrial stationary fuel use trends

The demand for stationary fuels by the commercial and industrial sectors was dynamic for both sectors during the reporting period. Manufacturing industries, particularly energy-intensive sectors such as construction materials, food processing and industrial heating, account for a much larger share of fuel use. By contrast, the commercial sector includes retail, office parks, hospitals, and hospitality facilities, which require reliable energy for heating, cooking, laundry and uninterrupted power supply. Figure 68 presents an overview of demand, sector shares, fuel shares and shifts over time. Key findings are as follows:

- In 2023, these two sectors together were estimated to account for around 8 415 TJ of stationary fuel demand, making up 31% of Cape Town's total stationary fuel use.
- Industrial activity dominated this share, consuming an estimated 6 386 TJ (23%), while commercial operations consumed around 2 028 TJ (7%).
- The fuel mix is diverse and has changed over time, requiring flexible and resilient supply chains:
  - Coal (37%) remains significant for industrial processes that require high and consistent heat.
  - Diesel (26%) plays a critical role in backup generation and thermal applications, especially during extended power outages. Diesel consumption has risen sharply in response to the escalation in load-shedding. Additionally, data availability on energy demand by large users improved post-2019.
  - Fuel oil (23%) continues to support heavy industrial applications, while paraffin (7%) and LPG (4%) are used for specialised and smaller-scale heating, cooking and processing.
  - LNG (1%), a new entrant to the data, still has a very small share, but points to the flexibility of industry that requires heating to diversify.

While pre-2019 data quality is poor, commercial stationary fuel use (Figure 69), driven largely by diesel use in generators, broadly follows major disruptions, such as the 2015 load-shedding spike, Covid-19 (2020), and the 2021–2023 escalation in load-shedding. Although the first major power shortages accelerated early private-sector adoption of SSEG, worsening load-shedding greatly increased reliance on diesel for business continuity, incurring both capital and operational costs without the payback of SSEG. Companies, particularly in the food and beverage as well as medical sectors, expanded uninterrupted power supply and generator installations to protect against failure of specialised equipment and cold chains, which can cause severe economic losses, while large retail chains were among the biggest single entity users of diesel in the period 2021–2023.

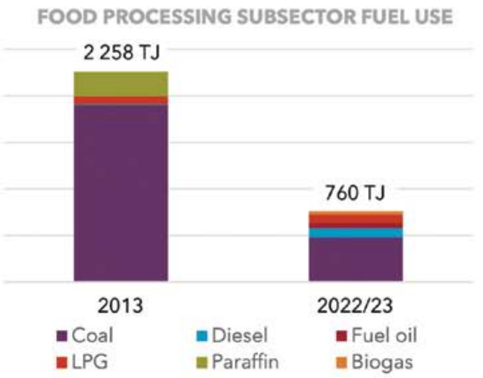
Figure 68: Overview of fuel use in the commercial and manufacturing sectors, and key trends

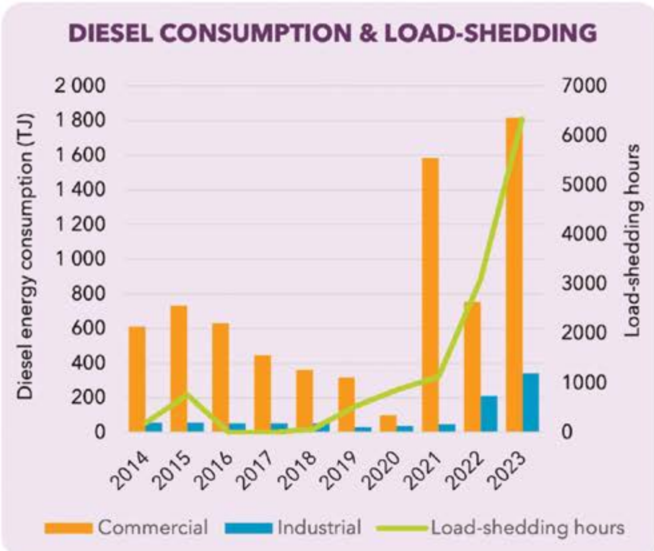


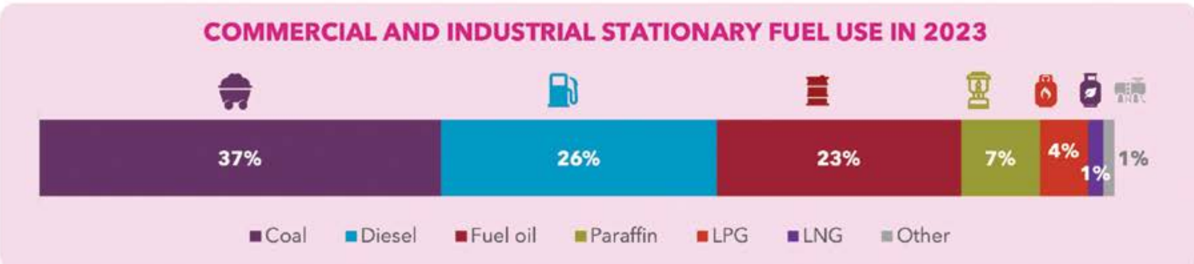
COMMERCIAL FUEL USE ACCOUNTED FOR **7%** OF CAPE TOWN'S **TOTAL STATIONARY FUEL DEMAND** IN 2023, CONSUMING **2 028 TERAJOULES**

INDUSTRIAL FUEL USE (INCLUDING COAL) ACCOUNTED FOR **23%** OF CAPE TOWN'S **TOTAL STATIONARY FUEL DEMAND** IN 2023, CONSUMING **6 386 TERAJOULES**

TOTAL OF **8 415 TERAJOULES** CONSUMED BY THE **COMMERCIAL AND INDUSTRIAL** SECTORS

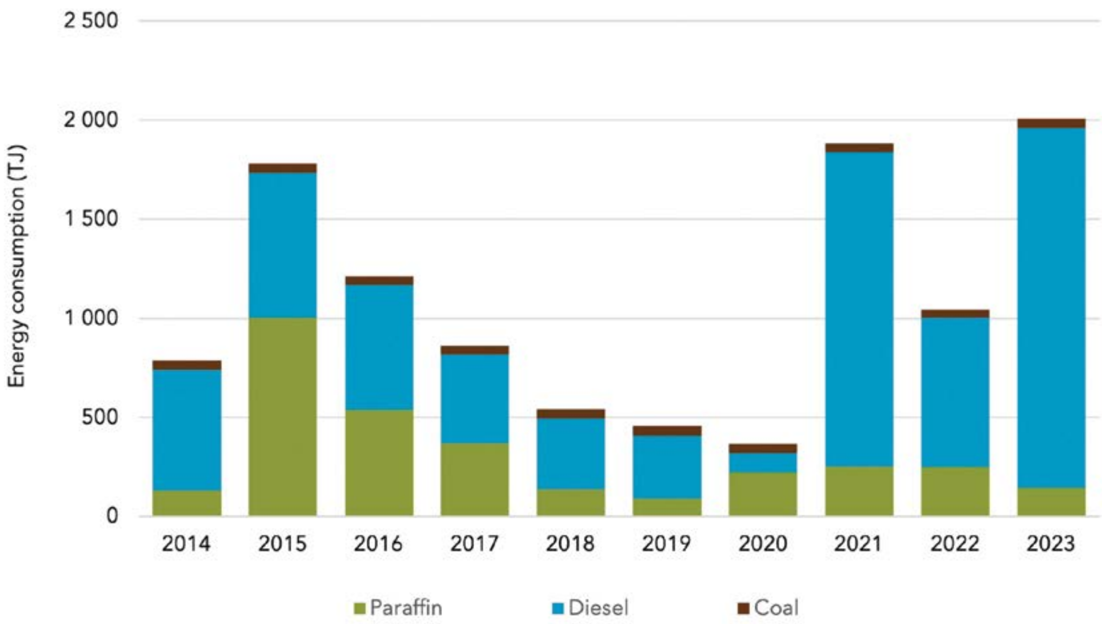






Sources:
Fuel use (2013): Western Cape Government LNG pre-feasibility study survey data
Fuel use (excl. paraffin) (2019–2023): DFFE (n.d), adjusted to account for Cape Town-based head-office reporting
Fuel use (excl. paraffin) (2014–2018): Modelled using total sales from DMRE and ratio of stationary use to total sales (2019–2023)
Paraffin (2014–2023): DEE (2023)
Load-shedding hours: CSIR

Figure 69: Commercial fuel use for stationary energy

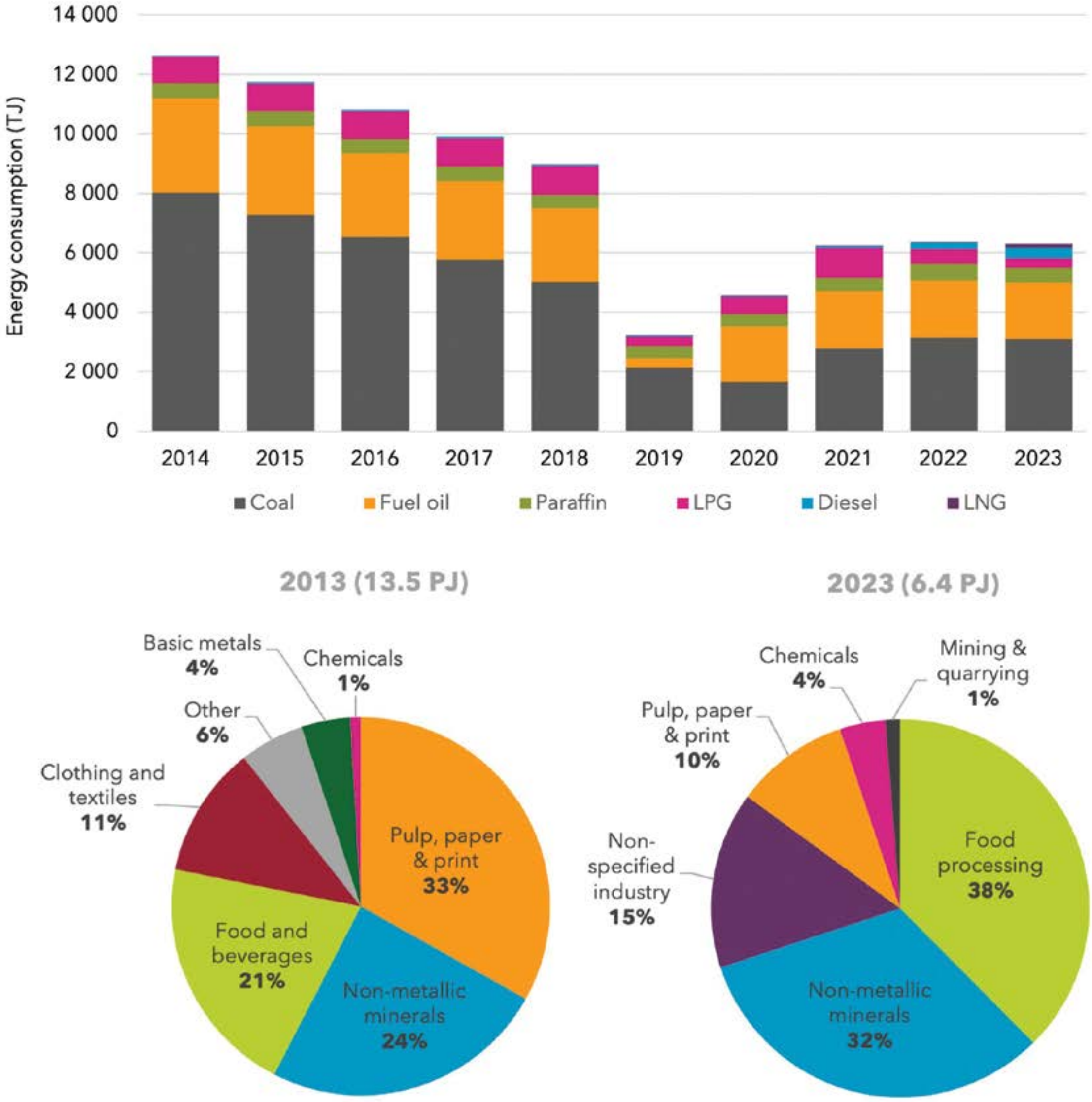


Source: Diesel and coal (2019 – 2023) DFFE (n.d), adjusted to account for Cape Town-based head-office reporting
Diesel and coal (2014 – 2018) modelled using total commercial sales from DMRE and ratio of stationary use to total sales (2019 – 2023)
Paraffin (2014 – 2023): (DEE, 2023)

While classifications differed slightly, comparison of a detailed 2013 WCG industrial energy survey conducted by Province (Visagie, 2013) and DFFE SAGERS survey data (DFFE, n.d.) allowed for a more detailed assessment of industrial energy shifts than previous editions of the SOEC report (Figure 68 and Figure 70). The following were among the central findings:

- Industrial fuel consumption in Cape Town has declined significantly since 2013. This appears to be linked to a combination of energy efficiency measures, structural shifts in firm business activities, fuel-switching, and the closure of major plants.
- A notable subsector is food processing, where it was possible to directly compare fuel use data from 11 food processing subsector facilities that were common to both surveys. Together, these facilities consumed over 2 368 TJ of fuel in 2013 (86% of survey sample), which declined to 967 TJ by 2023 (41% of survey sample), mostly because of a drop in coal consumption.
- One large paper mill reduced its consumption from over 4 PJ of coal in 2013 to less than 0,5 PJ in 2023 under new ownership.
- A major brick manufacturer reduced its use of coal from around 550 TJ in 2013 to 350 TJ in 2023.
- The closure of textile companies has further lowered industrial fuel demand.
- Fuel-switching has become increasingly evident as firms seek to manage costs and improve efficiency. In the food and beverage sector, large processing facilities and breweries have also reduced coal consumption, while diversifying their fuel mix. In some cases, coal use has fallen by over 90% in the past decade, with substitution by diesel, kerosene, heavy fuel oil and biogas.
- A major glass manufacturer has shifted from waxy oil and LPG to a mix of fuel oil, LNG and LPG. LNG is trucked from Renergen's Virginia gas project, offering a lower-carbon option as well as a buffer against price volatility and the risk of LPG shortages caused by limited national refinery output and insufficient import/storage capacity.
- Coal consumption levels (as shown in Figure 70) align with supplier reports confirming that coal used in Cape Town is largely trucked from inland sources, instead of being railed from the northeastern coalfields as was the case previously.

Figure 70: Manufacturing industries and construction stationary fuel consumption in Cape Town and subsector split, 2013 vs 2023



Sources:
Fuel use (2013): WCG LNG pre-feasibility study survey data
Fuel use (2019–2023): DFFE (n.d)
Fuel use (2014–2018): Estimated

In addition to supply considerations, policy instruments such as the carbon tax are reinforcing the move towards efficiency and lower-emission fuels. Industrial players are under growing pressure to cut costs and also meet regulatory requirements, and are accelerating investment in alternative fuels, efficiency improvements and process optimisation. Together, these trends point to a fundamental restructuring of Cape Town's industrial fuel use, with long-term implications for both energy security and emissions reduction.

Box 11: South Africa's carbon tax

A carbon tax is a tax on emissions measured in tonnes of CO_2 equivalent, applied to certain fossil fuel uses and other GHG emissions above a certain threshold.

South Africa introduced its carbon tax in 2019 under the Carbon Tax Act 15 of 2019, and it is administered by the South African Revenue Service (SARS). The tax gives effect to the polluter-pays principle by placing a price on GHG emissions, shifting investment and consumption decisions towards cleaner energy and low-carbon technologies.

The tax is implemented in phases. Phase 1 (2019–2025) featured a relatively low rate and generous allowances, starting at R120/tCO_2e and rising annually. Phase 2, beginning in 2026, proposes to ramp up the price signal significantly: The nominal rate could increase to R308/tCO_2e in 2026, and R462/tCO_2e by 2030, while tax-free allowances are gradually reduced. In addition, the tax is applied at source for stationary emitters (based on reported emissions) and through a fuel levy on petrol and diesel, collected at point of sale, ensuring that all fuel consumers contribute.

For Cape Town, the carbon tax has direct and indirect implications. The city's large commercial and industrial base – particularly food processing, glass manufacturing, and transport logistics – will face rising costs of carbon-intensive activity. From 2031, electricity tariffs are also expected to reflect the carbon tax, increasing pressure on households, businesses and municipal operations. At the same time, the tax strengthens the case for Cape Town's energy transition: Expanding rooftop solar, investing in waste-to-energy technology as well as shifting to electric mobility all reduce exposure to rising carbon costs, while building resilience.

Source: National Treasury (2024)

2.5.1.3.3 Energy industries: petroleum refining

Cape Town hosts a key national liquid fuel asset, namely the Astron refinery in Milnerton, which serves as the backbone of the regional petroleum fuel system (as outlined in section 2.5.1). This section offers an overview of the refinery's internal energy demand and additional system context.

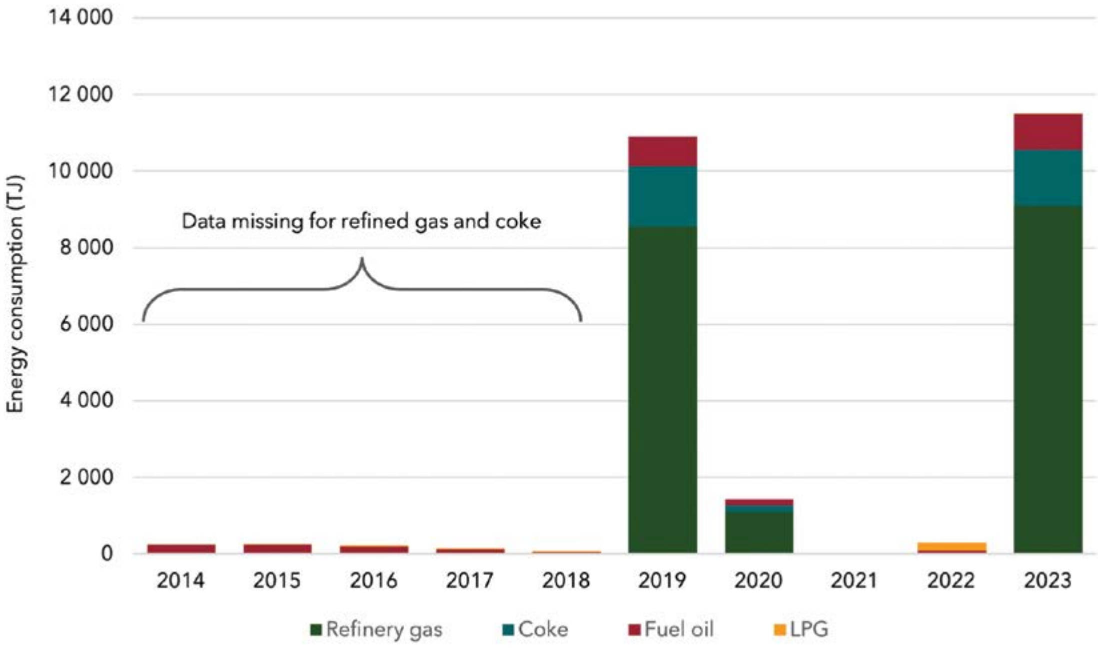
The refinery is directly connected to Cape Town harbour via dedicated pipelines, including a 12-inch white product line for refined fuels, a 26-inch crude oil line and a 10-inch heavy fuel oil line, and is linked to South Africa's large-scale strategic crude reserves at Saldanha Bay. These connections enable both the import and export of fuels, and the import of crude oil feedstock. Licensed capacity allows the facility to bring in up to 12 million barrels of white products annually, and storage is available both on-site and at third-party facilities.

The refinery produces a wide range of fuels, including petrol, diesel, jet fuel, LPG, fuel oil and selected industrial chemicals, making it a cornerstone of Cape Town's energy security. This is particularly the case for key fuels such as fuel oil and LPG, which are otherwise expensive and logistically complex to import. Recent upgrades completed during the 2020–2022 shutdown improved efficiency and throughput, enabling the facility to produce higher fuel volumes without a corresponding increase in emissions. Its ongoing upgrade programme is designed to ensure compliance with the country's cleaner-fuel standards ahead of the 1 July 2027[21] deadline. Planned investments include the installation of a gasoline hydrotreating unit, which will reduce sulphur levels in petrol and diesel to 10 parts per million, aligning production with Euro 5 specifications (Barradas, 2025).

Figure 71 below shows the stationary fuel consumption of the refinery. Data is available from 2019 only, although the refinery was operational in previous years. Refinery gas and coke are by-products of refining and essentially provide a source of 'free' energy within refining operations. These by-products are utilised directly on-site, reducing the need for additional purchased fuels and enhancing the overall efficiency of refinery processes.

Beyond its energy role, the refinery is also an important contributor to the economy. It is estimated to add around R95 billion annually to South Africa's GDP, while supporting more than 56 000 direct and indirect jobs through its operations and wider retail network.[22] This dual role, as both a provider of strategic energy infrastructure and a driver of economic activity, establishes the critical importance of the refinery for Cape Town and South Africa as a whole.

Figure 71: Astron refinery energy consumption (excluding petrol and diesel)



Sources:
Refinery fuel use (2019–2023): DFFE (n.d) – confidential data not shown
Refinery fuel use (2014–2018): Data missing and not added due to scale
Fuel oil (2014–2018): DEE (2023)

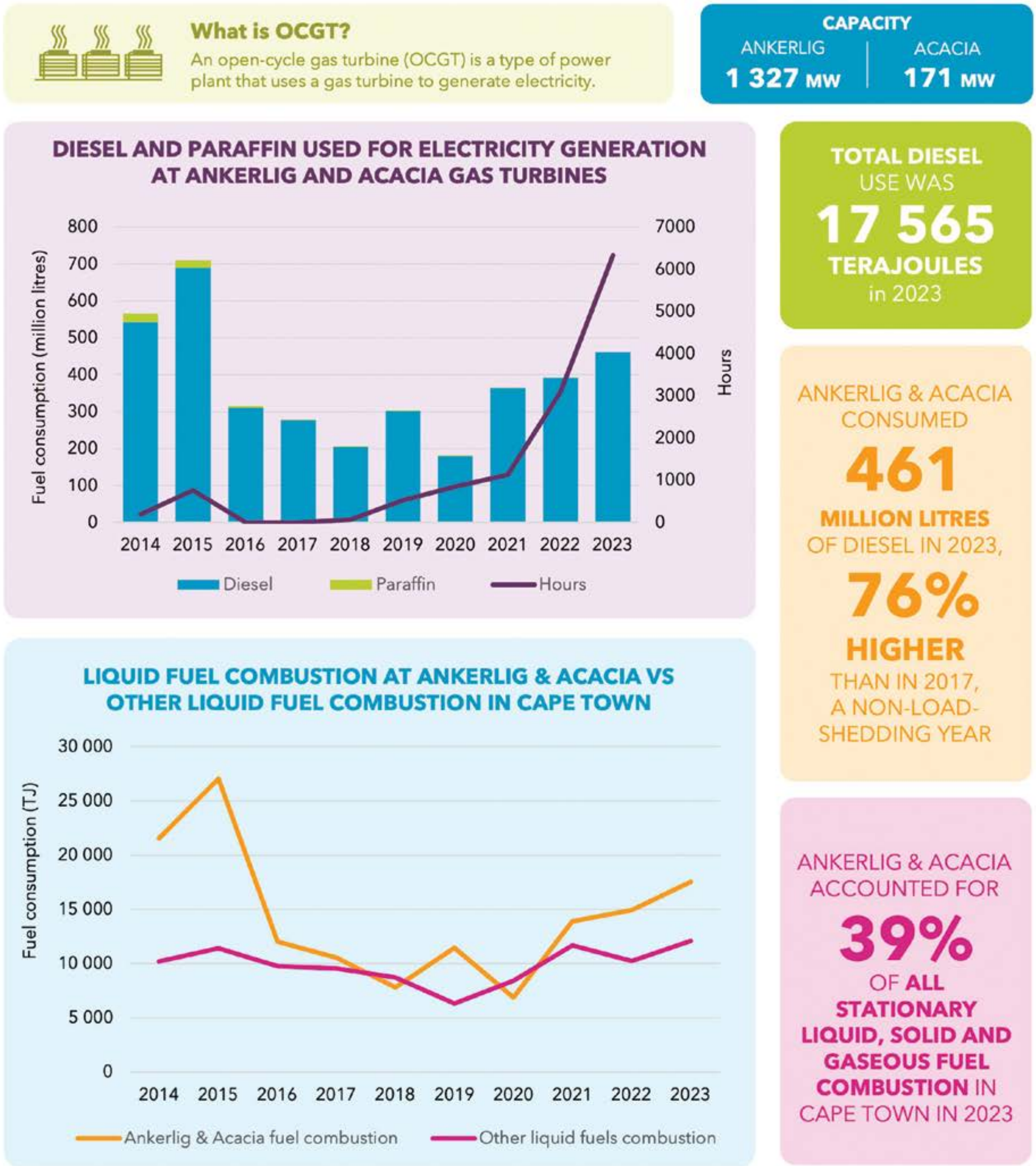
2.5.1.3.4 Energy industries: electricity generation

Eskom's open-cycle gas turbines (OCGTs) at Ankerlig (1 327 MW) and Acacia (171 MW) play an important part in balancing national electricity supply and demand. These plants, burning diesel and paraffin, were designed as 'peaking' plants to generate only during short periods of high demand, or as emergency generation assets.

Key statistics and trends are presented in Figure 72 below. In 2023, total diesel consumption for these facilities reached 461 million litres, accounting for 17 565 TJ of energy and a capacity factor in excess of 10%. This is well on the high end of the range for this type of plant, especially when fuelled by expensive and highly taxed diesel fuel. This scale of fuel usage distorts the city's fuel use profile: In 2023, Ankerlig and Acacia alone accounted for 39% of all stationary liquid, solid and gaseous fuel combustion in Cape Town, dwarfing other industrial and commercial users.

[21] *The Clean Fuels 2 programme, which is mandated by the Department of Petroleum and Mineral Resources and is scheduled to take effect on 1 July 2027, requires petrol and diesel to meet tighter specifications, including a maximum sulphur content of 10 parts per million, and stricter limits on compounds such as benzene, aromatics and olefins.*
[22] *https://www.astronenergy.co.za/about-us/.*

Figure 72: Diesel usage at Ankerlig and Acacia: safeguarding the national electricity grid



Sources:
Diesel and paraffin (2014–2023): Eskom AEL data
Load-shedding hours: CSIR

In 2023, OCGT fuel consumption was 76% higher than in 2017, reflecting the severity of load-shedding, although it was still below the exceptionally high levels of 2015. This pattern illustrates both the national system operator's difficulty in meeting demand under growing financial constraints, and the deepening failure of the coal fleet. While intensive OCGT use in 2014–2015 helped avert extreme outages, the post-2020 ramp-up in diesel burn – though never reaching 2015 GWh levels – proved insufficient to contain the exponential rise in load-shedding. Therefore, the escalating reliance on diesel-fired peaking plant has increased supply reliability in the short term, but has also created a severe financial risk, as shown in Eskom's annual financial statements (see Table 5 below). From the 2015 financial year, when diesel expenditure was R3,5 billion over budget, diesel costs and overspend have spiralled.

Table 5: Eskom's budgeted and actual diesel spend to produce electricity

ESKOM FINANCIAL YEAR (ENDING 31 MARCH)	DIESEL BUDGET (MILLION ZAR)	ACTUAL BUDGET SPENT ON DIESEL (MILLION ZAR)	ELECTRICITY GENERATED (GWH)
2015	R 6 019	R 9 546	3 709
2019	R 1 024	R 6 206	1 754
2020	R 10 782	R 8 630	2 039
2021	R 1 939	R 8 275	2 161
2022	R 1 556	R 12 710	2 725
2023	R 14 012	R 29 243	4 116
2024	R 27 921	R 33 357	5 143

Sources: Eskom (2026, 2025b)

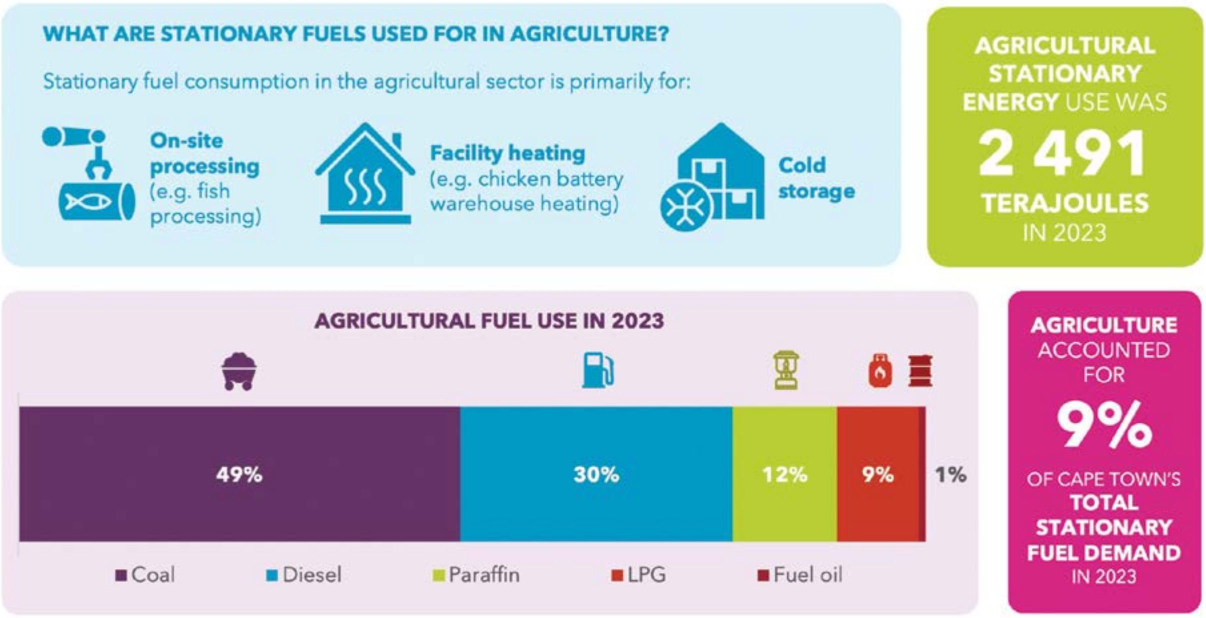
These unsustainable increases were driven by unfavourable diesel price movements and the sheer volume required. For example, although diesel expenditure in 2022 was 11% greater in real terms than 2015, diesel consumption in 2022 was around 27% lower. Consequently, while diesel combustion is a short-term reliability buffer, it imposes long-term affordability and financial resilience challenges, constraining Eskom's operational flexibility and worsening its balance sheet.

2.5.1.3.5 Agriculture, forestry and fishing trends

In 2023, an estimated 2 491 TJ of stationary fuel was consumed by Cape Town's agriculture, forestry and fishing sector, representing 9% of the city's total stationary fuel demand (Figure 73). Fuel consumption in the sector is shaped by a range of operational needs, including off-road vehicles, on-site processing activities such as fish processing plants, and the maintenance of controlled environments such as poultry houses, where heating is essential. Diesel generator backup for cold storage also represents a major area of fuel demand, given the sector's reliance on uninterrupted refrigeration to maintain product quality and prevent spoilage.

Coal was the dominant fuel in 2023, making up 49% of the sector's consumption, followed by diesel at 30%. Paraffin (12%), LPG (9%) and fuel oil (1%) also contribute to the mix, highlighting the sector's reliance on a diverse range of fuels to support operations.

Figure 73: Agriculture, forestry and fishing stationary fuel consumption, 2023

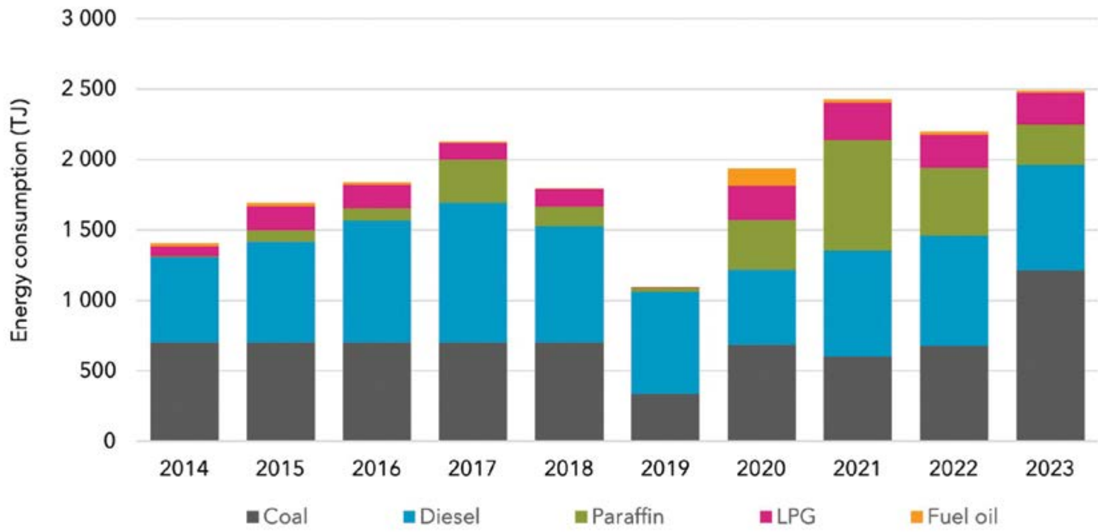


Sources: DEE (2023); DFFE (n.d)

Fuel use trends are shown in Figure 74. The following data issues apply, however:

- Smaller agricultural operations are generally not captured in available datasets.
- Energy use in industrial food processing facilities overlaps with agricultural activity, making it difficult to isolate agriculture-specific consumption.
- Paraffin is used for both energy (e.g. heating, diesel adulteration for tractors and generators) and non-energy purposes (e.g. fungicide or solvent in pesticide applications, cleaning), but current sales data does not distinguish between these uses. The data issues with DEE survey data discussed in section 2.5.1.1 apply to pre-2020 data. Paraffin spikes such as that in 2021 may reflect more favourable arbitrage, with diesel driving illegal use.
- Reliable LPG consumption data is only available from 2020 onward, restricting long-term trend analysis.

Figure 74: Trends in agriculture, forestry and fishing stationary fuel consumption



Source: Fuel use (2019 – 2023) DFFE (n.d)
Coal (2014 – 2018) estimated
Paraffin, LPG, Diesel, Fuel oil (2014 – 2018): DEE (2023)

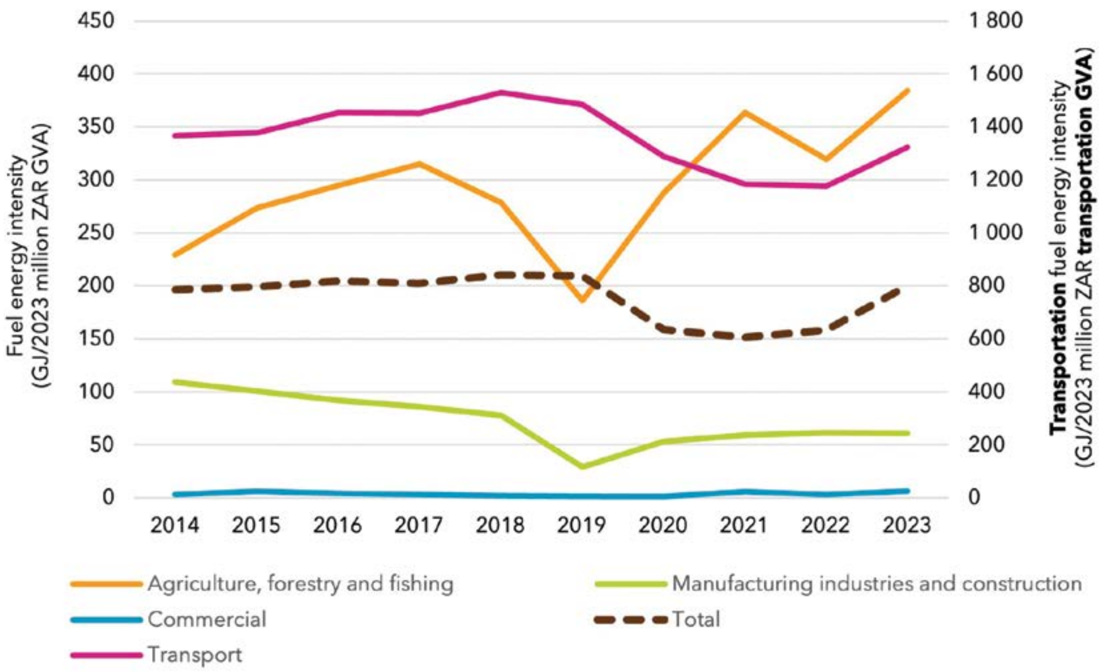
2.5.1.4 Sectoral fuel energy intensity

Figure 75 shows the fuel intensity per unit of GVA across Cape Town's major economic sectors, which is notably similar to GHG emissions intensity, discussed in section 2.5.4.3. The transport sector consistently shows the highest fuel intensity, remaining well above 1 200 GJ per million ZAR GVA over the past decade. This underscores the reality of structural dependence on a large, complex supply chain of fossil fuels for mobility, and the relatively low direct contribution to GVA of transport services (12%). Although transport fuel intensity dipped after 2019, linked to constrained fuel demand during the Covid-19 period, it has since rebounded somewhat.

Agriculture, forestry and fishing is another energy-intensive sector, although its contribution to the city's GVA is low, at 1%. The volatility likely reflects poor data quality for this sector, as well as the difficulties in allocating diesel to sectors, but may also be sensitive to seasonal conditions. By contrast, manufacturing and construction (which contributes 17–20% of local GVA)[23] has declined overall in fuel intensity since 2014, with improved firm-level data suggesting both efficiency gains and structural changes, including firm closures and business line realignment, as contributing factors (section 2.5.1.3.2). The commercial sector contributes a negligible share of fuel intensity in comparison as a result of its large contribution to GVA of over 50% and limited fuel use in value production.

[23] *S&P Global Market Intelligence.*

Figure 75: Fuel energy intensity per unit of GVA



Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); Stats SA; Transnet (2025); S&P Global (2025)

The reporting period saw an 11% real contraction in industry GVA, and a 14% expansion in the tertiary economy (trade, finance and community services), with finance, real estate and business services specifically recording a significant 25% expansion.[24] Given this structural shift, therefore, a drop in fuel use intensity per unit GVA of the entire economy is expected.

As discussed in sections 2.5.1.3.2 and 2.5.1.3.5, higher diesel consumption in commerce (not visible above due to high base), industry and agriculture during the severe load-shedding of 2023 kept fuel energy (and GHG emissions) intensity at 2014 levels. The restoration of reliable electricity supply since 2023 should cause this to drop going forward. The sections that follow discuss Cape Town's solid, liquid and gaseous fuels in the context of reliability, affordability, carbon neutrality, and resilience.

2.5.2 Reliability

Reliability, in the context of petroleum and other fuels, refers to the availability of sufficient energy of a suitable quality when it is needed. For Cape Town, reliability requires both the stability of local refining and storage capacity, and the security of international imports of crude oil, refined petroleum products and domestic supply of coal and LNG, which underpin the city's fuel supply. **During the reporting period, there were no recorded incidents of fuel shortages, market restrictions or widespread quality issues in Cape Town, indicating that the city's supply has remained reliable.**

[24] *S&P Global Market Intelligence.*

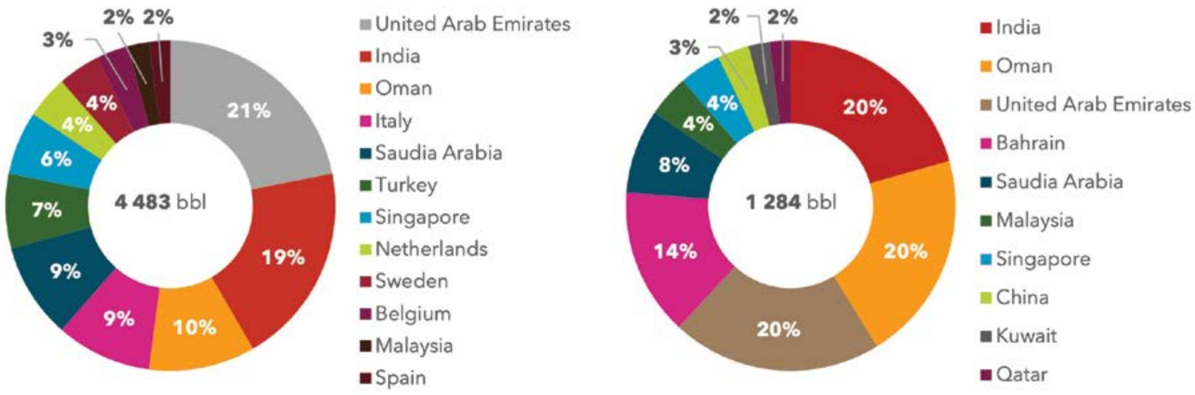
Box 12: Reliability of fuels

1. **Astron refinery:** A key supplier of petrol, diesel, LPG and jet fuel, underpinning local energy security.
2. **Storage capacity:** Significant petrol and diesel stockpiles provide a buffer against short-term disruptions.
3. **Global flexibility:** International markets can quickly respond to gaps in supply, as seen after the Astron refinery shutdown.
4. **Diversified imports:** Petrol and diesel are sourced from multiple countries, reducing over-reliance on any single supplier.
5. **Local alternatives:** LNG may emerge as a local lower-emissions alternative to LPG.
6. **Import dependence:** Over 70% of South Africa's crude imports come from Nigeria and Saudi Arabia, exposing supply to geopolitical and price volatility.
7. **Refinery decline:** Reduced national refining capacity has increased reliance on imported diesel and petrol, heightening vulnerability.
8. **Port logistics:** High winds at the Port of Cape Town regularly delay fuel vessel docking, creating short-term supply risks.
9. **Fuel adulteration:** 7% of diesel samples compromised nationally, though incidents limited in the Western Cape.
10. **Solid fuel pressures:** Coal supply reliant on upcountry transport, with declining availability and rising costs.

The Astron refinery plays a central part in maintaining this reliability. As one of South Africa's major refining facilities, it not only supplies petrol, diesel, jet fuel and LPG to the local market, but also provides Cape Town with resilience against supply disruptions. When the refinery was unable to restart after the 2020 shutdown, procurement teams were able to secure refined products from international markets, demonstrating the flexibility of global supply chains, and the importance of Cape Town's significant fuel storage infrastructure. However, for fuels such as fuel oil, stockpiles are smaller and international markets less flexible, making supply less certain. Operational constraints at the Port of Cape Town, particularly restrictions on docking during periods of high winds, also present logistical risks, with vessels sometimes delayed for days before being able to discharge.

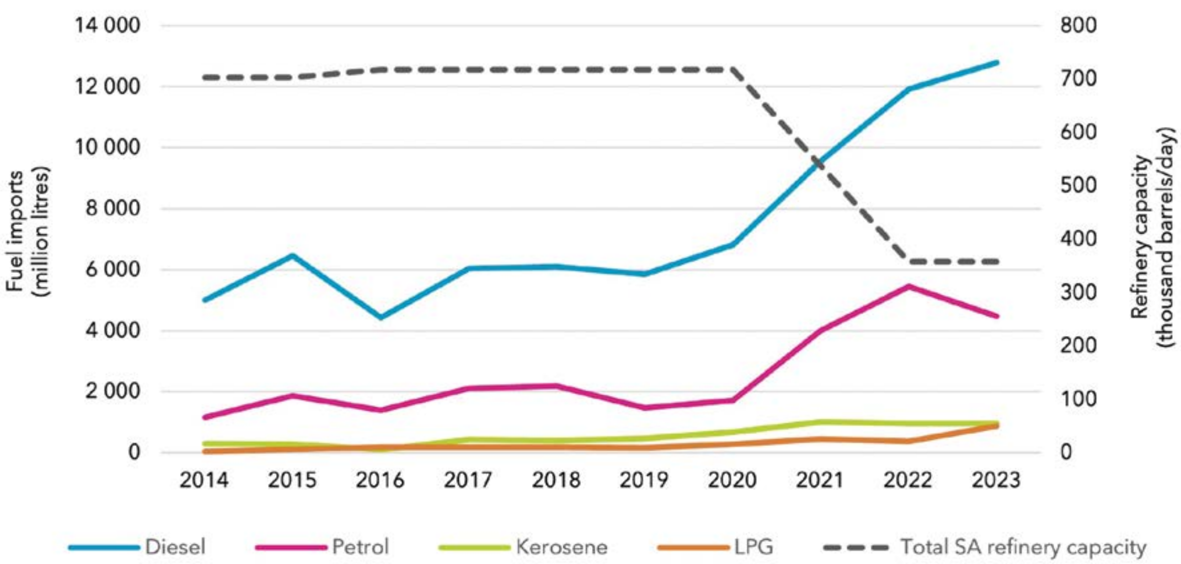
South Africa remains highly dependent on imported crude oil and refined products, with crude imports in 2023 dominated by Nigeria (46,1%) and Saudi Arabia (32,7%), alongside contributions from the United Arab Emirates, India, Oman and Angola. For refined products, South Africa's petrol imports are sourced largely from the United Arab Emirates (21%), India (19%) and Oman (10%), while the majority of diesel imports are also spread between the aforementioned three nations (each at 20%) (see Figure 76 below). While this distribution indicates a measure of diversification, reliance on suppliers in geopolitically volatile regions presents ongoing risks of price volatility and supply disruption. The sharp increase in petrol and diesel imports since 2020, linked to declining domestic refinery capacity as shown in Figure 77, highlights this vulnerability.

Figure 76: South African imports of petrol and diesel, 2023



Source: SAPIA (2023)

Figure 77: Fuel imports vs refinery capacity in South Africa



Source: SAPIA (2023)

Fuel adulteration is another reliability concern nationally, with testing in 2023 revealing that 7% of diesel samples were compromised by paraffin blending (FIASA 2024). While most incidents were concentrated outside the Western Cape, with only four of the 70 failed samples recorded locally (Van Zyl, 2024), the issue underscores the importance of regulatory enforcement and quality assurance in maintaining market integrity.

Beyond liquid fuels, LNG is emerging as an alternative lower-emissions energy source in Cape Town, but faces its own reliability constraints. Supply is currently trucked from Renergen's Virginia gas project in the Free State, making it dependent on a single source and long-distance road transport. This creates exposure to logistical delays and cost pressures, limiting LNG's reliability compared with globally traded liquid fuels. Although phase II of the Virginia project is expected to increase production, this is not a certainty, and LNG remains a niche and vulnerable component of the city's energy mix.

Coal continues to be used by certain industries and households, but faces increasing reliability pressures. Industrial coal supply depends on long-haul transport from Mpumalanga, exposing users to high logistics costs and potential disruption. For poorer households, informal coal markets are irregular and often provide fuel of inconsistent quality. With national demand for coal declining, alongside regulatory and carbon tax pressures, long-term availability and affordability of coal in Cape Town is likely to become increasingly constrained.

2.5.3 Affordability

Fuel affordability reflects whether households, businesses and industry can meet essential energy needs at a reasonable cost. In considering the affordability principle, there are three important factors when viewed through a data lens:

- Trends in fuel costs relative to inflation, which can be referred to as the 'real energy cost'
- Whether real energy price rises are compounded by real escalation in the prices of other essential goods and services and/or shrinking incomes
- The extent to which costs are being mitigated by policy, efficiency, or consumption avoidance

For households, rising real prices of petrol, diesel, LPG, paraffin, coal and wood increase transport and basic energy expenses, deepening energy poverty – especially for low-income communities. This affects mobility, equity, health and wellbeing. Given transport's dependence on petroleum fuels, affordability must also consider the cost of transport services, and the time burdens carried by commuters. For businesses and industry, fuel price volatility influences operating costs and competitiveness. Petroleum fuels, LPG, coal and diesel remain central to operations, while measures such as the carbon tax increase the cost of carbon-intensive fuels and encourage cleaner alternatives. Box 13 below summarises some of the direct and indirect factors influencing what households and businesses spend on fuels.

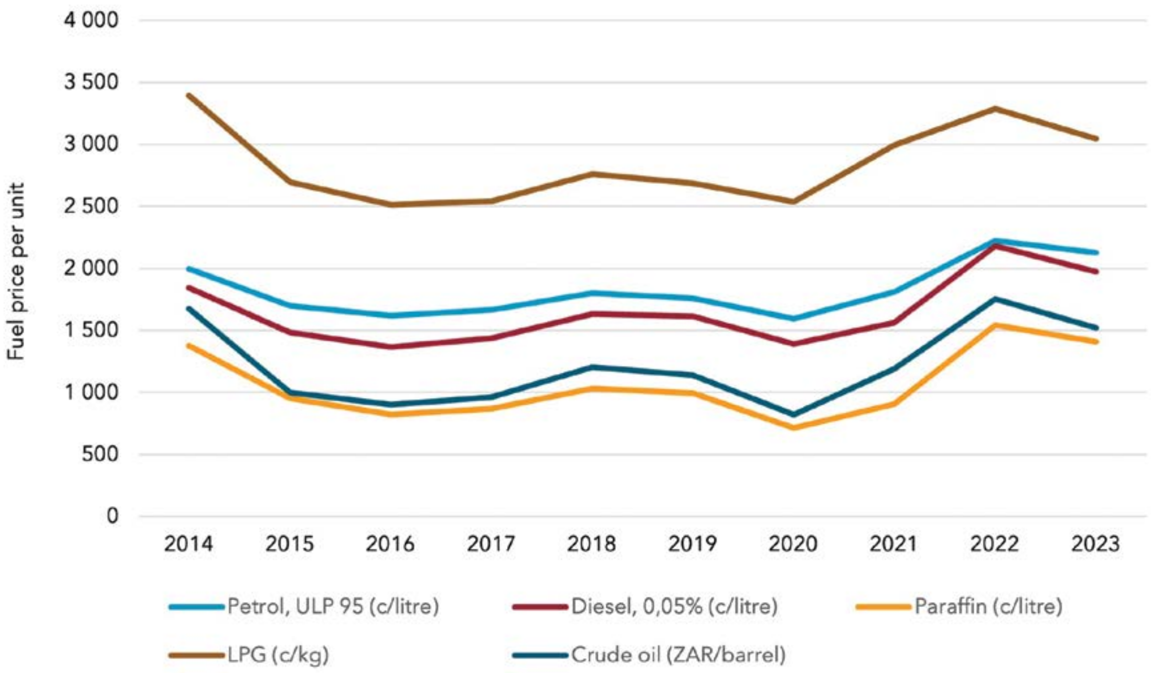
Box 13: Affordability of fuels

1. Cape Town's transport fuel use has **declined since 2017**, possibly driven by improved **vehicle fuel efficiency**, increased **work-from-home** levels since Covid-19, car pooling and **higher fuel prices**.
2. **Incentive for fuel-switching and efficiency** from carbon tax, promoting adoption of lower-carbon fuels and renewables in industry and commercial sectors.
3. **Rebuilding of rail services:** After ceasing to operate, major investment and leadership have enabled a restart of the system since 2022, with rapid growth in passenger trips, showing rail's renewed potential.
4. **Alternative transport modes** (MyCiTi & rail) can offer competitive travel times and potentially lower costs compared to car use.
5. **Increasing electricity tariffs** and inadequate FBE levels may prevent the migration of households away from **coal, wood, LPG and paraffin**.
6. **Volatile petroleum fuel prices** rising above inflation since 2014, driven by global oil price increases and higher taxes.
7. **Long travel distances & inefficient spatial form:** Cape Town's urban layout means low-income households on the periphery face higher fuel and transport costs.
8. **Carbon tax escalation** for high-carbon fuels: This risk is amplified for energy-intensive manufacturing, where fuel-switching is not always immediately feasible, creating cost vulnerability.
9. **For Eskom:** Rising diesel expenditure at Ankerlig exacerbates Eskom's financial fragility and erodes capacity for critical investment in sustainable generation, keeping the grid carbon-intensive.

2.5.3.1 Liquid and gaseous fuel costs

Figure 78 shows that liquid and gaseous petroleum fuel prices for Cape Town closely track global crude oil prices. National fuel prices are set through the basic fuel price mechanism,[25] which pegs domestic prices to international markets and applies import costs, distribution margins and taxes (DMRE, n.d). Because of the volatility of the oil price since 2005, however, a much longer review period than the reporting window is required to understand trends.

Figure 78: Crude oil and petroleum fuel prices, 2023



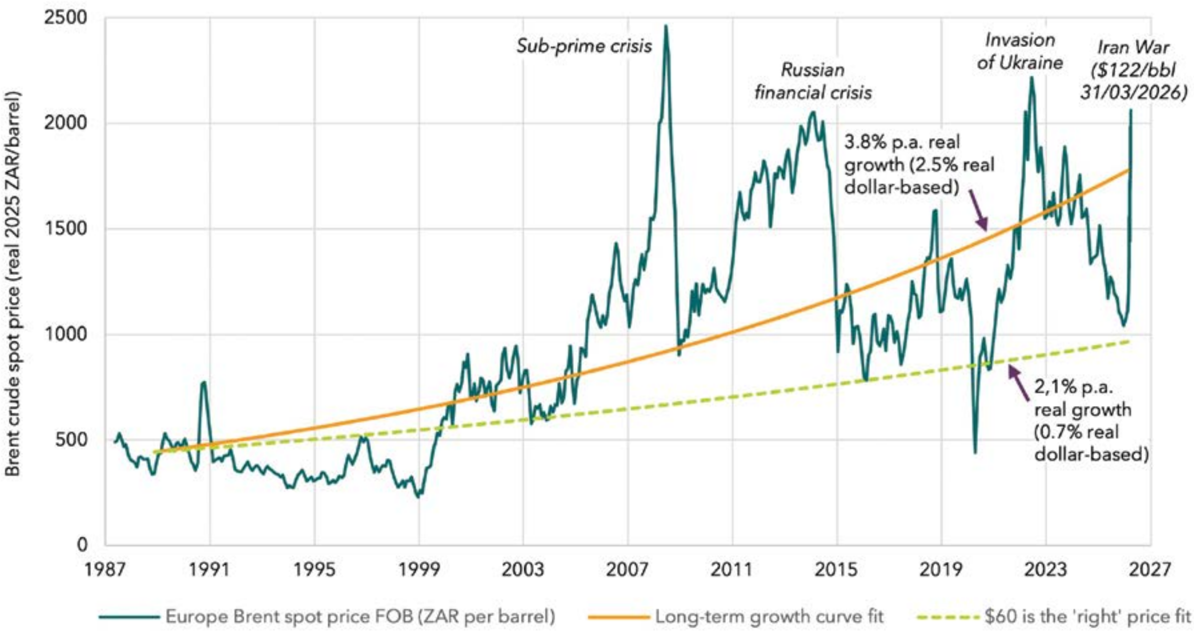
Sources: Stats SA (2025b); FIASA (2024)

Long-term oil price trends (Figure 79) show a real annual increase of around 3% in dollar terms – and about 4%[26] in rand terms once currency depreciation is included. Therefore, the drivers (excluding taxes) are completely external, with the 2007/8 sub-prime crisis and the sequence of Covid-19 to the invasion of Ukraine causing two of the most extreme spikes, collapses and rebounds in real rand prices. Such shocks ripple through the local economy, affecting households, businesses and transport costs across Cape Town.

[25] *See **https://cefgroup.co.za/**.*

[26] *Many factors affect the underlying average cost of extraction, notably the progressive exhaustion of the cheapest reserves, the advent of new technology such as horizontal drilling, and the ratio of demand to remaining reserves. Therefore, the compound growth curve fit shown is useful for a backward-looking assessment, but not for extrapolation.*

Figure 79: Oil price in real 2025 rands, accounting for exchange rate, 1987–2025



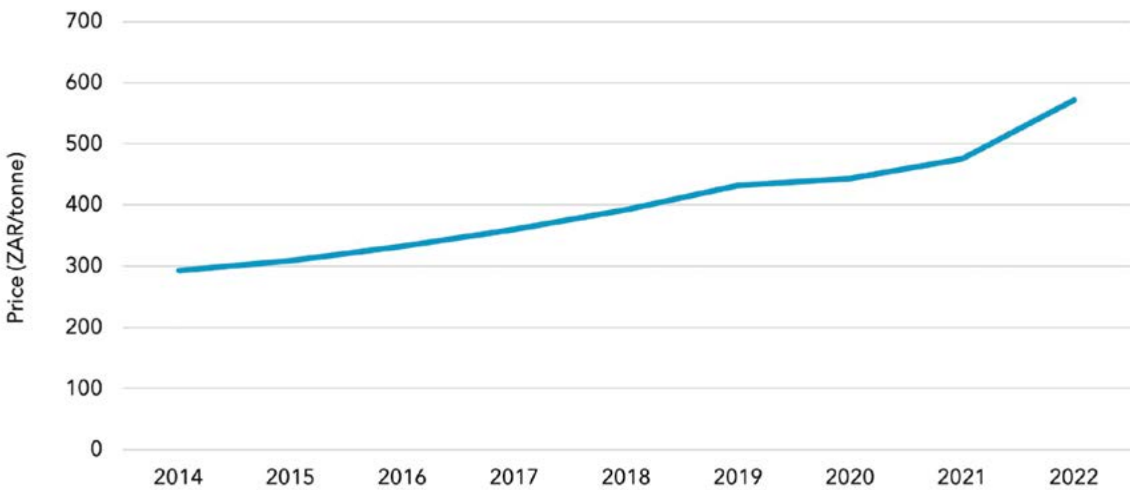
Sources: Oil price from U.S. Energy Information Administration (2026); ZAR/$ exchange rate from Federal Reserve Bank of St. Louis (2026); CPI from Stats SA (2025b)

Despite having a refinery within city boundaries, Cape Town is not shielded from national pricing: Local users pay the same regulated fuel prices as the rest of the country, and unlike electricity tariffs, the City has no mechanism to mitigate these fuel costs. As detailed in sections 2.5.1.2.1 and 2.5.1.3.2, market responses have, instead, been in the form of greater energy efficiency and reduced consumption.

2.5.3.2 Solid fuel costs

Since 2013, coal prices have risen faster than inflation, but not to the same extent as electricity prices, which disincentivises a fuel switch to electricity for applications where switching is possible. However, when considering the indirect cost of coal in the form of the carbon tax, this could add between R19 and R150 per tonne of coal used in 2023 (assuming tax-free allowances of 60%–95%).

Figure 80: Coal prices (ZAR/tonne)



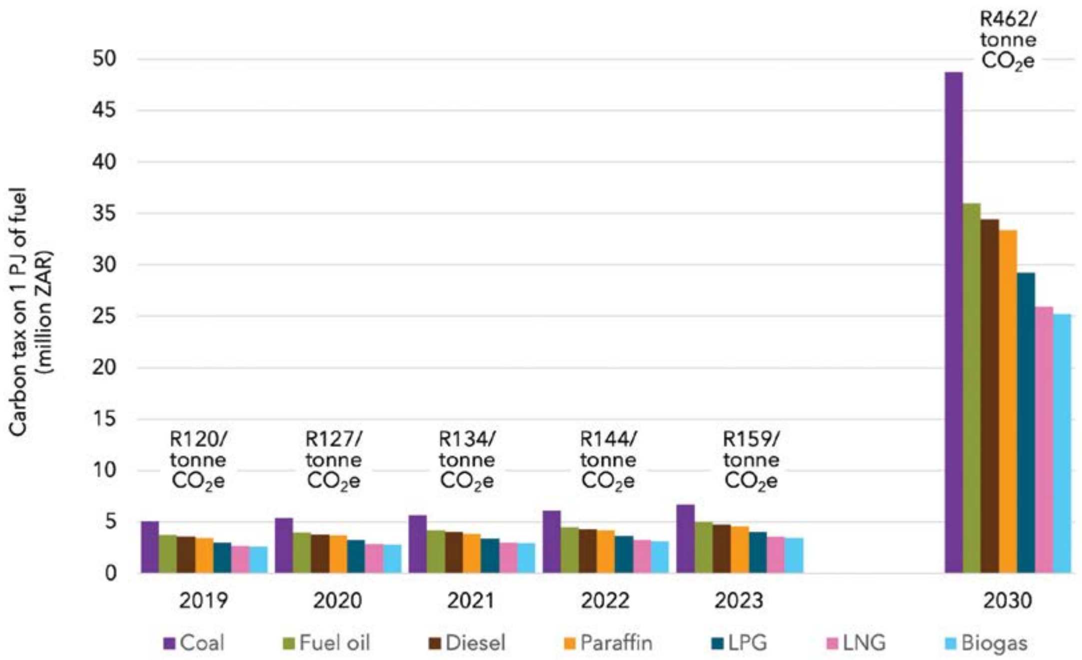
Source: DMRE (2024)

2.5.3.3 Carbon tax

The introduction of South Africa's carbon tax in 2019 has begun reshaping industrial energy use in Cape Town, driving both behavioural and structural changes. Between 2019 and 2023, the headline carbon tax ranged from R120 to R159 per tCO_2e, as shown in Figure 81. This was largely mitigated by substantial tax-free allowances (60–95%). However, these allowances will begin to be phased out from 2026. In 2030, the headline tax rate is forecast to be R462 per tCO_2e.

Figure 81 also illustrates the potential financial impact of the tax on different fuels, expressed as the cost per PJ, assuming 60% tax-free allowances in 2019–2023 and no tax-free allowances in 2030. The carbon tax impact is highest for coal, at over R6 million per PJ in 2023, followed by fuel oil, diesel, LPG and LNG, which are 20%, 23%, 35% and 42% lower than coal respectively. In 2030, the carbon tax on 1 PJ of coal could be as high as R45 million. This escalation creates strong economic incentives for fuel-switching (e.g. from coal to lower-carbon fuels such as LPG and LNG, or biogas or electricity) and efficiency improvements, but also, in some cases, the closure of energy-intensive facilities where costs of process changes are prohibitive. While the tax increases near-term operational costs, it may also accelerate investment in low-carbon technologies and renewable energy, aligning industrial operations with Cape Town's long-term climate and energy objectives.

Figure 81: Indicative Carbon Tax for 1PJ of fossil fuel use



Source: IETA (2023)

**Note: For 2019–2023, a basic tax-free allowance of 60% has been included in the calculation, but no other allowances have been added. The 2030 value excludes all allowances to show the possible maximum future impact of the carbon tax per PJ of fuel use if allowances fall away. Biogas has a non-negligible carbon footprint relating to CH_4 and N_2O released during combustion.*

2.5.3.4 Transport affordability

Income and public transport use are strongly correlated in Cape Town. As expected, Table 6 below indicates that low-income households spend a higher share of their income on transport generally and that for them choosing private transport is prohibitively expensive.

Table 6: Direct transport expenditure by income group, 2018

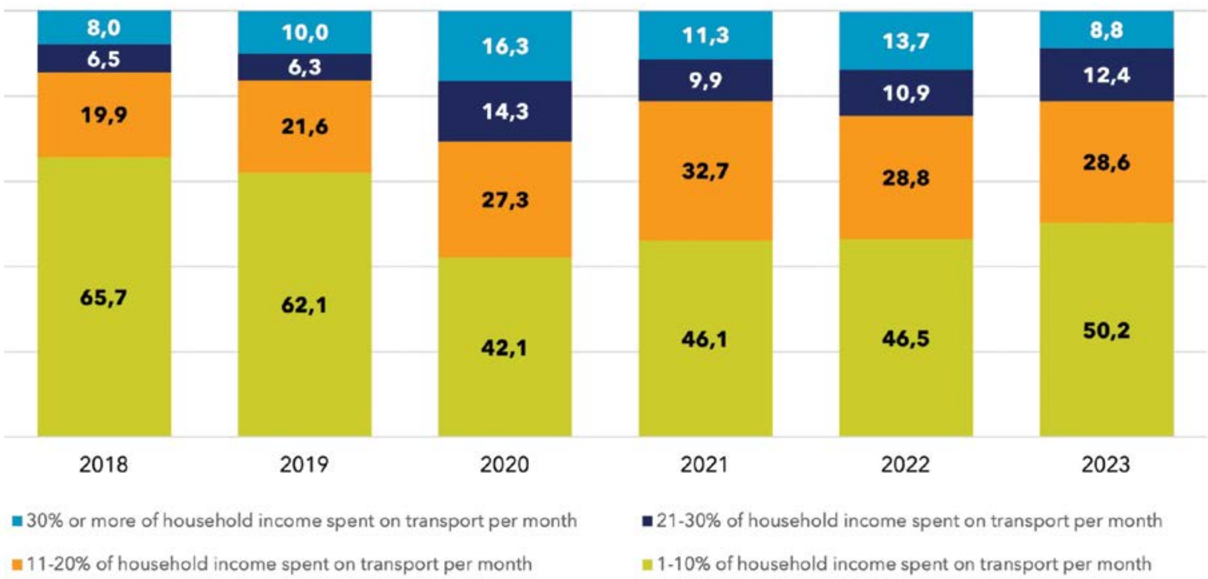
INCOME GROUP	INCOME STRATIFICATION	PERCENTAGE OF EMPLOYED POPULATION	AVERAGE MONTHLY INCOME	AVERAGE DIRECT COST EXPENDITURE VS MONTHLY INCOME (%)		
				PUBLIC TRANSPORT	PRIVATE TRANSPORT	BOTH
Low-income	< R 4 640	47%	R 2 400	17%	35%	26%
Medium-income	R 4 640 – R 37 100	45%	R 14 100	3%	23%	14%
High-income	> R 37 100	8%	R 70 800	1%	9%	7%

Source: Stolworthy, Krogscheepers, & Rabe (2021)

The decline in Cape Town's rail system between 2013 and 2021, and the recent partial recovery described in section 2.5.1.2.1, has had a profound impact on transport affordability, particularly for low-income households. Rail once was the backbone of the city's public transport network, offering the most cost-effective fares for commuters. With rail's modal share collapsing from 18% in 2013, when the system was already ailing, to effectively zero in 2021, climbing slightly to 1,3% in 2023, many commuters were forced to shift to more expensive modes such as minibus taxis, buses and even private vehicles. By 2018, households earning less than R4 640 per month were already spending an estimated 17% of their income on transport, well in excess of the 10% affordability benchmark (City of Cape Town, 2025d). The current rail recovery programme, therefore, is critical for the public transport network, with around 95% of users falling into the low-income to low-middle-income brackets.

Figure 82 shows the longer-term trend of increasing transport costs associated with the shift to more private transport, with 21,2% of households spending more than 20% of total household income on transport per month in 2023. The impacts of Covid-19 are also visible in this graph: In 2020, the pandemic caused costs to increase, with over 30% of households spending more than 20% of their income on transport. This trend was likely linked to travel restrictions and social distancing measures, combined with heightened concerns about infection risk. Workers unable to work remotely, particularly those in blue-collar roles involving manual labour, physical work or skilled trades, may have prioritised personal safety and hygiene over cost considerations (Bruwer, 2022).

Figure 82: Percentage of Cape Town household income spent on transport per month



Source: Stats SA (2025a) Stats SA (2025c)

Affordability challenges also extend to those using private vehicles: While the use of private cars increased relatively moderately from 53% in 2013 to 57,5% in 2023 (Figure 61), the reliance on petrol and diesel – fuels that are subject to volatile global oil markets (Figure 79) – leaves households increasingly exposed to rising costs.

Cape Town's sprawling, low-density urban form, shaped by apartheid spatial planning, creates long travel distances that undermine economically viable transport networks, raise commuting costs for low-income households located on the periphery, and reinforce inequities. Although the Municipal Spatial Development Framework (City of Cape Town, 2023b) prioritises densification, change of the built environment is inherently slow, locking in high transport energy intensity. Overcoming these constraints is central to improving mobility, lowering travel costs, and building a more inclusive, efficient and sustainable transport system.

2.5.4 Carbon Neutrality

In the absence of viable technologies for carbon capture and storage or use, the notion of the carbon neutrality of petroleum fuels is a contradiction in terms. As widely stated, the optimal path to carbon neutrality in fossil fuels is to stop using them, which means finding alternative energy carriers for its main applications, such as transport, energy generation and manufacturing.

In response to the challenge of the energy transition, the City has already implemented multiple initiatives, covering aspects such as energy efficiency within the municipal infrastructure, the procurement and use of renewable energy, incentives for SSEG, and improvements to the distribution infrastructure necessary to accommodate distributed energy generation (see section 4.3). In this section, Cape Town's progress with the uptake of EVs and other technologies that will potentially replace a large share of liquid fuels is reviewed.

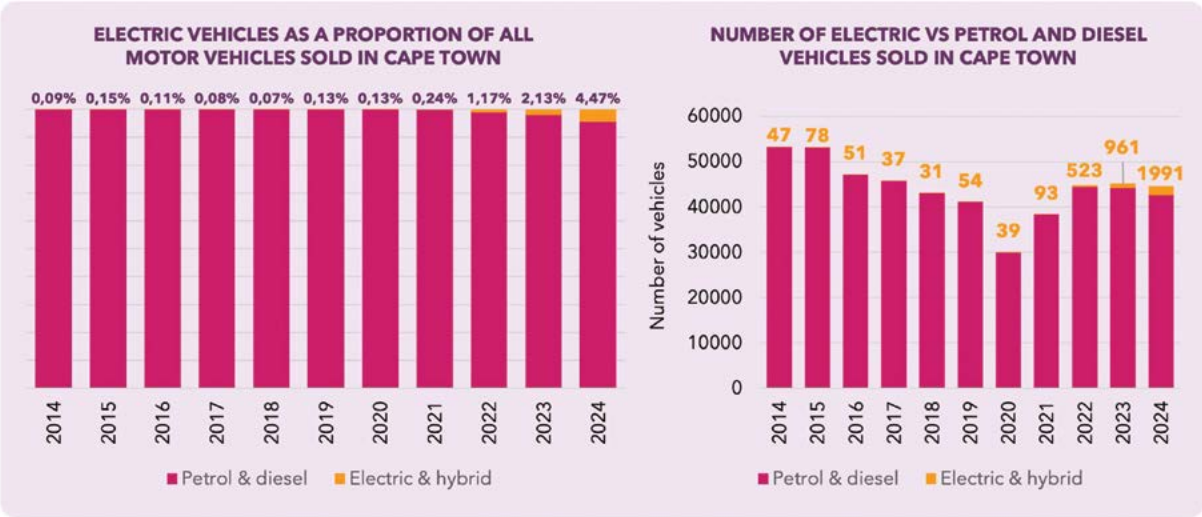
Box 14: Carbon neutrality of fuels

1. **Fossil fuel use in industry has declined** significantly in the past decade as a result of fuel-switching, energy efficiency and process changes and/or closure.
2. **Carbon tax signals:** Escalating carbon tax (forecast to reach R462/tCO_2e by 2030) incentivises efficiency and low-carbon fuel-switching.
3. Biogas initiatives and landfill gas capture demonstrate potential for **lower-carbon or net-neutral-carbon energy.**
4. **Resurgence of rail** could signal a shift towards lower-carbon and affordable public transport.
5. **Changing work patterns**, including remote work and hybrid work, have continued to suppress demand.
6. The only option to make petroleum fuels carbon-neutral is **to stop using them**.
7. While the need for decarbonisation is widely accepted, the **shift towards net zero** in Cape Town **has been limited in terms of fuel use**.
8. **High electricity prices and load-shedding** lead to reliance on liquid and solid fuels, and undermine climate goals, reinforcing the urgency of accelerated grid-scale renewables and storage deployment.
9. **High reliance on private vehicles** increases fuel emissions.
10. The transport sector is almost **entirely reliant on petroleum fuels**, limiting immediate decarbonisation options.
11. The **uptake of EVs** in Cape Town (and South Africa more broadly) **is slow**, with only 4,5% of new vehicle sales in Cape Town comprising EVs in 2023.

2.5.4.1 Electric vehicle (EV) sales and charging infrastructure in Cape Town

EVs are crucial to the decarbonisation of mobility, provided that the electricity supply for recharging the vehicles is derived from renewable resources. In South Africa, the uptake of hybrid vehicles and EVs has been slow. For instance, of the 44 560 new vehicles purchased in Cape Town in 2024, only 1 991 (4,5%) were either hybrid or battery EV, as shown in Figure 83.[27]

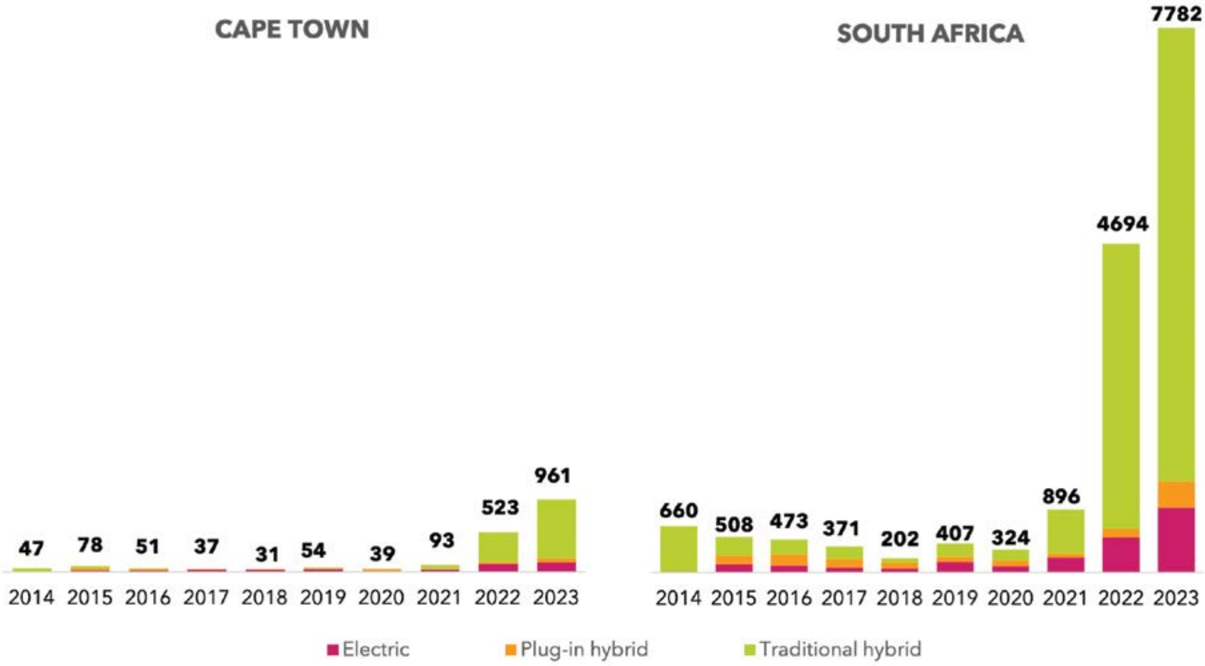
Figure 83: Electric vehicles as a proportion of total motor vehicle sales in Cape Town



Source: Lightstone Auto vehicle sales Western Cape, 2019–2024

[27] Data is available at **capetown.gov.za/Explore and enjoy/transport-and-vehicles/greener-travel/electric-vehicles.**

Figure 84: Sale of electric vehicles in Cape Town and South Africa



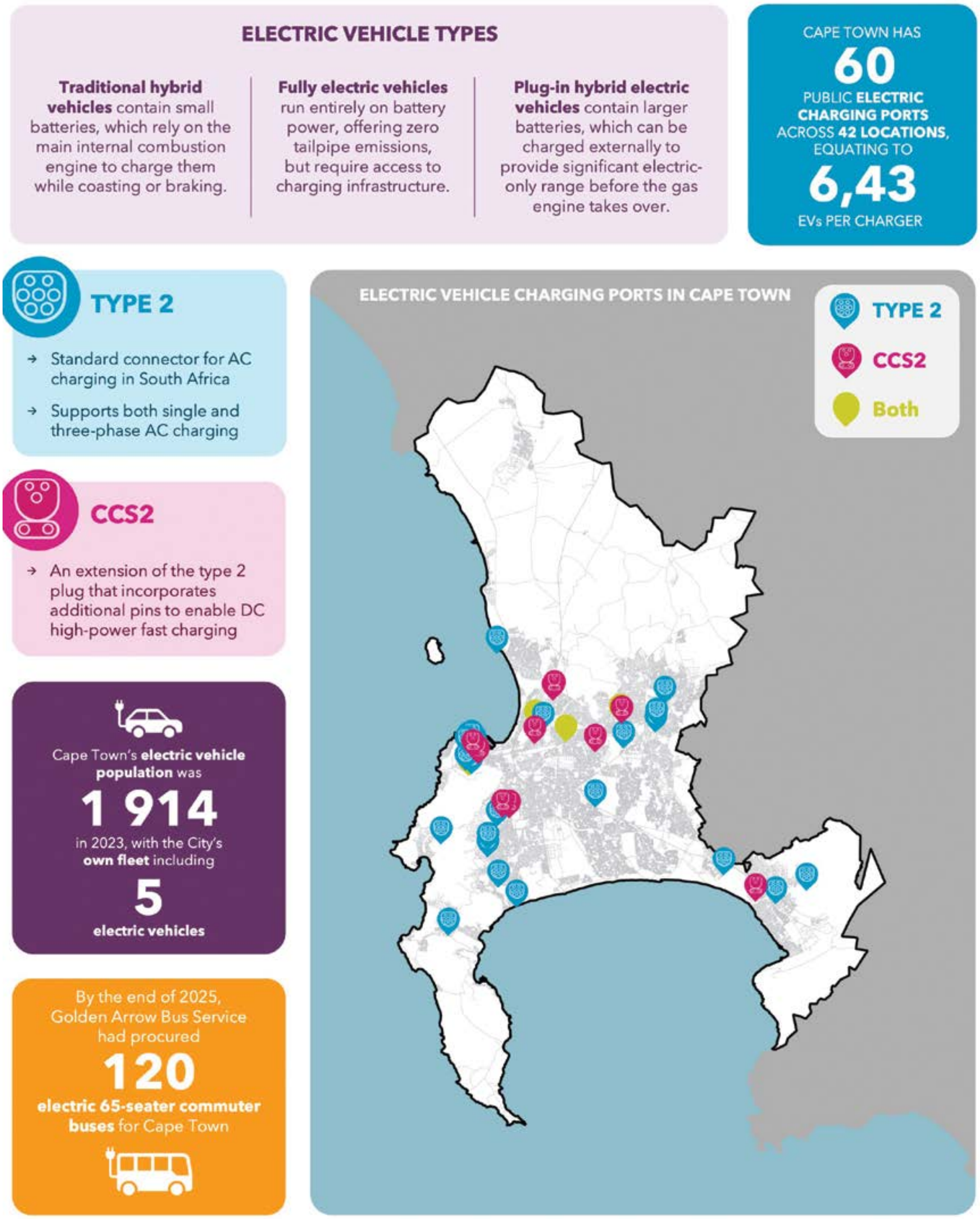
Sources: Lightstone Auto vehicle sales; NAAMSA

Although the proportion of EVs remains small, the infrastructure necessary for public EV charging is growing quickly. A total of 60 public charging stations are available across 42 locations in town (see Figure 85), mostly at refuelling stations along major routes and at key consumer sites such as malls, office parks and car dealerships. The number of EVs per public charger is estimated to be well below ten, reflecting not only the low number of EVs on the road, but also the spatial extent of the city. This level is comparable to cities in China, but is much lower than in some European and United States cities, where EVs per public charger are three times as high (C40 Knowledge, 2021).

The City has launched two public EV charging stations with associated carport solar PV systems at the Bellville civic centre (December 2020) and Somerset West municipal building (March 2021). These were donated by the United Nations Industrial Development Organisation as part of the Low-Carbon Transport South Africa project (GreenCape, 2021).

Type 2 chargers are the standard connector for alternating current (AC) charging in South Africa, supporting both single and three-phase AC charging. The combined charging system (CCS2) is an extension of the type 2 plug that incorporates additional pins to enable direct current (DC) high-power fast charging. Many public charging stations are AC, but DC fast chargers are projected to increase, driven by the growth of public-transport EVs and long-distance travel (GreenCape, 2021).

Figure 85: Electric vehicle recharging infrastructure in Cape Town



Sources: Plugshare, (n.d.); GreenCape (2021); Lightstone Auto; City of Cape Town (2025c)

2.5.4.2 Lower carbon fuels

2.5.4.2.1 Biogas

Biogas from unavoidable waste streams or sustainable sources represents an important opportunity for Cape Town's transition to lower-carbon fuel sources, particularly for applications requiring process heat and steam. However, its contribution to the energy mix remains very limited, with production and use in the order of 1,3 billion litres, or 75 000 GJ (approximately 1% of industrial fuel use), as shown in Figure 86.

Figure 86: Biogas consumption

Source: DFFE (n.d)

Currently, the SAB Newlands brewery is the only facility in the city that actively generates and uses biogas. The brewery has installed an anaerobic digestion system that treats wastewater while producing enough biogas to meet about 10% of its steam demand. This approach highlights the dual benefit of wastewater management and renewable energy generation.

In recent years, other biogas initiatives have struggled to remain viable. The New Horizons energy plant, once operational, closed down, but has since been acquired by Cape Town Biogas, which plans to restart production (Competition Tribunal, 2024). Smaller projects such as the Bayside Mall biogas facility have also ceased operations (GreenCape, 2017), and the proposed Winelands Pork[28] project abandoned biogas entirely in favour of a pyrolysis system during design.

As a result, biogas supply in the city is highly constrained. Transporting biogas over long distances adds complexity and cost, meaning plants need to be located close to users for efficiency.

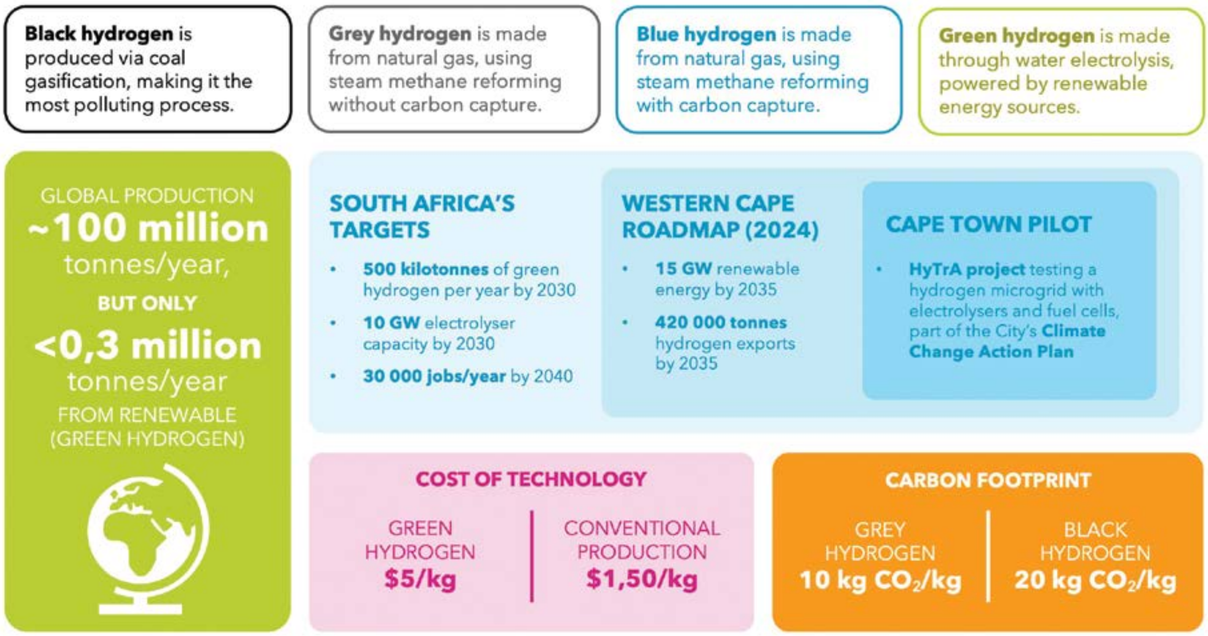
An alternative opportunity lies in capturing landfill gas for energy generation. The Coastal Park waste-to-energy project is a current example (Venter, 2025a), and similar systems could be implemented at other existing and future landfill sites, providing a scalable renewable energy solution.

2.5.4.2.2 Hydrogen – an emerging fuel

Hydrogen is increasingly recognised as a potential contributor to global decarbonisation, particularly in hard-to-abate sectors such as cement manufacture, iron and steel production, and aviation. At present, however, production is dominated by fossil fuel-based pathways. In 2023, global hydrogen production was estimated at around 100 million tonnes per year, of which less than 0,3 million tonnes were produced using renewable electricity and electrolysis. Approximately 62% of hydrogen is produced from natural gas (grey hydrogen), 19% from coal (black hydrogen), and the remainder as a by-product from oil refining (IEA, 2025).

[28] *https://zerowaste.co.za/projects/winelands-pork-waste-to-energy-project/.*

Figure 87: Hydrogen at a glance



Sources: WCG (2024a); IEA (2025); (IDC 2023); Young (2024); DST (2007); Bloomberg News (2025)

Globally, hydrogen is used mainly as an industrial feedstock, with applications in oil refining (42%), ammonia production (32%) and methanol production (16%). Only a very small fraction is used in the transport sector. The carbon intensity of current production is high, with grey hydrogen emitting around 10 kg CO_2 per kg of hydrogen, and black hydrogen closer to 20 kg CO_2 per kg. Therefore, shifting production to low-carbon hydrogen will be essential if global net-zero targets are to be met.

Despite its potential, the development of a global green hydrogen market has been slow. Costs remain a central barrier, with production from renewable electricity at around R89–R143 per kg, which is approximately five times the cost of conventional hydrogen (Young, 2024). Hydrogen also faces challenges of low energy density, high transport and storage costs, and limited infrastructure and regulation. These factors have slowed investment and delayed project delivery globally. The experience of the NEOM project in Saudi Arabia illustrates this risk, with costs escalating from $5 billion to over $8,5 billion due to supply chain pressures and infrastructure costs (Bloomberg News, 2025).

Nevertheless, some applications of green hydrogen remain critical and are being further developed. According to Johnson et al. (2025), low-carbon (green or blue) hydrogen will be essential to decarbonise ammonia production, the production of petrochemicals, and hard-to-abate sectors such as steelmaking, heavy transport and long-duration energy storage. It has been recommended that hydrogen strategies should focus and support these applications, and avoid uses such as residential heating, light-duty vehicles and aviation (Johnson et al, 2025).

South Africa has identified hydrogen as a strategic opportunity, both for domestic decarbonisation and for green industrial development. The Hydrogen Society Roadmap (2021) sets a vision for hydrogen to play a central role in the energy transition (DSI, 2021). The Green Hydrogen Commercialisation Strategy (2023)) (IDC, 2023), in turn, outlines ambitious targets, including:

- 500 kilotonnes of green hydrogen per year by 2030;
- 10 GW of electrolyser capacity by 2030; and
- 30 000 jobs per year by 2040.

The strategy also highlights six priorities, namely capturing export opportunities; building domestic demand in green steel, sustainable aviation fuels and mining; localising manufacturing of electrolysers and fuel cells; securing finance; ensuring socioeconomic benefits; and strengthening the policy environment. Early progress has been made, including the establishment of a Green Hydrogen Programme Management Office at the Industrial Development Corporation (IDC), the commissioning of Africa's first commercial-scale green hydrogen facility in Sasolburg, and the identification of hydrogen hubs at Saldanha Bay, Coega and Boegoebaai.

2.5.4.2.2.1 Hydrogen in Cape Town and the Western Cape

Hydrogen has also emerged as a standard feature of policy documents at regional and local level as interest in hydrogen escalates, both as a means to carbon neutrality and as a mega-scale business opportunity in sunny countries (viable green hydrogen needs ultra-cheap renewable electricity). At a provincial level, the Western Cape Green Hydrogen Strategy and Roadmap (2024) sets a target of 15 GW of renewable energy generation and 420 000 tonnes of hydrogen exports by 2035, alongside job creation, skills development and industrial diversification commitments (WCG, 2024a). As part of its citywide vision for energy, the City's Climate Change Action Plan (City of Cape Town, 2021b) includes a broader programme of stakeholder action to "develop a regional value chain for carbon-neutral molecular fuels". However, the City itself has no mandate to engage in the molecular fuel value chain, and until green hydrogen technology is more economically viable, the municipality would have to weigh up investments in pilots against its many service delivery priorities.

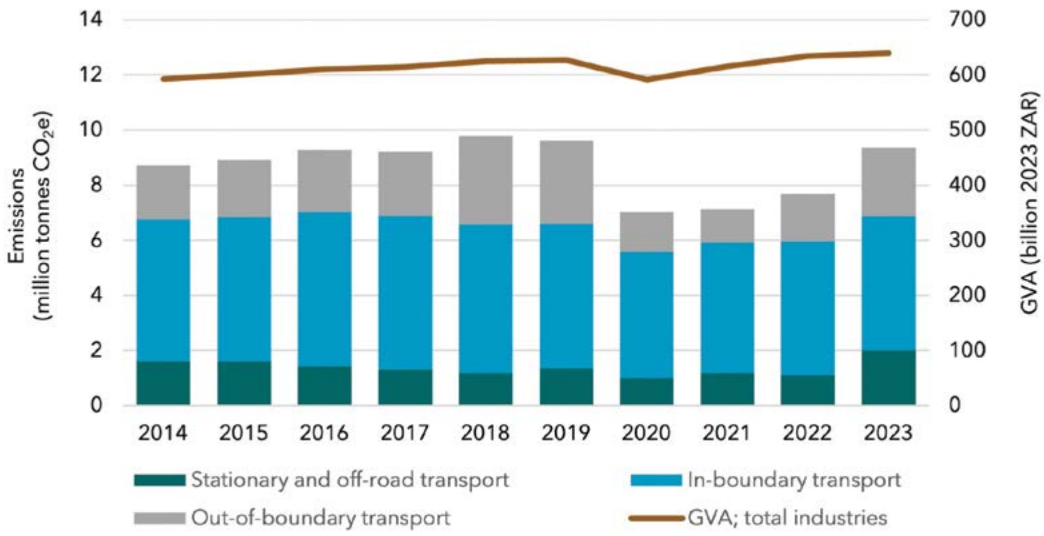
One such pilot, funded by the German government, is the Hydrogen Tryout Areal (HyTrA) project – a hydrogen microgrid demonstration in Cape Town that integrates electrolysers and fuel cells to convert surplus renewable energy into stored hydrogen for reconversion to electricity (BMUKN, 2025). This is intended as a step towards improving resilience for industrial users in the face of load-shedding and liquid fuel dependence.

2.5.4.3 Emissions intensity of solid, liquid and gaseous fuel use in the economy

Figure 88 shows emissions from fuel use in Cape Town between 2014 and 2023, disaggregated into fuels used for transport (in-boundary and all transport) and those used for stationary energy purposes, alongside the city's total GVA. Given the dominance of transport energy, the overall pattern is similar to the transport energy trends shown in Figure 61. Total emissions from fuel use fluctuated in response to external shocks in the period 2020–2023, but over the whole period, emissions remained fairly stable, despite modest real economic growth (7%)[29] and high population growth (19,5%) (City of Cape Town, 2024a). As discussed in sections 2.5.1.2.1 and 2.5.1.3.2, the data suggests improved transport efficiency, less discretionary travel and a slowdown in passenger car growth as long-term drivers of this trend, while efficiency, structural changes and contraction (-11%)[29] in industry also contributed.

[29] *S&P Global Market Intelligence*

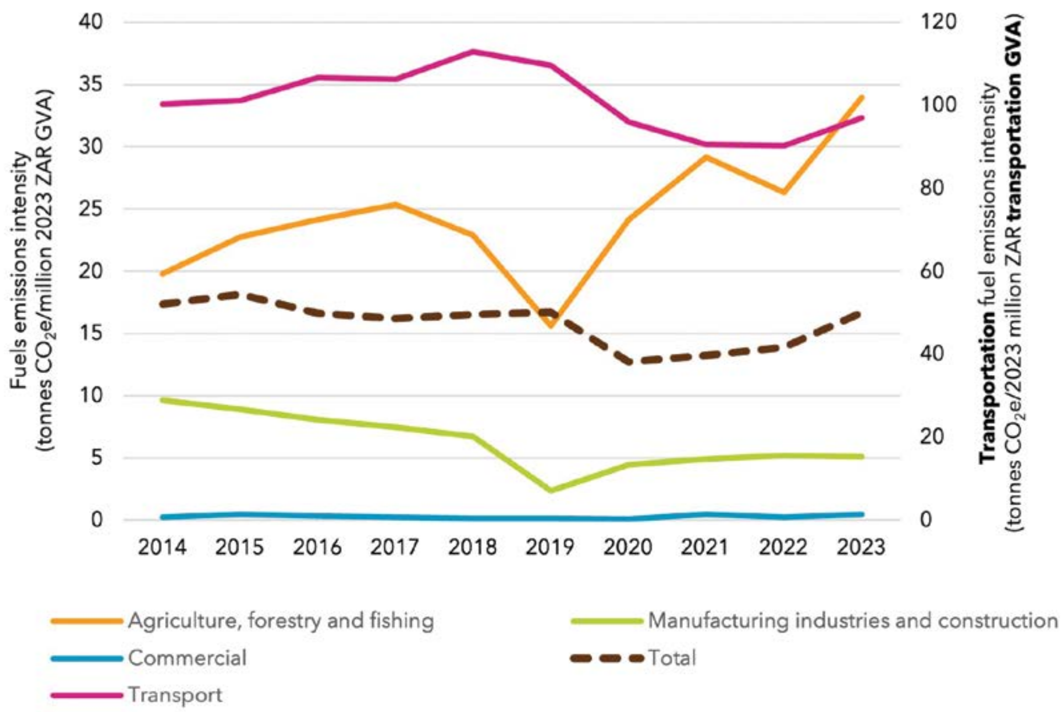
Figure 88: Total fuel emissions and GVA



Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); Stats SA; Transnet (2025); S&P Global (2025)

Figure 89 below shows the fuel emissions intensity per unit of GVA of the main economic sectors. The data closely tracks Figure 75 in section 2.5.1.4 because petroleum fuels have similar emission factors of around 70–80 tonnes CO_2e/TJ. Therefore, the same drivers discussed in section 2.5.1.4 apply.

Figure 89: Sectoral fuel emissions intensity per unit of GVA



Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); Stats SA; Transnet (2025); S&P Global (2025)

2.5.5 Resilience

Energy resilience is defined as the capability of an energy system to restore functionality in the event of a shock or stress, and to reduce overall exposure to shocks and stresses. In terms of petroleum fuels, resilience includes the ability of the system to use diverse energy sources, in the event of a major disruption to any single source e.g. switching to diesel generators to meet electricity demand.

Box 15: Resilience in the fuel sector

1. **Diverse fuel base:** Continued availability of petroleum fuels provides flexibility for transport and industrial operations.
2. Manufacturing sector has demonstrated a **switch to different fuel types**.
3. Fuel-switching is evident through the use **of diesel for electricity generation** at both **small scale** (e.g. commercial & residential buildings) and **utility scale** (in OCGT facilities).
4. **Local refinery presence:** While not conferring price advantage, a refinery within city limits supports supply continuity.
5. **Fuel storage capacity** provides a buffer against short-term supply disruptions.
6. **Reconstruction of the rail** system starting in 2022 and **extension of the MyCiTi network** into the metro southeast create potential for sustainable and affordable public transport.
7. **High import dependence:** Liquid fuel prices are tied to volatile international oil markets, limiting local control.
8. **Decline of rail transport:** Decline of rail has increased dependence on road-based fuels, reducing system resilience.
9. **Load-shedding and reliability of electricity** prevent fuel-switching to electricity, increasing reliance on diesel generators and OCGTs.
10. **Rising carbon tax and fuel prices** will increase costs of coal and liquid fuels, affecting industrial and commercial resilience.
11. **Limited alternative fuels at scale** – LNG, biogas and landfill gas remain small-scale, with logistical and distribution challenges for wider use.
12. **Fuel-stacking** by poorer households, while the use of a diversity of fuels and demonstrating resilience are also symptoms of energy poverty.

Cape Town's petroleum fuel system demonstrated strong resilience during two major disruptions – the Astron refinery shutdown (see section 2.5.1) and the Covid-19 pandemic – maintaining stable supply through alternative import channels, with minimal impact on consumers and businesses. Although the refinery plays a key role in providing locally produced diesel, petrol, fuel oil, jet fuel and LPG, its temporary closure showed that Cape Town could meet demand without significant interruption. The outage further accelerated diversification of supply, with industry exploring new LPG sources, and LNG entering the energy mix. National initiatives such as the LPG Rollout Strategy (DMRE, 2021) continue to strengthen supply security by improving LPG import capacity, ensuring that the city remains well positioned to meet critical liquid fuel needs under future external shocks.

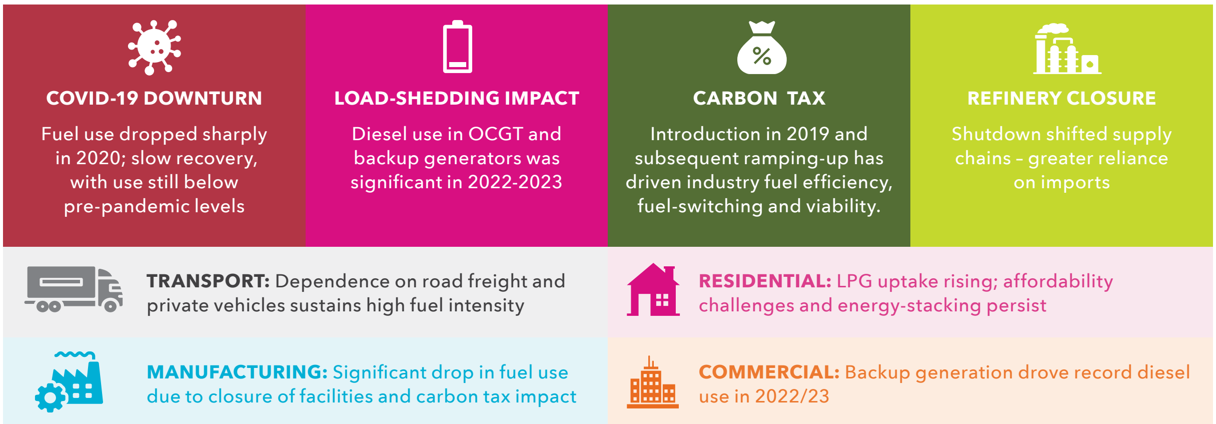
Fuel resilience in Cape Town is also closely linked to electricity system performance. Where electricity supply remains constrained or unreliable, opportunities for fuel-switching to electricity in industry are significantly limited. Furthermore, power shortages often lead to increased demand for petroleum fuels, both for OCGTs supporting the grid, and for on-site generation by businesses and households. This interdependence underscores the importance of addressing energy resilience across multiple carriers in an integrated manner.

Solid fuels have been part of South Africa's energy mix over a long period. Changes to international regulations, however, will pressurise energy users to replace fuels such as coal with renewable resources. These pressures raise a different set of questions for large-scale energy users, including whether renewable solid fuels such as biomass can replace coal in high-temperature applications. However, the industrial sector has perhaps shown the most resilience, with clear signals coming from the carbon tax, bringing about significant reductions in absolute solid, liquid and gaseous fuel use through efficiency and fuel-switching.

2.5.6 Summary of fuel use trends

Figure 90 below summarises the dynamics that affect the supply and demand of solid, liquid and gaseous fuels.

Figure 90: Key dynamics impacting solid, liquid and gaseous fuels and sector highlights



Overall, Cape Town's solid, liquid and gaseous fuel data profile reflects the following:

- Large-scale impacts by the two major events over the reporting period: Covid-19 and load-shedding.
- An energy system dominated by liquid fossil fuels in terms of final energy consumed within Cape Town's municipal boundaries. This does not translate into the same dominance of energy services because of the amount of energy lost to heat in direct combustion processes. Nevertheless, these volumes are important, as oil price shocks have been extreme since 2005.
- Typical for a region without a concentration of heavy industries, transport accounts for the vast majority of fuel-related energy demand. However, the difficulties of diesel allocation in 2023 notwithstanding, per capita consumption of liquid fuel use for mobile applications is estimated to have decreased by 24% since 2017. A quarter to half is likely due to greater energy efficiency, implying less personal travel for both work and leisure purposes.
- Given the potential scale, transport electrification poses challenges to grid infrastructure and electricity supply.
- Manufacturing has suffered from firm closures and increasing input costs, but the data indicates that value is being generated with greater energy efficiency.
- While the heavy dependence on petrol, diesel and other fossil-based fuels leaves the city highly exposed to global price volatility and carbon costs, the system was resilient to supply shocks in the period 2020–2023.
- Paraffin use by households has decreased markedly on a 20-year view, and clean cooking rates as a result of increased LPG uptake are very high by global standards. However, the data suggests that fuel-stacking is common in fast-growing informal communities, and that urbanisation and economic factors are negatively affecting electricity access and energy poverty.
- Together, these trends point to a system that has had to adapt rapidly despite its scale, producing mixed outcomes for society. It will require a managed transition to strengthen energy security and advance towards carbon neutrality for energy services currently supplied by solid, liquid and gaseous fuels. This includes pragmatic, targeted decarbonisation strategies, improved energy efficiency, and policies and business planning that respond realistically to tightening economic constraints.

3 State of Carbon

3.1 Introduction

The City and its partners have been publicly reporting GHG emissions citywide and for City operations since the first Cape Town State of Energy report was published in 2003 (City of Cape Town, 2003). The past decade has seen this work support a number of detailed policies and plans, and become an important component of the environmental, social and governance (ESG) activities integral to financing municipal service delivery and development in the modern context. The City declares carbon tax liabilities and undertakes both voluntary (CDP, 2024) and statutory reporting (DFFE, 2020) annually. The scope of the latter will expand as the local government obligations under the recent Climate Change Act (DFFE, 2024a) are defined.

The detailed policy context for the City's response to climate change is delineated in the following documents:

- The City's policy and planning framework for responding to shocks and stressors such as climate change is described in the ***Resilience Strategy*** (City of Cape Town, 2019a).
- The ***Climate Change Strategy*** (City of Cape Town, 2021c) sets out a vision of Cape Town as a climate-resilient, carbon-neutral and resource-efficient city that enables inclusive economic development and thriving communities.
- The ***Climate Change Action Plan*** (City of Cape Town, 2021b) translates this vision into action, identifying ten strategic focus areas, including zero-carbon energy, mobility, buildings, and a circular waste economy, as well as five cross-cutting work areas, including mainstreaming, finance and health.
- Mitigation of both GHG and local air pollutants is targeted in the ***Air Quality Management Plan*** (City of Cape Town, 2024e).
- The diversion of organic waste and reduction of material use is a component of the ***Waste Strategy 2025*** (City of Cape Town, 2025f).
- The overall improvement of an integrated transport network, which is key to GHG mitigation and resilience, is the focus of the ***Comprehensive Integrated Transport Plan (CITP) 2023–2028*** (City of Cape Town, 2025d).
- The ***Energy Strategy*** (City of Cape Town, 2023d) provides a roadmap for securing a carbon-neutral energy system by 2050, while addressing energy poverty and system resilience.

Together, these documents provide both strategic direction and operational pathways for climate action, both to mitigate GHG emissions and adapt to inevitable climate change. This State of Carbon section of the SOEC report aims to complement these by:

- providing a comprehensive overview and analysis of Cape Town's GHG emissions to offer insight into progress and future action for climate change mitigation;[30]
- leveraging the cross-sectoral GHG accounting framework to lay out the main features of some of the larger natural and infrastructure systems of the city that would support a systems approach to other challenges apart from GHG emissions; and
- demonstrating the City's commitment to maintain the scope, coverage and quality of its ESG reporting as far as possible, given a resource allocation appropriate to local government in a developing-country context.

The sections that follow present the City's current emissions profile across stationary energy, transport, waste, industrial processes and product use (IPPU) as well as agriculture, forestry and land use (AFOLU). This is complemented by a technical report that expands on data sources, methods, assumptions and gaps, and is supported by an emissions calculation tool developed from sectoral datasets available on the ***Cape Town Open Data Portal*** (City of Cape Town, 2025a). Together, these resources provide the evidence base to monitor progress towards Cape Town's climate commitments and identify the interventions needed to achieve a carbon-neutral, climate-resilient future.

[30] *"Climate change mitigation refers to actions or activities that limit emissions of GHGs from entering the atmosphere and/or reduce their levels in the atmosphere." (IPCC, IPCC_AR6_WGIII_FAQ_Chapter_01, 2026).*

Box 16: The City's leadership in CDP reporting

The City demonstrates international leadership through its annual reporting to the CDP (formerly the Carbon Disclosure Project), being the primary global disclosure system for subnational climate action, and the reporting platform for C40 member cities. The City prepares Cape Town's GHG inventory in line with international standards (GHG Protocol, 2021). This ensures transparency, accountability, and alignment with global best practice, while strengthening the City's evidence base for local decision-making.

Performance in CDP reporting has been consistently strong, with the City achieving an **A-rating annually from 2020 to 2025**. Only **16% of reporting cities worldwide (120 in total)** attained this rating in 2025, placing Cape Town among the leading cities globally in terms of transparency and ambition.

In 2025, the City expanded the coverage of its reporting from the BASIC level to BASIC+ by including the AFOLU and IPPU sectors, which aligns with the sources required for national reporting under the IPCC guidelines. These ratings and ongoing improvements affirm the quality of the City's reporting and its integration of climate goals across energy, transport, waste and urban development.

3.2 Accounting standards and methodologies

The citywide inventory is prepared according to the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC Protocol 1.1, 2021). The GPC provides the internationally recognised framework for measuring and reporting GHG emissions at the city scale. By classifying emissions into standardised sectors, it allows cities to build robust inventories, set meaningful targets, and track progress over time. Importantly, it enables comparability with other cities worldwide, supporting transparency and shared learning in the global effort to address climate change.

Under the GPC, a city's emissions can be reported across five major sectors:

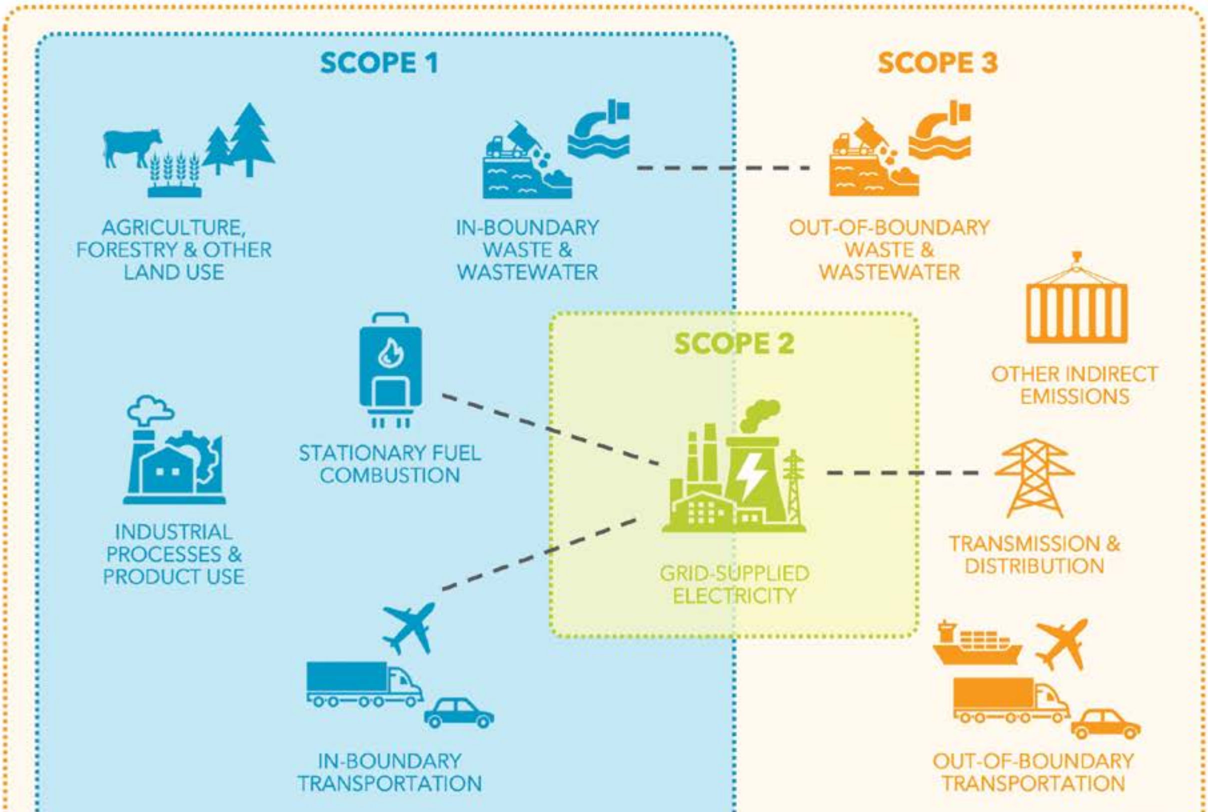
- **Stationary energy:** Covers emissions from the combustion of fuels to provide energy in homes, businesses and industry. It includes subsectors such as residential and commercial buildings, manufacturing, construction, energy industries and agriculture.
- **Transportation:** Covers emissions from the combustion of fuels in the transport sector, including on-road vehicles, rail, aviation, shipping and off-road transport
- **Waste:** Covers emissions arising from solid waste disposal, biological treatment, incineration, open burning, and wastewater treatment and discharge
- **Industrial processes and product use (IPPU):** Covers emissions from chemical and physical transformations in industry, as well as the use of products that release GHG, such as air conditioners and refrigeration
- **Agriculture, forestry and other land use (AFOLU):** Covers emissions and removals from agricultural activities, livestock and land use change. Subsectors include livestock, land, and aggregate sources such as fertiliser use and biomass burning.

As shown in Figure 91, emissions are further classified according to their integration with systems outside Cape Town's boundaries, for example the electricity grid, and their link to activities within the boundaries. Figure 92 shows the city's GHG emissions in 2023, calculated according to the GPC.

Figure 91: Key concepts in greenhouse gas accounting for cities

SCOPES	Activities taking place in Cape Town generate GHG emissions that occur both within and outside the city's boundaries. Emissions are grouped into three categories, called *scopes*, based on where they occur. **Scope 1**, **2** and **3** emissions are summarised in the table and diagram below.
REPORTING LEVELS	The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) defines two reporting levels for city planning: **BASIC and BASIC+.** The BASIC level covers city-induced scope 1 and all scope 2 emissions from stationary energy and transportation, as well as city-induced scope 1 and scope 3 emissions from waste. The City uses BASIC emissions to track its targets. BASIC+ involves more challenging data collection and calculation processes, and additionally includes emissions from IPPU, AFOLU as well as transboundary transportation. **In 2025, Cape Town's full BASIC+ inventory was estimated for the first time.**
TERRITORIAL (ALL SCOPE 1) EMISSIONS	Territorial emissions include all GHG emissions within the city's boundaries (all scope 1), regardless of whether they are caused by Cape Town activities or external demands (e.g. national grid energy generation, or waste from outside the city). The territorial total accounts for all scope 1 emissions only, in such a way that multiple territorial totals from community-scale inventories can be aggregated to a regional or national total of all emissions. The BASIC/BASIC+ total is a local planning metric and includes 'city-induced' emissions of all three scopes.

SCOPE	DEFINITION
Scope 1	GHG emissions from sources located within the city's boundaries
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city's boundaries
Scope 3	All other GHG emissions that occur outside the city's boundaries as a result of activities taking place within the city's boundaries



Source: GPC v1.1 (2021)

Figure 92: GPC framework with Cape Town 2023 emissions summary

Sector		Total by scope (tCO_2e)				Total by city-induced reporting level (tCO_2e)	
		Scope 1 (territorial)	Scope 2	Scope 3 included in BASIC/ BASIC+	Other scope 3	BASIC	BASIC+
Stationary energy	Energy use	2 012 725	9 891 620	291 461	Not occurring	11 904 345	12 195 805
	Energy generation supplied to the grid	1 305 988					
Transportation		4 880 785	Included elsewhere	2 475 872	Not occurring	4 880 785	7 356 657
Waste	Generated in the city	2 604 239		Not occurring	Not occurring	2 604 239	2 604 239
	Generated outside the city	38 952					
IPPU		1 006 104			Not occurring		1 006 104
AFOLU		277 015			Not occurring		277 015
Total		12 125 808				19 389 369	23 439 821

Key

- Sources required for BASIC reporting
- Sources required for BASIC+ reporting
- Sources included in other scope 3
- Sources required for territorial total, but not for BASIC/BASIC+ reporting *(italics)*
- Non-applicable emissions

Sources: GPC Protocol 1.1 (2021); City of Cape Town (2025c)

The details of the energy system are documented in the State of Energy section of this report (see section 2). The section below provides a brief description of the physical characteristics and a system overview of the waste sector, followed by an overview of trends across all emissions sources and sectors for GHG accounting reporting.

3.3 System overview of the waste sector

This section provides brief contextual data on the physical characteristics and activity levels of the waste sector.

GHG emissions arise both from solid waste and wastewater, mainly in the form of methane from anaerobic decomposition of organic material. The wastewater system is directly linked to the water system. Local governments in South Africa carry the core responsibility for delivering water and waste services, and in Cape Town, this mandate is supported by a substantial infrastructure network that faces the dual challenge of high population growth and growing informality. Detailed information on the water, wastewater and solid waste systems and supporting policy frameworks are available in the following documents:

- ***Waste Strategy 2025*** (City of Cape Town, 2025f)
- ***Our Shared Water Future – Cape Town's Water Strategy*** (City of Cape Town, 2019b)
- ***Cape Town Water Outlook*** (City of Cape Town, 2024b)

Box 17: Circular waste economy goals from the City's Climate Change Strategy

Goal 22: Develop and implement an integrated waste management strategy that is financially feasible, and maximises material efficiency by prioritising waste avoidance, reduction, treatment and recycling in line with national targets.

Goal 23: Reduce organic waste disposal to landfill (in line with provincial Integrated Waste Management Plan targets) by 50% by 2022 and 100% by 2027 through better waste separation, treatment and utilisation.

Goal 24: Increase diversion of recyclables from disposal to landfill by 40% by 2025, 55% by 2030, >70% by 2035, and 85% by 2050, through improved collection, waste separation, and providing support to informal workers.

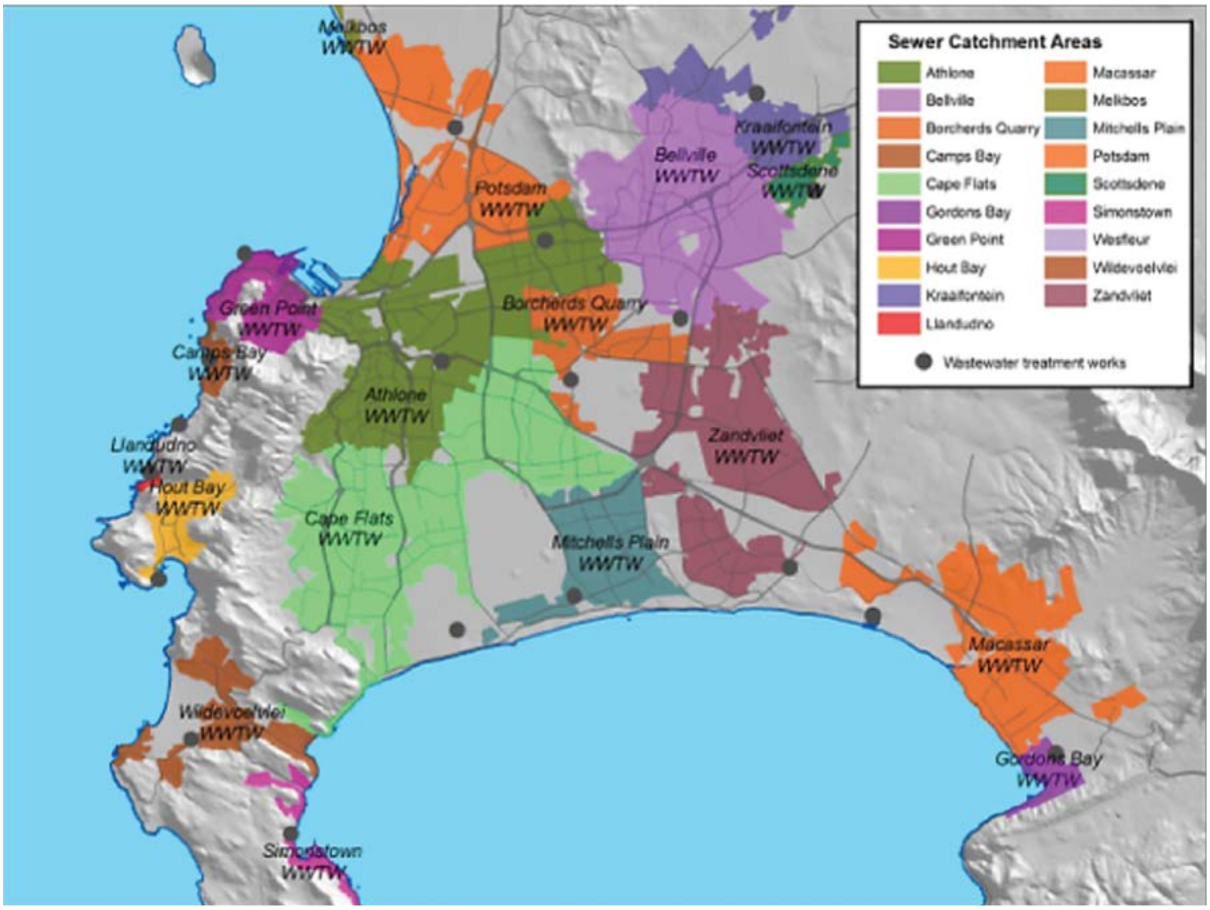
Goal 25: Reduce the climate and environmental impact of waste disposal and wastewater treatment facilities by increasing biogas and landfill gas collection efficiency, treatment and utilisation.

3.3.1 The wastewater treatment system and supporting water system

Wastewater is an unavoidable by-product of urban life, and therefore, its treatment is a critical service for Cape Town, ensuring both public health and environmental protection. The key features and statistics of the wastewater system are laid out in Figures 93 and 94 below. The headlines relevant to GHG emissions are as follows:

- The City operates 11 dams, 12 water treatment plants, 24 bulk reservoirs, 658,5 km of bulk pipelines, 750 pump stations and more than 10 000 km of water reticulation pipelines, supplying close to one billion litres of potable water daily (City of Cape Town, 2022).
- Some of the potable water supplied to the city is returned to the water system as wastewater effluent, the largest proportion of potable water is used by households.
- The City's wastewater network includes close to 500 pump stations and 10 000 km of sewer pipeline (City of Cape Town, 2022).
- Approximately 640 million litres of wastewater per day (131 litres per capita per day) were treated across Cape Town in 2023, including flows from both households and industrial activities.
- This network links residents to a highly centralised system of 17 activated-sludge works, four rotating bio-contactors, three marine outfalls and two pond systems. The three largest of the treatment plants, Athlone, Cape Flats and Zandvliet, processed 132 409 million litres in 2023 (362 million litres per day, 57% of the total).
- In 2023, a total of 97% of all wastewater was processed by aerobic conventional activated sludge treatment plants (with or without membrane bioreactors). Nearly 3% was discharged following preliminary treatment into the sea via purpose-designed marine outfall systems, and only a fraction (<1%) was handled by means of a pond system.
- Activated-sludge processes produce considerably lower methane emissions compared with purely anaerobic treatment without mitigation such as biogas flaring.
- The large aeration blowers make the process relatively energy-intensive, however; wastewater treatment accounts for nearly 30% of the City's operational electricity consumption. This made the system particularly susceptible to load-shedding.

Figure 93: Sewer catchment areas and wastewater treatment works (WWTWs)



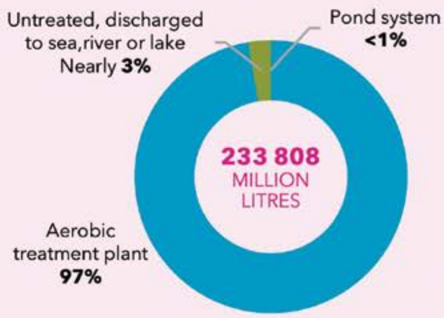
Source: City of Cape Town (n.d.(b))
**Note: The data shown is from 2016.*

Figure 94: Key wastewater facts and figures, 2023

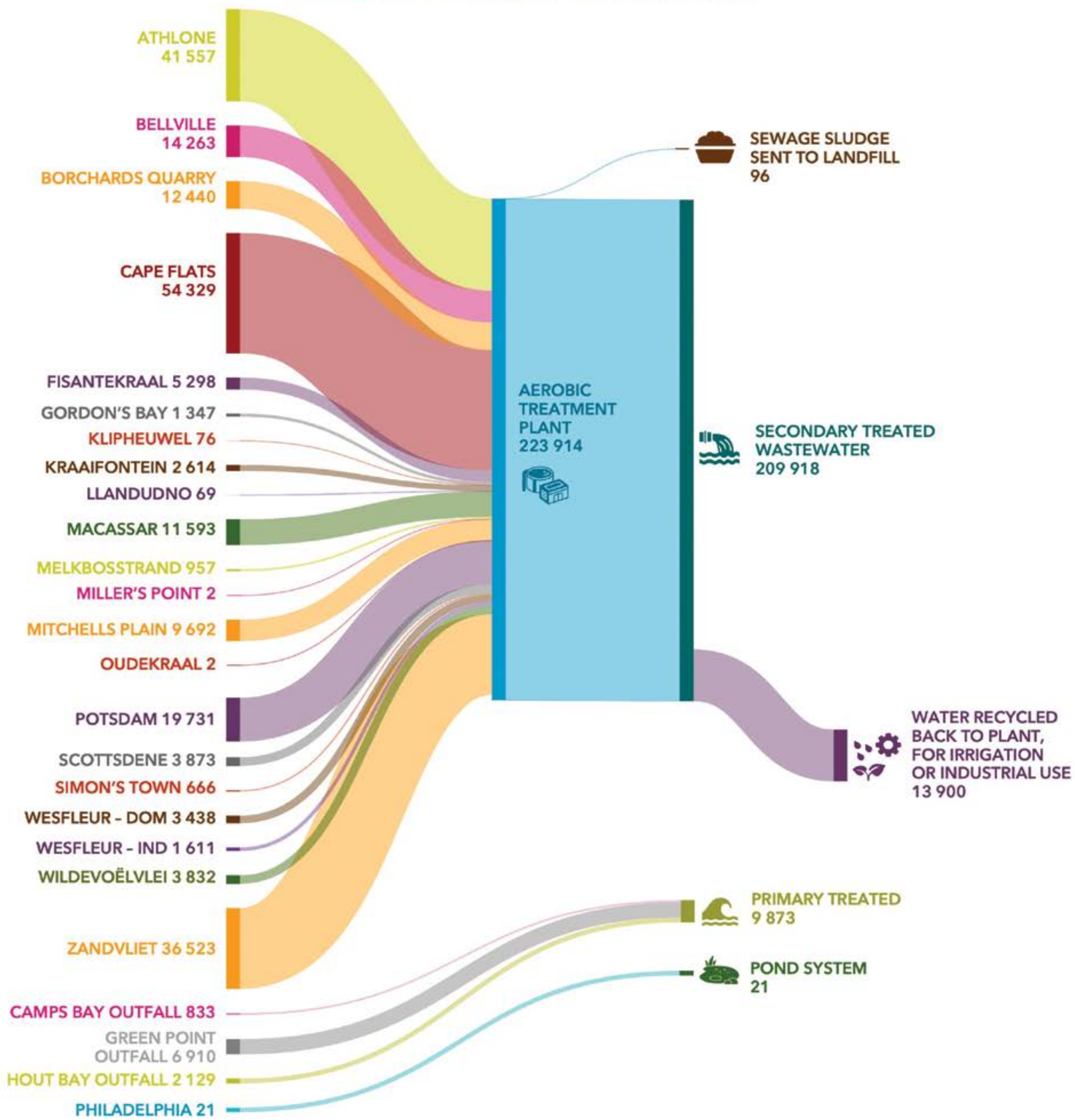
WASTEWATER EMISSIONS WERE
289 528
TONNES CO_2E IN 2023, ACCOUNTING FOR
1,2%
OF TOTAL BASIC+ EMISSIONS

131 **LITRES/CAPITA/DAY OF WASTEWATER WERE TREATED IN 2023** (INCLUDING INDUSTRIAL WASTEWATER)

WASTEWATER RETURN PATHWAYS (2023)



WASTEWATER TREATMENT IN CAPE TOWN, 2023 (ML)



Source: City of Cape Town (2025c)

3.3.2 The solid waste management system

The key system features and statistics of the solid waste system are summarised in Figure 95 below. The system headlines relevant to GHG emissions are as follows:

- In 2023, an estimated 2,6 million tonnes of waste were handled within the municipal boundaries, of which approximately 1,75 million tonnes were landfilled and 925 000 tonnes diverted (recycling, composting, recovery) by the City as well as private facilities.
- Most general waste (municipal solid waste) is disposed of at Coastal Park and Vissershok-City, the City's two remaining active landfill sites. Bellville landfill reached capacity in 2021.
- Other City waste infrastructure includes:
  - the Kraaifontein integrated waste management facility;
  - four Athlone refuse transfer stations;
  - the Bellville refuse transfer station;
  - the Swartklip refuse transfer station;
  - the Coastal Park materials recovery facility;
  - the Bellville compost plant; and
  - 29 community recycling facilities.
- Hazardous waste streams, including untreated medical waste, asbestos, industrial hazardous waste and sewage sludge, are sent to the private Vissershok landfill.
- Neighbouring municipalities such as Stellenbosch also make use of Cape Town's landfills.
- The City directly landfilled 1,18 million tonnes and actively diverted 576 000 tonnes, including builder's rubble, which is stored for future recycling.
- Private facilities handled the remaining 860 000 tonnes of waste, including hazardous waste, which is landfilled at the private Vissershok landfill, and 292 000 tonnes of plastic, metal and paper diverted at private recycling depots (data available post-2019 only).
- The waste generated in 2023 equates to a per capita waste generation rate of 1,19 kg/person/day for Cape Town. This may be compared to the following benchmarks:
  - South Africa: 0,98–2 kg/person/day for South Africa, and;
  - Sub-Saharan Africa: 0,46–0,90 kg/person/day;
  - Global high-income average: ~1,58 kg/person/day.
- Combined with a shortage of landfill space and the resulting long transfer distances, this causes high local collection and disposal costs.
- Coastal Park landfill is projected to reach capacity by 2027, unless diversion efforts accelerate.
- Therefore, reduction and diversion are both economic and environmental imperatives.

The waste sector is currently subject to ambitious national and provincial targets:

- The National Waste Management Strategy (NWMS) (2020) calls for the diversion of 40% of waste from landfill within five years, 55% within 10 years, and at least 70% within 15 years. The NWMS also aims to achieve zero waste to landfill beyond 2035. At the time of drafting this SOEC report, the DFFE had just released the draft National Waste Management Strategy (NWMS) 2026 for public comment. The key purpose of the 2026 draft is to align South Africa's waste sector with the sustainable development goals under Agenda 2030 as well as the National Development Plan Vision 2030, thereby supporting the transition towards zero waste to landfill, reduced pollution, and cleaner, well-managed communities.
- Province set a target of 50% diversion of organic waste from landfill by 2022, and seeks to ban organic waste from landfills by 2027. However, the City has concluded that this is not achievable (City of Cape Town, 2025f).

Response to challenges:

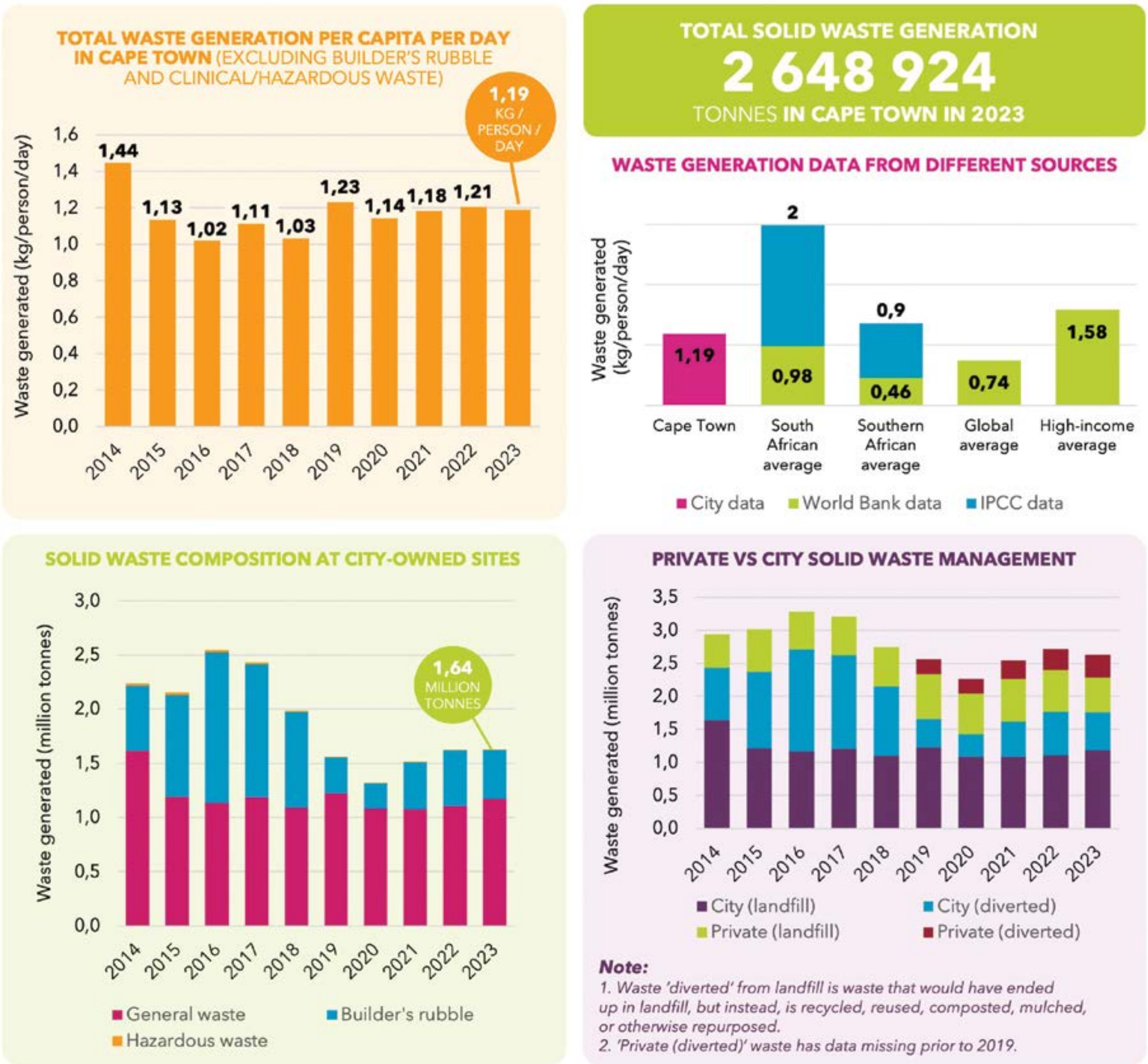
- Cape Town is working towards these goals through a combination of household recycling collection (the Think Twice programme),[31] which

[31] *Separation-at-source recycling programme that aims to increase recycling rates in Cape Town. The separated recyclables are collected by contracted third-party operators alongside general waste collection (**https://www.capetown.gov.za/Family%20and%20home/greener-living/recycling-at-home/recycling-services**).*

deploys private-sector contractors, an extensive network of community recycling centres, and targeted organic waste diversion initiatives.

- Builder's rubble volumes are variable because of construction cycles, affecting diversion target compliance. Nevertheless, the Cape Town system attained a 33% diversion rate in 2023, with waste diverted (excluding rubble) having more than doubled from 160 000 tonnes in 2014 to approximately 420 000 tonnes in 2023.

Figure 95: Solid waste generation and composition at City-owned sites, and private vs City solid waste management trends



Sources: City of Cape Town (2018, 2023a, 2025c); EnviroServ; SAWIC

3.4 Overview of emissions sources and trends

This section provides a cross-sectoral overview of GHG emissions caused by activities in Cape Town, with the GPC sectors examined in more detail in the subsequent sections. The key data headlines are as follows:

- Total GHG emissions were estimated at 23,4 $MtCO_2e$ for Cape Town in 2023 under the BASIC+ framework, which equates to approximately 6% of South Africa's total emissions (DFFE, 2024b).
- This total was attributed to the following reporting scopes:
  - Scope 1 (46%):
  - Arises from direct fuel combustion (e.g. diesel, petrol, jet fuel, fuel oil and coal) (2 $MtCO_2e$), methane emissions from landfilled solid waste and wastewater (2,6 $MtCO_2e$), as well as IPPU (1,0 $MtCO_2e$) and AFOLU activities (0,2 $MtCO_2e$).
  - Transport emissions from public transport, private vehicles and freight are the dominant source. Petrol and diesel used for transport account for 4,9 $MtCO_2e$. Externally induced scope 1 emissions excluded from the BASIC+ total are 11% (1,3 million tonnes of CO_2e) of total scope 1 emissions. This includes electricity generation (Eskom's Ankerlig and Acacia plants) and waste from neighbouring municipalities disposed of at private landfills within the city.
  - The territorial total (scope 1) allows multiple city inventories to be aggregated as a national or regional total.
  - In the case of Ankerlig, a peaking station, this dispatch reflects Eskom's operating decisions in response to national supply constraints, particularly during periods of acute load-shedding, when diesel-fired OCGTs are dispatched more frequently. This results in high year-to-year variability in the data, with peaks in 2015 and again from 2021 onwards as the national energy crisis deepened.
  - While the local petroleum refinery supplies an area well beyond the metropolitan boundary, the bulk of its production is consumed locally and its scope 1 emissions have been included as part of the BASIC+ framework.

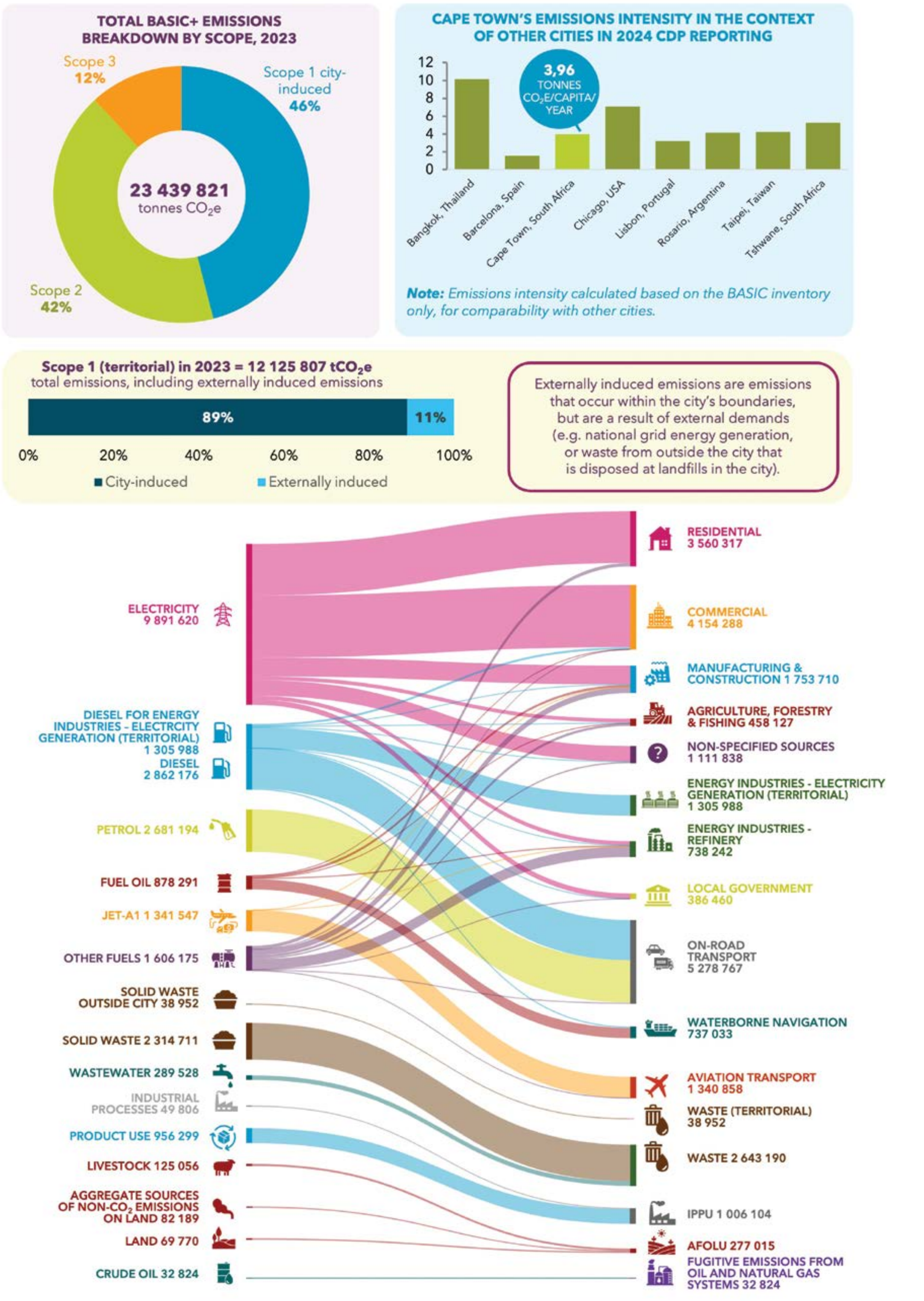
  - Scope 2 (42%):
  - These emissions arise from electricity use across sectors (9,9 $MtCO_2e$), and therefore, the major driver of emissions is the coal-intensive national grid.
  - The ongoing mitigation opportunities are reflected in the downward trend over the past decade because of grid decarbonisation, energy efficiency and SSEG uptake, but sharply increasing real prices likely also play a role. These trends are discussed in detail in section 2.4.

  - Scope 3 (12%):
  - This includes transmission/distribution losses and aviation, marine navigation and freight activities beyond city boundaries. Cape Town's strategic position, tourist economy and distance from other centres drive these emissions as significant contributors.
- Absolute GHG emissions have remained stable at 22–24 $MtCO_2e$/year over the past decade, with an expected Covid-19 dip in 2020 and a gradual rebound thereafter, but not to pre-pandemic levels.
- Per capita emissions have declined significantly from over 5 tonnes CO_2e/person in 2014 to around 4 tonnes CO_2e/person in 2023. This is driven both

by demographic shifts (informal urbanisation) and decreasing electricity intensity and carbon intensity of electricity.

- Per capita emissions are, as expected, lower than more-developed industrialised cities, given lower average incomes. Comparison with other South African cities mainly reflects Cape Town's tertiary economy rather than a necessarily lower carbon trajectory, as the current GHG inventory does not quantify the emissions embedded in imported goods supplied from much more carbon-intensive industrial cities in South Africa.
- Keeping global warming within a 1,5 °C pathway, in line with the extensive scientific consensus coordinated by the International Panel on Climate Change (IPCC), will require all economies to sharply reduce per capita emissions after 2030, approaching carbon neutrality in the 20 years thereafter, as reflected in South Africa's most recent national determined contribution and Cape Town's GHG emissions reduction goals.
- Cape Town's economy is also becoming progressively less carbon-intensive off the back of lower electricity intensity. Overall carbon emissions intensity per unit economic output dropped from 35 tonnes CO_2e/ZAR million GVA in 2014 to 30 tonnes CO_2e/ZAR million GVA in 2023, pointing to a positive trajectory for long-term competitiveness.
- Manufacturing has shown a downward trend in emissions intensity as a result of reduced coal and heavy fuel oil use. Relatively high-quality data sources (see section 2.4.6) for 2013 and 2023 confirm this as not solely a result of closures of heavier industries seen nationally, although detailed firm-level data and analysis remain a gap.
- Transport emissions intensity per unit economic output of the sector is considerably higher than other sectors, and was increasing steadily before Covid-19. While there has been the expected rebound, the trend is still unclear. Sectoral details and mitigation opportunities are discussed in more detail in section 3.6 below.

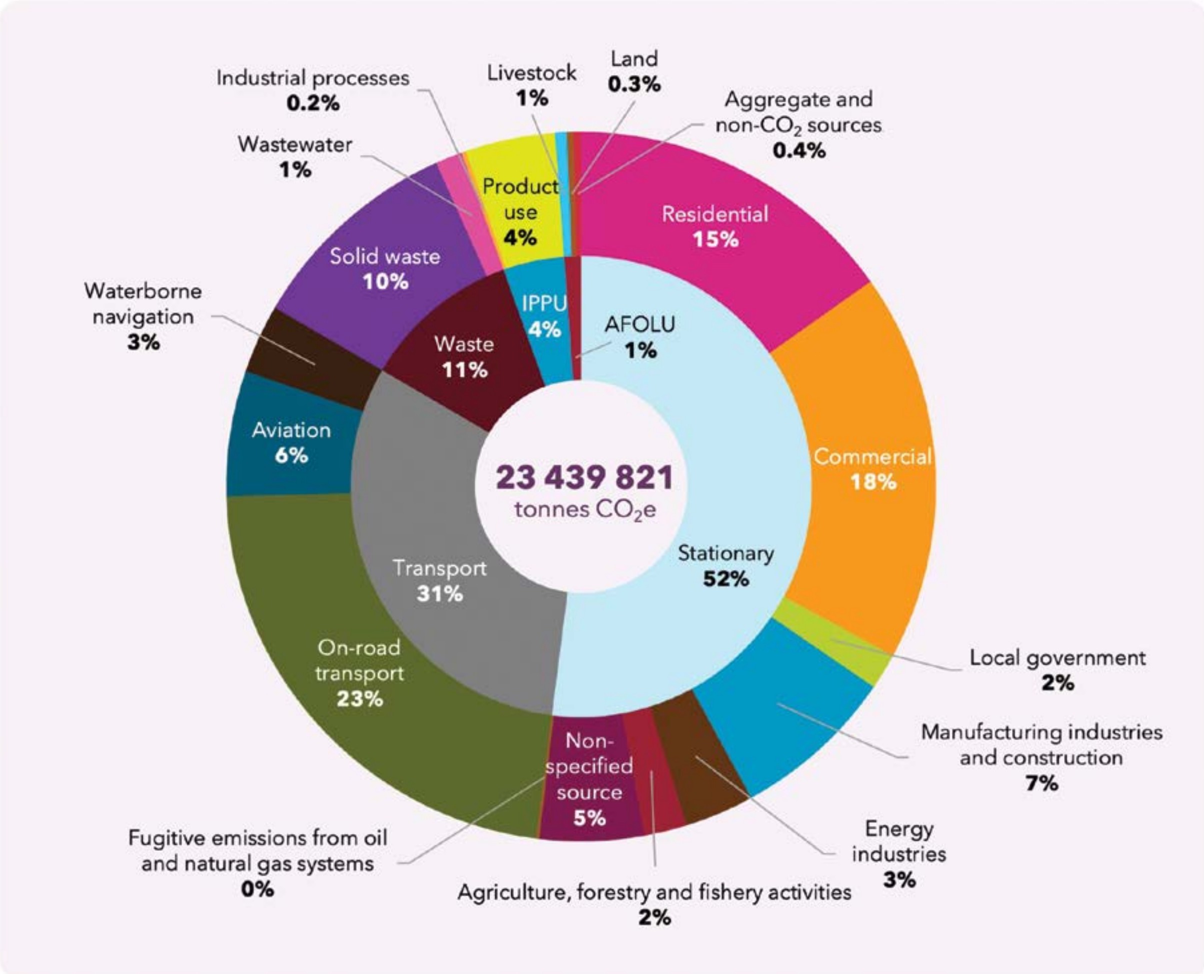
Figure 96: Cape Town's overall GHG emissions, 2023



Note: Scope 1, 2 and 3 territorial total includes electricity generation dispatched by the national grid system operator, as well as solid and biological waste generated outside the city's boundaries.

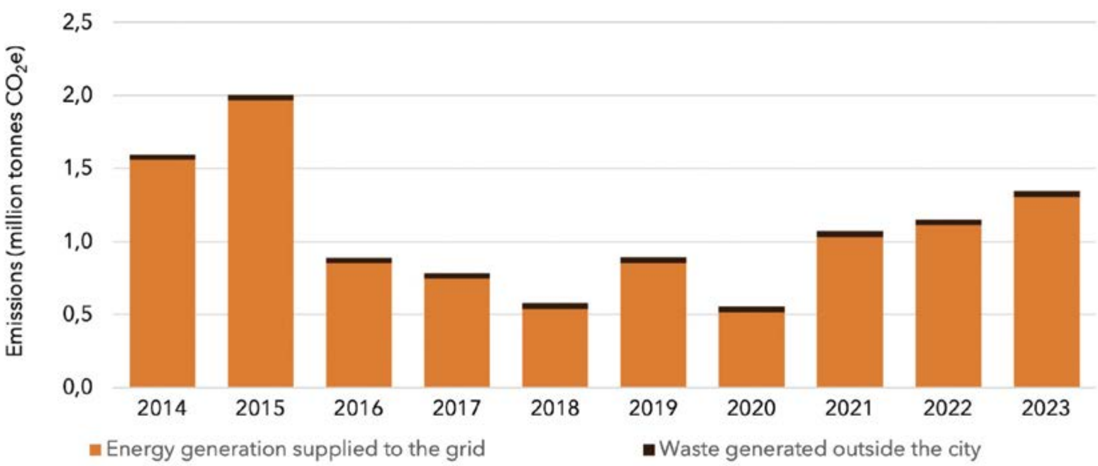
Sources: ACSA (2025); City of Cape Town (2025c); DFFE (2018, 2020, 2022, n.d); DEE (2023); Eskom (2025a); LEAP model; NASA EarthData (2025); SARS (2025a); SAWIC; Stats SA (2024, 2025a); Transnet (2025); WCG (2025b)

Figure 97: Cape Town's total BASIC+ emissions breakdown by sector and subsector, 2023



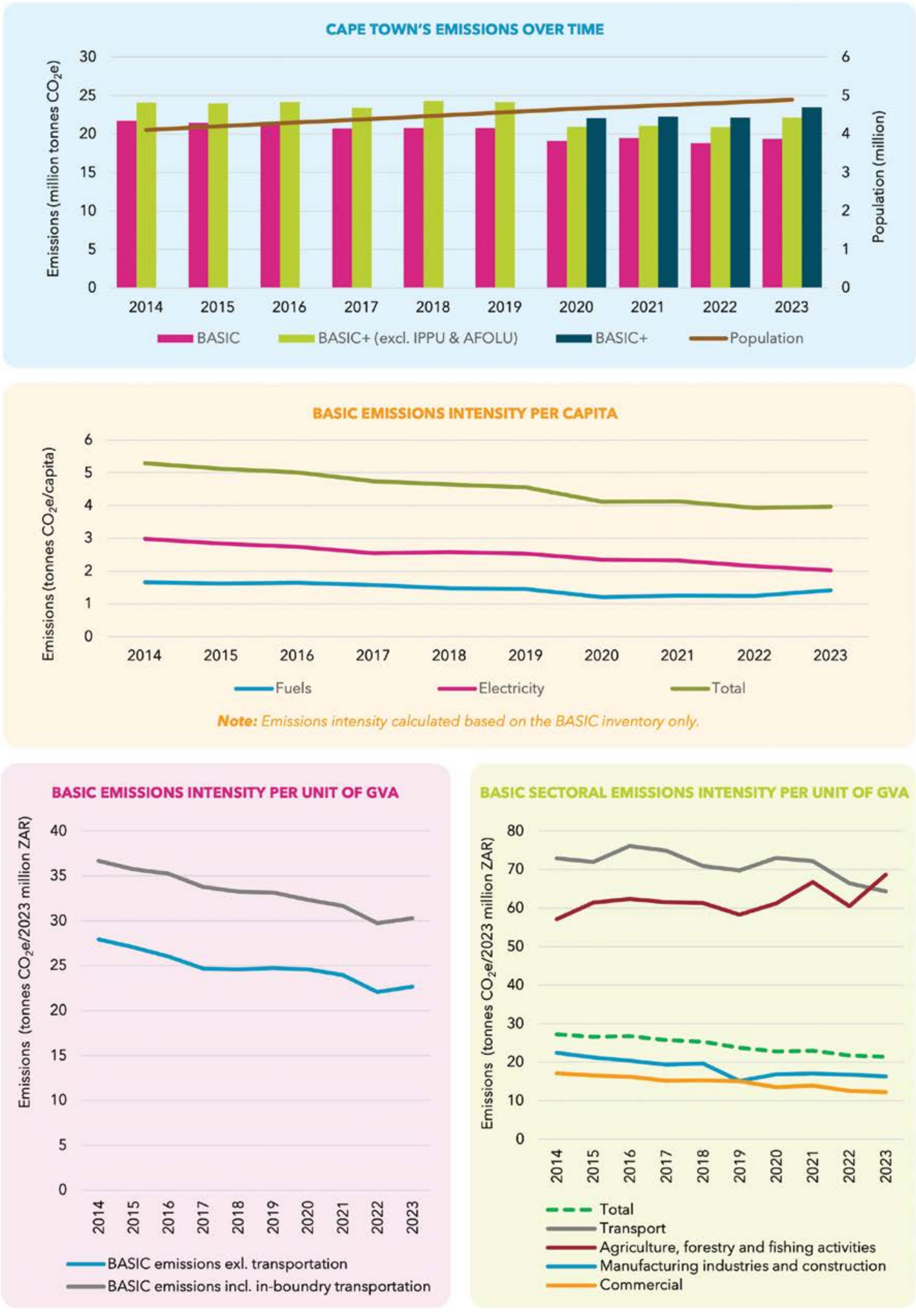
Sources: ACSA (2025); City of Cape Town (2018, 2023a, 2023c, 2025c); DEE (2023); Eskom (2025a); LEAP model; Stats SA (2024, 202 a); Transne (2025); FAO (2024); EnviroServ; SAWIC ; DEA (2016); DFFE (2018, 2020 & 2022, n.d); NASA EarthData (2025); WCG (2025b); SARS (2025a)

Figure 98: Sources required for territorial (scope 1) total, but not for BASIC and BASIC+ reporting



Sources: Eskom (2025a); SAWIC (2025)

Figure 99: Cape Town emissions trends over time, 2014–2023



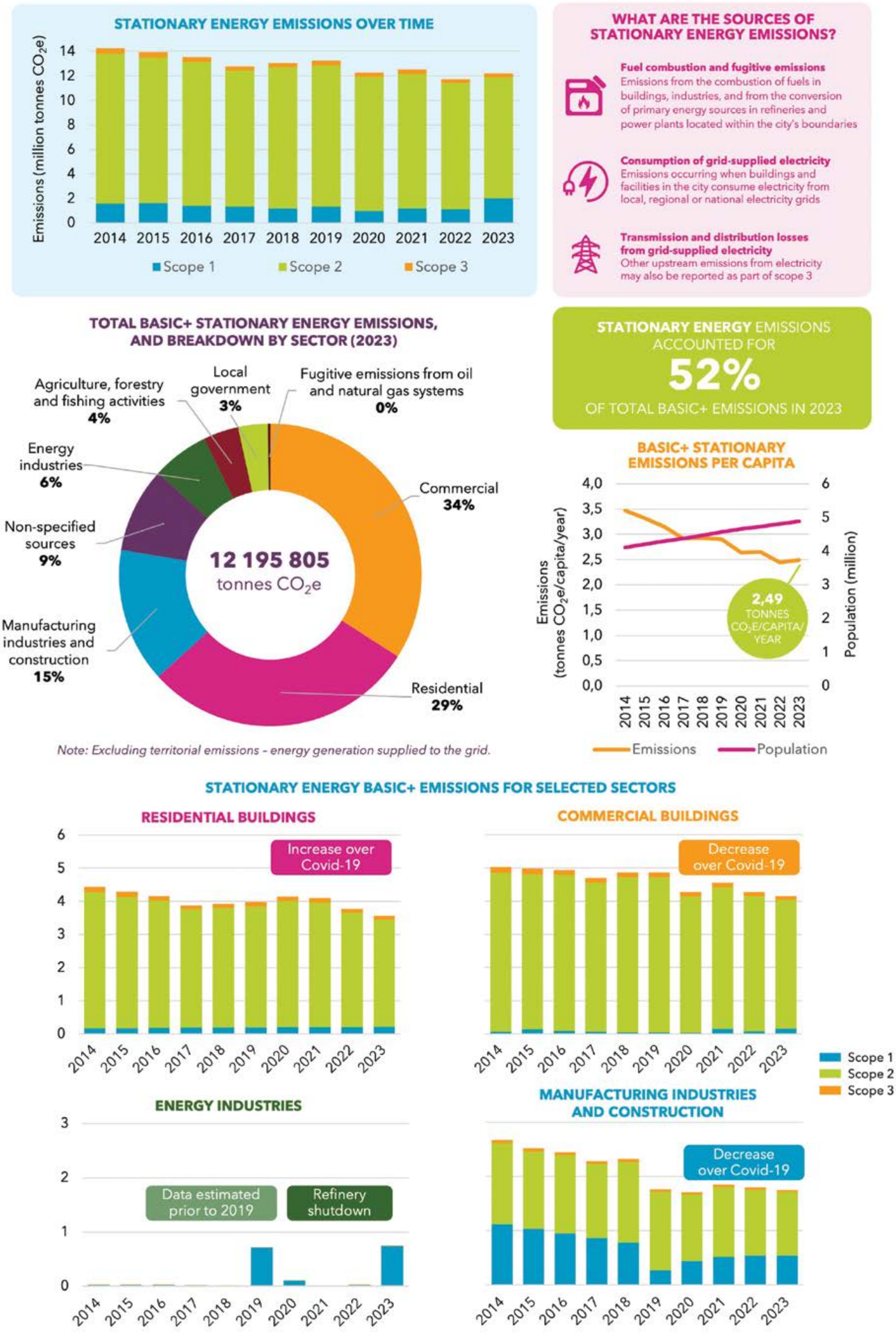
Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); LEAP model; NASA EarthData (2025); DFFE (n.d); SARS (2025a); SAWIC; Stats SA (2024, 2025b); Transnet (2025); WCG (2025b)

3.5 Stationary energy emissions

The components of the stationary energy system are described in more detail in sections 2.4.1 (sector electricity consumption) and 2.5.1 (stationary fuel use). Trends in stationary energy emissions arising from these systems are broken down by source in Figure 100 below. The following are the key data headlines:

- Stationary energy emissions are the largest contributor, accounting for 52% of Cape Town's total BASIC+ emissions in 2023, and having remained around 12–13 MtCO_2e with some subsector variations since 2016.
- Grid electricity demand is the dominant source, and therefore, emissions are strongly linked to South Africa's coal-based national grid.
- Per capita emissions declined from >3 tCO_2e/person in 2014 to 2,49 tCO_2e/person in 2023. A combination of several drivers can be assumed, including efficiency gains; distributed generation; a growing share of zero-carbon grid electricity; demographic shifts, with the share of informality in the city growing; and reduced demand due to electricity price increases well in excess of inflation, combined with weak economic growth.
- Covid-19 (2020–2021) and the local refinery shutdown (2020–2022) resulted in sector fluctuations over the past decade, but the three demand sectors show a similar long-term decline in emissions, which can be expected to continue as electricity supply decarbonises.
- Extreme load-shedding in 2022–2023 suppressed electricity demand and reduced emissions, with a possible rebound after Covid-19, but a large increase in scope 1 emissions from diesel-fuelled self-generation is evident by 2023.

Figure 100: Overview of BASIC+ stationary emissions



Sources: ACSA (2025); City of Cape Town (2023a, 2025c); DEE (2023); Eskom (2025a); LEAP model; DFFE (n.d); (2025); Stats SA (2024, 2025a)

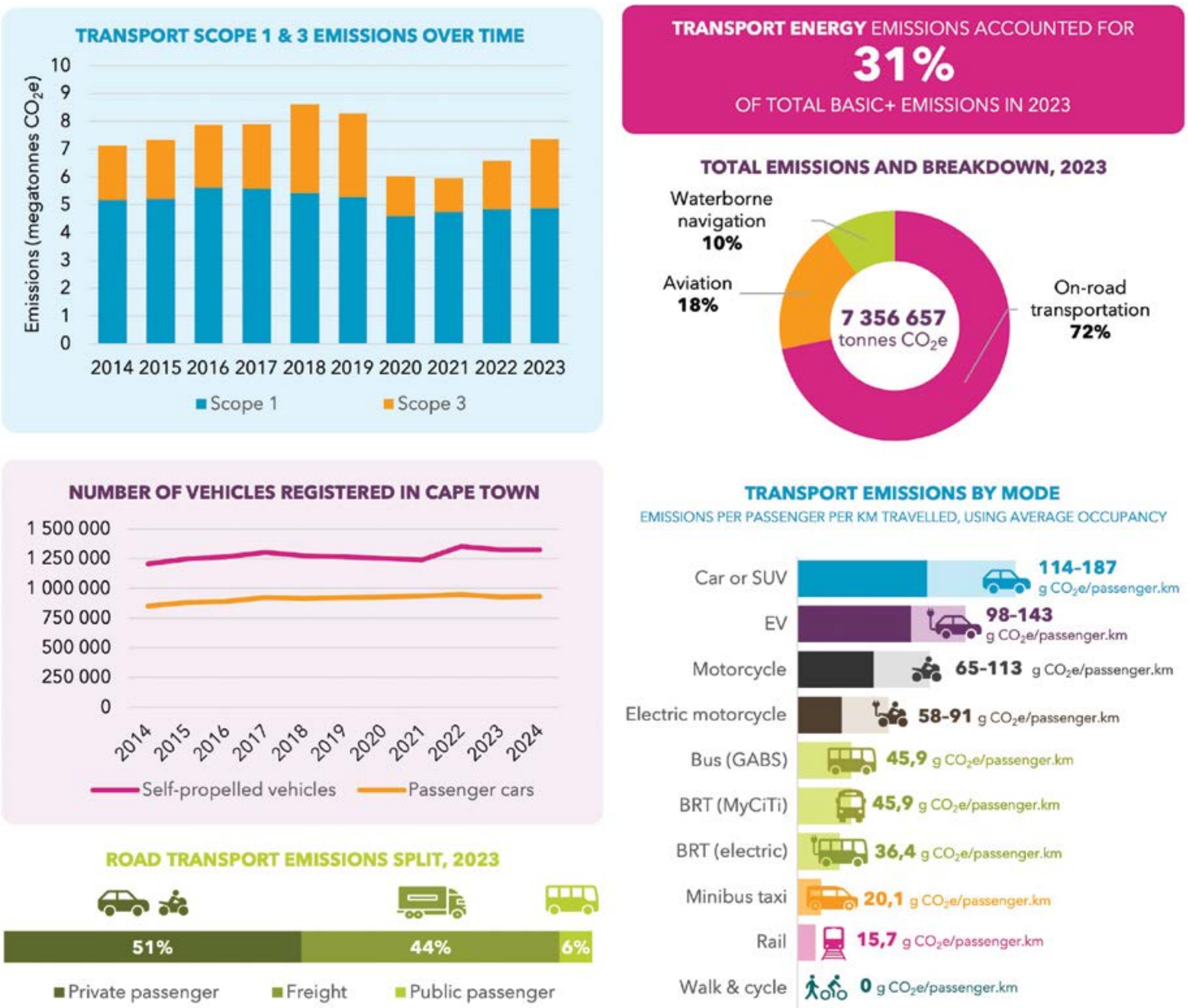
3.6 Transportation emissions

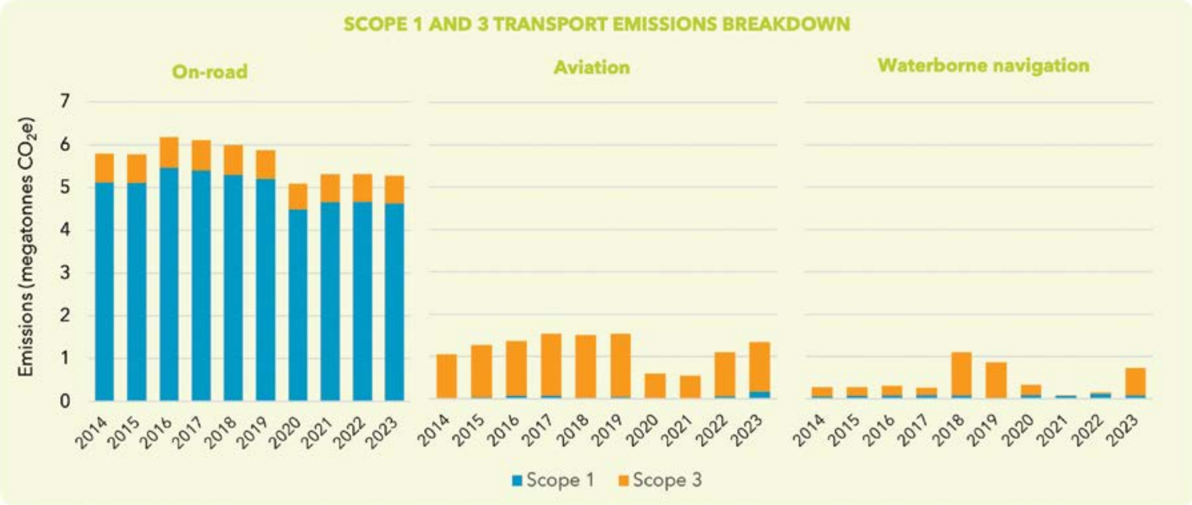
The transport energy system is described in more detail in sections 2.5.1.2.1 and 2.5.3.4, while trends in EV uptake are discussed in section 2.5.4.1. Three subsectors, all significant for Cape Town, have been identified as 'hard-to-abate' large contributors to global GHG emissions, namely road freight, aviation and shipping (IRENA, 2024). Trends in transport emissions are broken down by source in Figure 101 below. The following are the key data headlines:

- Transportation was estimated to account for 31% of Cape Town's BASIC+ emissions in 2023, and remains the single highest emitting sector, having accounted for 7–9 $MtCO_2e$ per annum over the past decade.
- The sector depends heavily on liquid fossil fuels (diesel, petrol, jet fuel and fuel oil) for passenger and freight mobility.
- On-road transport was estimated to account for around 72% of transport emissions in 2023.
  - A total of 57% of on-road transport emissions arise from public and private passenger vehicles, (90% of which are from private passenger vehicles).
  - Around 44% of on-road transport emissions arise from freight, comprising heavy-duty diesel trucks, particularly inter-city long-haul trips, and petrol and diesel light delivery vehicles, with the share of the latter having grown markedly over the past ten years.
- Aviation was estimated at 18% (Cape Town International Airport) and waterborne navigation as 10% (shipping and port activities) of transport emissions in 2023.
- The Covid-19 lockdown (2020–2021) induced a large drop in overall transport emissions after a trend of steady growth. While aviation continues to rebound, road transport emissions appear to have levelled out at a lower point. Load-shedding and quality effects on the data make this uncertain.
- Transport activity and liquid fuel distribution are complex to track, and diesel use for energy is highly variable. Therefore, the activity data and analysis requirements for emissions sector and scope attribution are high. Scope attribution was as follows:
  - **Scope 1:** Trips entirely within city boundaries
  - **Scope 2:** Currently very small due to low rail share; data currently unavailable from both rail utilities
  - **Scope 3:** Transboundary trips (road, sea, air). Accounting convention attributes a 50% share of scope 3 emissions to Cape Town's inventory, and the remainder to the corresponding origin or destination. Google EIE utilises a sample of Android phone-user tracking data to estimate road trips within a city and across a city's boundaries, thereby allowing estimation of scope 1 and 3 emissions for a city (Google EIE, n.d). The challenge is to split these into road freight and passenger trips, which can have an order-of-magnitude difference in emissions intensity.
- As presented earlier in Figure 60, private car ownership in Cape Town is typical of a middle-income developing country, and is not high by global standards. Most trips to work, however, are made in private passenger cars, which account for 90% of passenger transport emissions because of their high emissions intensity.
- However, public transport, particularly if electrified, offers mitigation opportunities. The average occupancy of a vehicle as well as its efficiency and fuel carbon content drive emissions. The emissions intensities of passenger transport modes, therefore, differ markedly and will diverge further as the electric grid emission factor drops:
  - Private cars: >114 gCO_2/passenger-km (low occupancy)
  - Minibus taxis (14 passengers): 20 gCO_2/passenger-km
  - Commuter buses/BRT (25 passengers): 36 gCO_2/passenger-km (electric) to 46 gCO_2/passenger-km (fossil)
  - Rail: 16 gCO_2/passenger-km

- While densification has been a longstanding policy priority in Cape Town, and is bearing fruit, a sprawling, segregated urban form that results in long commutes remains a driver of cost, productivity losses and emissions.
- The City's Phase 2A bus rapid transit (BRT) expansion is under way. This will serve over 30 communities along one of Cape Town's busiest transport corridors from Khayelitsha and Mitchells Plain to Wynberg and Claremont. These interventions aim to address long-standing inequalities in mobility access, but will also reduce GHG emissions.

Figure 101: Overview of Cape Town's transport emissions





Note: Emissions from off-road transport, such as agricultural tractors and construction equipment, are included in other sectors where the equipment is used.

Sources: ACSA (2025); City of Cape Town (2025c); DEE (2023); Eskom (2025a); NaTIS; Transnet (2025)

3.7 Waste (solid waste and wastewater treatment) emissions

The activities and systems of the waste sector are described in section 3.3. Providing these essential services generates both direct and indirect emissions. Direct emissions arise primarily from methane released at landfill sites, and nitrous oxide emitted by wastewater treatment processes. Indirect emissions, which fall under the stationary energy category discussed in section 4, stem from the electricity required for pumping, treatment and operational processes. According to the GPC methodology, waste and wastewater direct emissions are classified as a BASIC category in urban GHG inventories. International benchmarks indicate that this sector contributes around 10% of BASIC emissions across C40 cities, and about 15% in African cities. Cape Town's contribution of 13% places it between these averages, underscoring both the scale of the challenge and the opportunity for mitigation.

3.7.1 Emissions from wastewater treatment

Wastewater is a source of both methane, generated from the anaerobic degradation of organic matter, and nitrous oxide, generated from the degradation of nitrogen-based compounds also favoured by conditions where oxygen is limited. Treated effluent is primarily released into waterways or directly into the marine environment, where methane generation can occur if the environments are carbon and/or methane-saturated, although this is limited by the removal of organic material as sludge and the aerobic treatment process. The wastewater system is described above in section 3.3.1. Trends in wastewater emissions are broken down by source in Figure 102 below. The following are the key data headlines:

- Direct GHG emissions from treatment processes are currently a small share of the total, estimated at 289 528 tCO_2e, which is equivalent to 1,2% of the city's total BASIC+ emissions in 2023.
- Emissions from over 112 GWh of plant electricity consumption accounted for a further 103 $ktCO_2e$ reported in the stationary energy sector.

- An estimated 4,6% of residents are not served by City sewerage systems, with 1,6% served by chemical/ecological toilets, 1% by septic tanks, and 2% without improved sanitation (pit latrines, bucket toilets, open defecation). Together, these are estimated to account for approximately 6% of wastewater emissions.
- Biological oxygen demand (BOD) and chemical oxygen demand (COD) are related water quality indicators used by utilities to monitor treatment effectiveness. COD can be measured by online instruments, and the City monitors inlet and outlet COD concentrations weekly and wastewater treatment input flowrates daily. Input conditions are highly variable and seasonal (e.g. Zandvliet WWTP's measured input COD concentrations in 2023 varied between 347 mg/ℓ and 2 139 mg/ℓ).
- With such variable input conditions, modelling methane emissions is very challenging. Direct measurement, in turn, is technically demanding and requires specialist instruments either to aggregate the emissions of each process or work back to mass from the concentration of the plume emanating from the plant as a whole. Therefore, standard inventory estimation methodologies have been necessarily quite simplistic, and have been found to typically underestimate emissions (Xinyue He, 2025).
- The IPCC has extensively updated the wastewater calculation methodologies and emission factors in their 2019 guidelines refinement (IPCC, 2019). Significant changes that have affected the emissions estimates that the City published previously include the following:
  - Aerobic WWTPs are no longer broken down into a subjective assessment of 'well-managed' (non-emitting) or 'overloaded' (emitting) classes, and all plants are now assumed to emit some methane.
  - Emissions from treated wastewater effluent released into natural environments from WWTPs are now considered.
- Due to the inherent uncertainty and variability in wastewater treatment processes, the IPCC guidelines stipulate that unless methane emissions are directly monitored at plants, estimated WWTP emissions should be calculated assuming a total nutrient load based on an assumed per capita BOD generation rate (African default value: 37 g BOD/capita/day, equivalent to 89 g COD/capita/day).
- This results in emissions estimates from wastewater treatment in Cape Town that closely track population growth, with the city's population having increased from 4 million people in 2014 to almost 5 million people in 2023 (Figure 102 below).

Figure 102: Wastewater volumes, treatment pathways and emissions

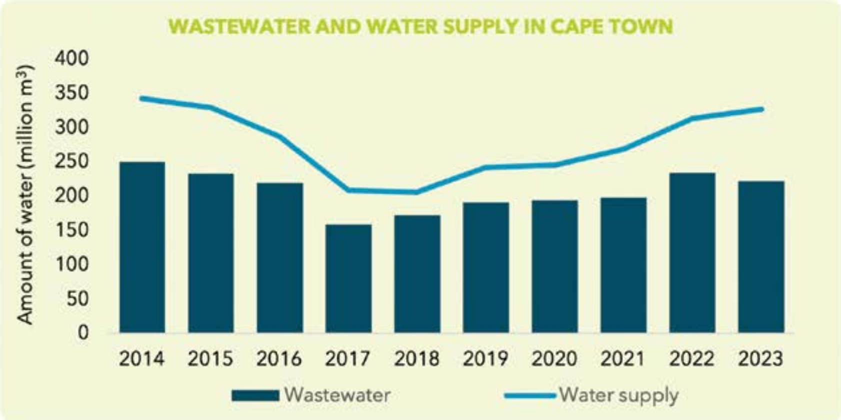
HOW IS WASTEWATER TREATMENT TYPICALLY MEASURED?

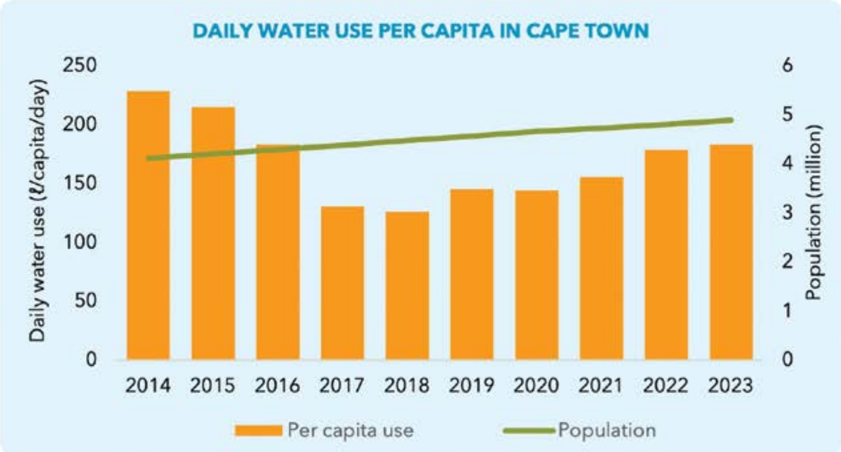
Chemical oxygen demand (COD) measures the total material available for chemical oxidation.

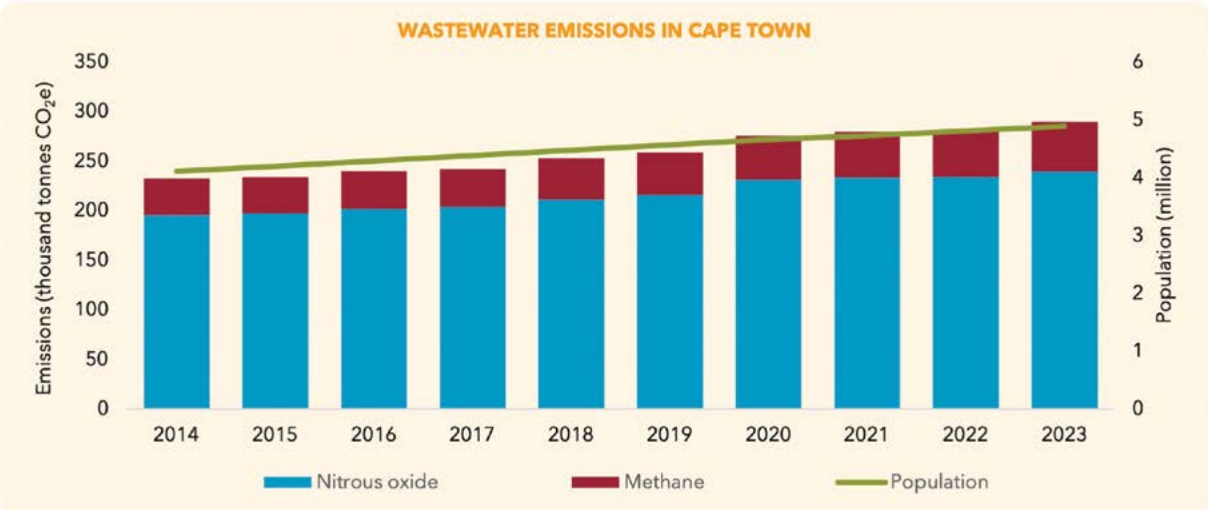
Biochemical or biological oxygen demand (BOD) concentration indicates only the amount of carbon that is aerobically (i.e. naturally) biodegradable.

Both are used as a measure of wastewater contamination, as they indicate the amount of oxygen required to degrade wastewater contaminants. In nature, this oxygen demand strips oxygen from the aquatic environment, thus harming aquatic ecosystems.

The ratio between BOD and COD depends on whether contaminants are readily degradable by micro-organisms; however, in sewerage systems, the average ratio is 0,42 kg BOD/kg COD.







Sources: City of Cape Town (2023a, 2023c, 2025c); FAO (2024)

3.7.2 Emissions from solid waste

Solid waste gives rise to GHG emissions primarily through methane released from decomposing organic matter in landfills. This process is multi-decadal, as the waste passes through a number of biochemical phases (IPCC, 2000b). Landfill emissions can be calculated using two methods:

- The methane commitment (MC) approach, which attributes all the methane likely to be emitted from the decomposition of waste over time to the year of commitment only
- The first-order decay (FOD) model, which "produces a time-dependent emissions profile that better reflects the true pattern of the degradation process over time" (IPCC, 2000a). This is the method required for the national reporting of scheduled emitters (DFFE, 2020).

In previous citywide inventories, the MC method was used. However, as the GPC states: "For most cities, the MC method will consistently overstate GHG emissions by assuming that all decomposable organic waste disposed in a given year will decay and produce methane immediately." Therefore, the GPC, IPCC and DFFE all prefer the FOD approach. However, the FOD method requires historical waste data going back at least 50 years.

For this inventory, historical landfill data was sourced from 1960 to the present for the operational landfills Coastal Park and Vissershok-City as well as the closed sites at Bellville, Brackenfell, Faure, Swartklip and Waterkloof. Data for the private Vissershok landfill, which opened in 1974, was not available, so average data was used for years prior to 2012, which likely results in an overestimate for this site.

Other methodological updates for Cape Town's inventory include the following:

- Inclusion of composting and anaerobic digestion emissions, which were calculated using 2019 IPCC refinement default values for methane and nitrous-oxide emissions per tonne of waste treated
- Calculating incineration and open burning emissions based on the tonnes of waste per waste type, assuming IPCC 2019 default values for physical waste characteristics
- Updated global warming potentials from the IPCC 6th Assessment Report

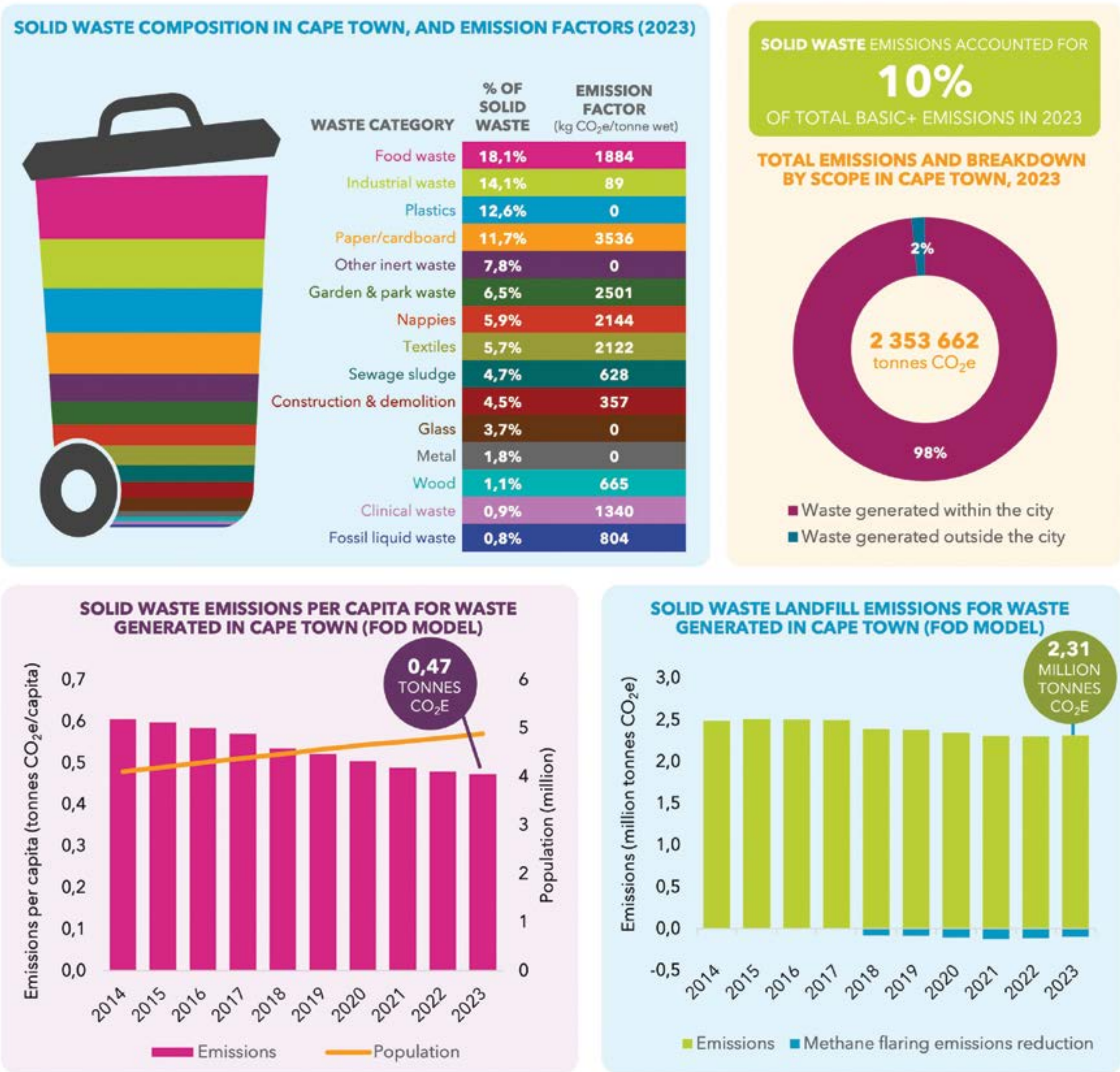
The solid waste disposal system in Cape Town that gives rise to emissions is described in section 3.3.2. The following are the key data headlines:

- Together, the methodology changes resulted in an overall increase in emissions compared to values reported in previous years.
- Solid waste GHG emissions for Cape Town in 2023 were estimated to be 2,35 million tonnes CO_2e under scope 1, of which 98% was attributable to waste generated within the city and reported under the BASIC+ total, with emissions from imported waste making up the remainder (territorial emissions, reported separately).
- Therefore, GHG emissions from solid waste are around 10% of total BASIC+ emissions.
- The methodology updates better reflect the downward trend in emissions estimates over time, with total emissions falling from just under 2,5 million tonnes CO_2e in 2014 to 2,3 million tonnes in 2023 – a decline of around 7%.
- Per capita emissions over this period declined by 22% to 0,47 tonnes CO_2e per person per year. Although this trend is somewhat higher in absolute terms than the European Union average of 0,19 tonnes CO_2e per person per year, it mirrors the substantial reductions in per capita emissions from landfilled waste seen in developed countries over the past 30 years (Hanwen Guo, 2022).
- The reduction is attributable to improved waste diversion practices, particularly garden waste composting, private-sector recycling, and flaring. Annual methane destroyed through flaring at Coastal Park since operations commenced in 2018 is estimated to have been in the range of 18–31% of methane generated. Smaller shares have been flared at Bellville landfill since 2020 and Vissershok landfill since 2024, with an

estimated 5–7% share of total methane destroyed for all landfills. This points to considerable potential for further reductions.

- Landfill gas is mostly methane (CH_4), which is a 27-times more potent GHG than CO_2. Flaring involves simply combusting the landfill gas in the burner of the flaring system, converting the carbon in the methane to CO_2, and thereby substantially reducing the global warming impact of the landfill gas.
- Coastal Park's landfill methane recovery system now fuels a waste-to-energy plant generating 1,3 GWh/month. This energy is mostly exported to help substitute the carbon-intensive grid (Venter, 2025a), which reduces net emissions more than flaring.
- Solid waste composition is a key driver of GHG emissions. In 2023, food waste made up the largest single category, at 18,1% of total waste, with an associated emission factor of 1 884 kg CO_2e per tonne. Other high-impact categories include paper and cardboard (11,7%), garden and park waste (6,5%), and nappies and sanitary products (5,9%), all of which generate significant methane when landfilled. By contrast, glass, demolition waste, metal and electronic waste together made up a tenth of waste volumes, but since they are inert, have little or no associated landfill emissions.

Figure 103: Cape Town's solid waste composition and emissions trends



Note: Emissions resulting from the transport of waste to landfill are not calculated as part of this analysis.

Sources: City of Cape Town (2018, 2023a, 2025c); EnviroServ; SAWIC

3.8 Agriculture, forestry and other land use (AFOLU)

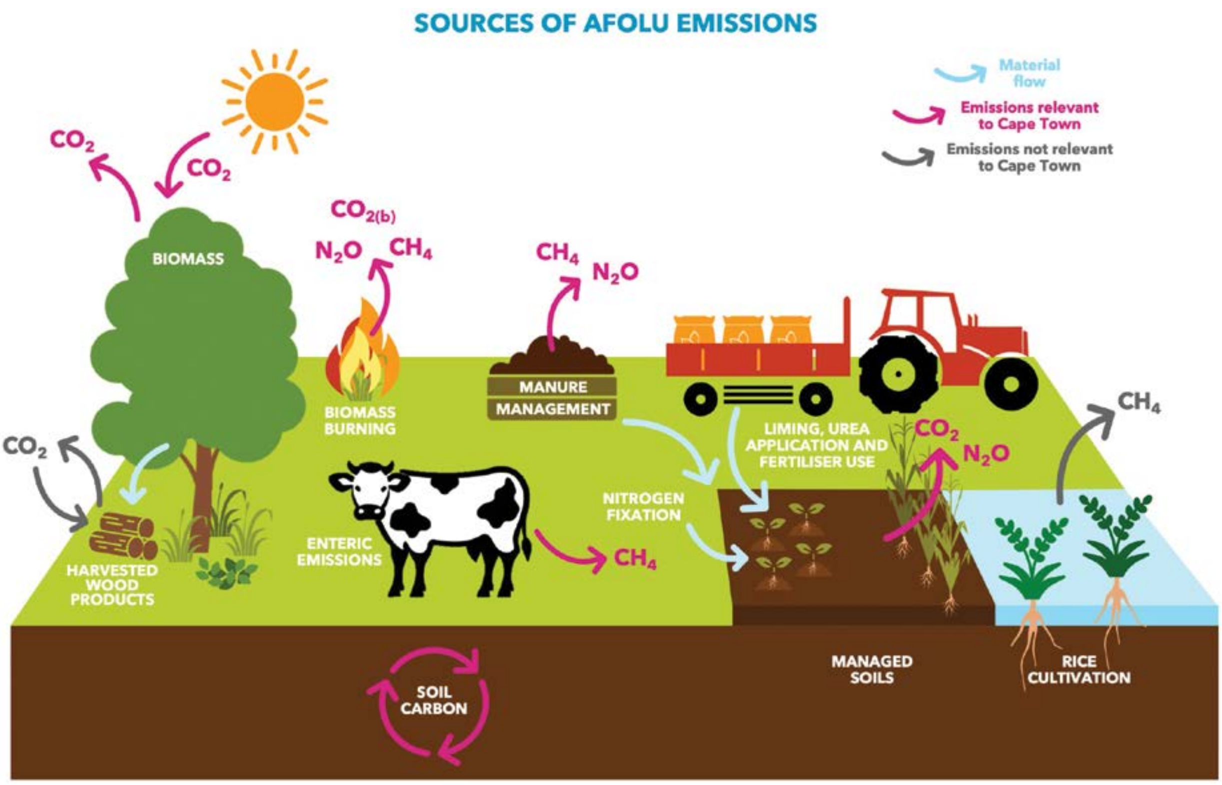
AFOLU emissions form part of the BASIC+ reporting level under the GPC. These emissions arise from the following United Nations Framework Convention on Climate Change (UNFCCC) reporting categories:

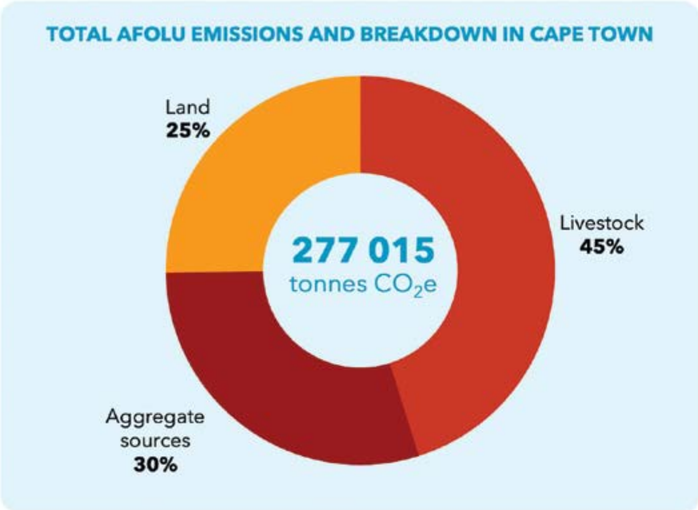
- **Livestock production** – through enteric fermentation and manure management
- **Land use and changes in land use** – such as the clearing of natural vegetation for residential expansion and limited agriculture
- **Aggregate sources and non-CO_2 emissions on land** – notably field burning and fertiliser application

This report marks the first time that AFOLU emissions have been systematically collected, analysed and reported at the city scale for Cape Town. AFOLU is recognised internationally as one of the most complex sectors to quantify, with challenges relating to data availability, scale, and variability of practices. While acknowledging the inherent limitations and uncertainties of city-level AFOLU accounting, reporting at this level reflects the City's commitment to governance, completeness and alignment with international best practice. Additionally, land, ecosystems and agricultural activities are under pressure given high population growth, and play an important part in the carbon system and climate resilience within the municipal boundaries.

In 2023, AFOLU emissions were estimated to have contributed 277 015 tonnes CO_2e, equivalent to 1,2% of Cape Town's total BASIC+ emissions. The breakdown of sources shows that livestock accounts for 45% of AFOLU emissions, followed by aggregate sources (30%) and land (land use and changes in land use) (25%). While small relative to energy and transport emissions, AFOLU provides important insights into the intersection of urbanisation, land management and climate change, and establishes a baseline against which future changes and interventions can be tracked.

Figure 104: Overview of sources of AFOLU emissions for Cape Town, 2023





AFOLU EMISSIONS ACCOUNTED FOR
1,2%
OF TOTAL BASIC+ EMISSIONS IN 2023

CAPE TOWN'S AFOLU EMISSIONS IN 2023 WERE **13% OF THE WESTERN CAPE'S** AFOLU EMISSIONS (2018) AND **3% OF NATIONAL** AFOLU EMISSIONS (2022)

Sources: DEA (2016); DFFE (2018, 2020 & 2022); NASA EarthData (2025); Stats SA (2024); WCG (2025b)

3.8.1 Livestock

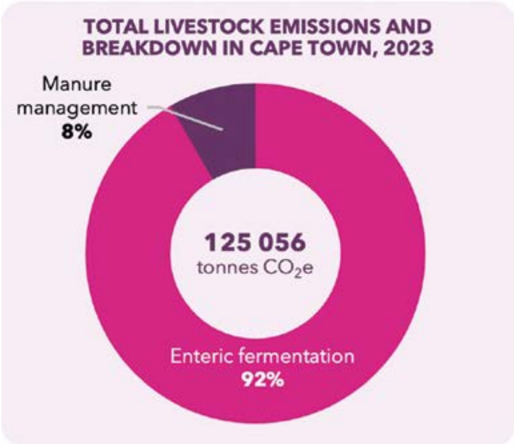
While livestock farming does occur within the municipal boundaries, it is limited in scale, with around 670 000 head of livestock, mostly poultry. This is a fraction of the 23 million head in the Western Cape, and the 200 million nationally. As a result, Cape Town's estimated livestock emissions for 2022 of 125 056 tonnes of CO_2e account for just 5% of the Western Cape total (WCG, 2022) and are negligible at the national scale (DEA, 2016).

According to the 2022 Census of Agricultural Households (Stats SA, 2022), poultry makes up the largest share of livestock in the city, with close to half a million birds, while heads of cattle, goats, sheep and swine total 170 000. These animals are mostly concentrated in commercial farming enterprises, with a few also kept by smaller agricultural households. Of the 17 861 agricultural households recorded in 2022, almost 12% reported involvement in livestock or poultry production, underlining its role in both livelihoods and local food systems.

GHG emissions were calculated using the IPCC 2019 refinement to the 2006 guidelines, applying South African-specific values for herd structures, feed intake, and other parameters where available. As livestock numbers are reported only periodically, 2022 figures were used for 2023.

The majority of livestock-related emissions arise from enteric fermentation – a natural digestive process in ruminant animals such as cattle, sheep and goats that produces methane as a by-product. Emissions rates are particularly high for beef cattle. In Cape Town, enteric fermentation accounts for 92% of total livestock emissions, with the remainder (8%) linked to manure management practices.

Figure 105: Number of livestock and livestock emissions (2022 data reported for 2023)



LIVESTOCK EMISSION FACTORS

LIVESTOCK TYPE	ENTERIC FERMENTATION	MANURE MANAGEMENT	
	kg CH_4/head/year	kg CH_4/head/year	kg N_2O/head/year
Broiler chicken	-	0,02	0,01
Laying chicken	-	0,02	0,02
Sheep	7,5	0,1	0,01
Beef cattle	54,9	0,7	0,18
Swine	1,4	8,9	0,09
Goat	4,4	0,1	0,02

Source: Stats SA (2024)

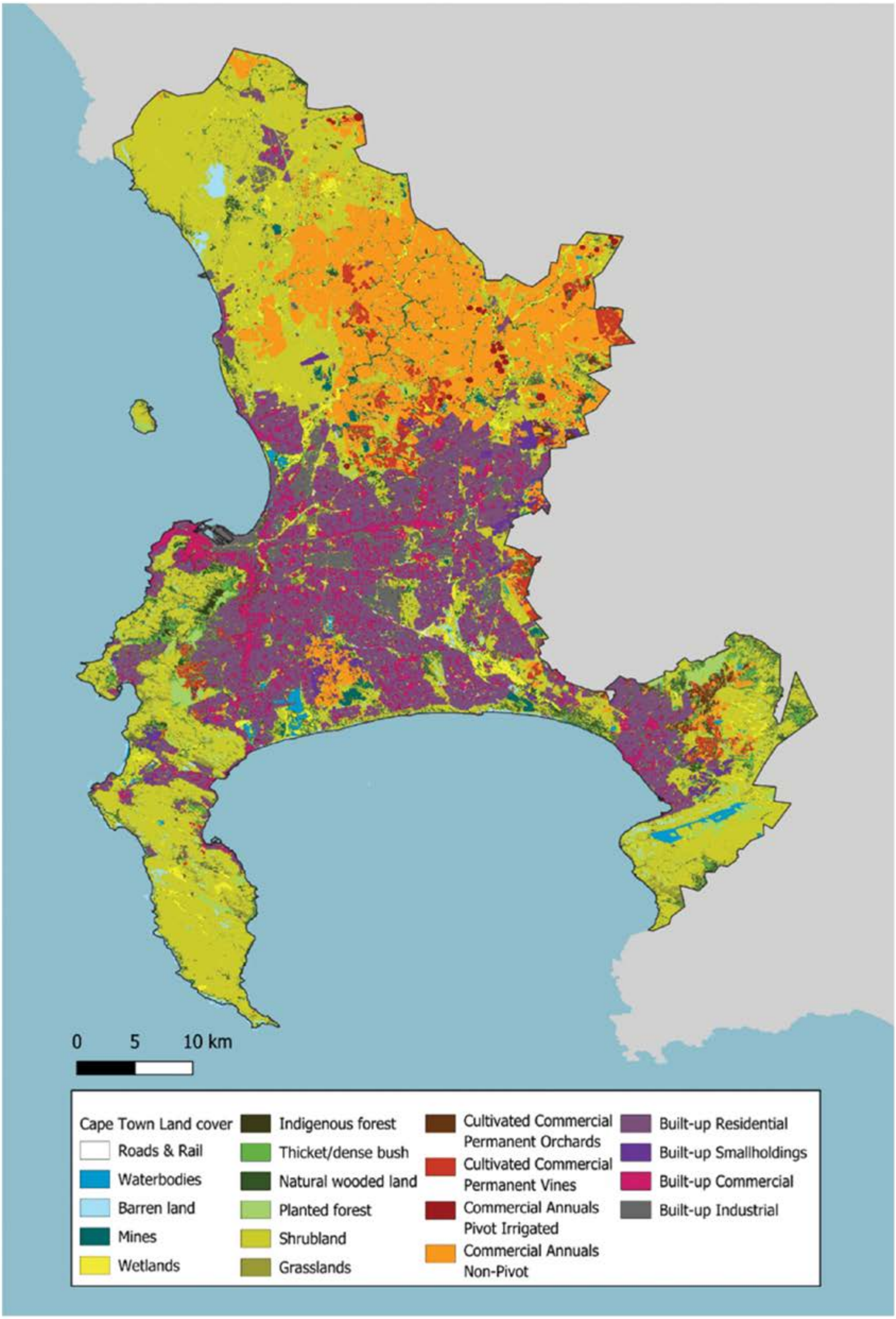
3.8.2 Land use and changes in land use

The 25% of AFOLU emissions associated with land use change are primarily linked to the clearance of natural vegetation for urban development. While forest land in Cape Town, including small stands of natural forest land in conservation areas and remaining plantation stands (primarily pine plantations), does continue to sequester carbon, these carbon removals are outweighed by the emissions associated with settlement expansion. By contrast, the Western Cape as a whole is a net carbon sink as a result of the significant increase in permanent orchards, which actively sequester carbon (WCG, 2021). Nationally, forestry land is the primary driver of carbon sequestration, although other land classes remain net emitters.

Cape Town spans a total area of 2 445 km², or 244 549 ha (City of Cape Town, 2024a), comprising a diverse mix of urban development, agricultural areas and unique natural ecosystems (Figure 106 below). As part of the Cape Floristic Region, Cape Town is recognised internationally as a global biodiversity hotspot, with Table Mountain national park alone covering approximately 25 000 ha (City of Cape Town, 2024a). This ecological diversity coexists with rapid urban growth and agricultural expansion, both of which are reshaping the city's land cover and its associated carbon dynamics.

Urban expansion has been one of the most prominent trends over the past decade, with built-up areas increasing by more than 12 000 ha. At the same time, cultivated commercial land has expanded by nearly 5 000 ha, particularly in the form of permanent orchards and vineyards that support Cape Town's agricultural economy. Despite these pressures, natural vegetation still accounts for nearly half of the city's land area. However, some natural categories have declined significantly: Dense thicket and bushland decreased by about 19 000 ha between 2014 and 2022, highlighting the tension between development needs and biodiversity protection.

Figure 106: Cape Town land cover, 2020



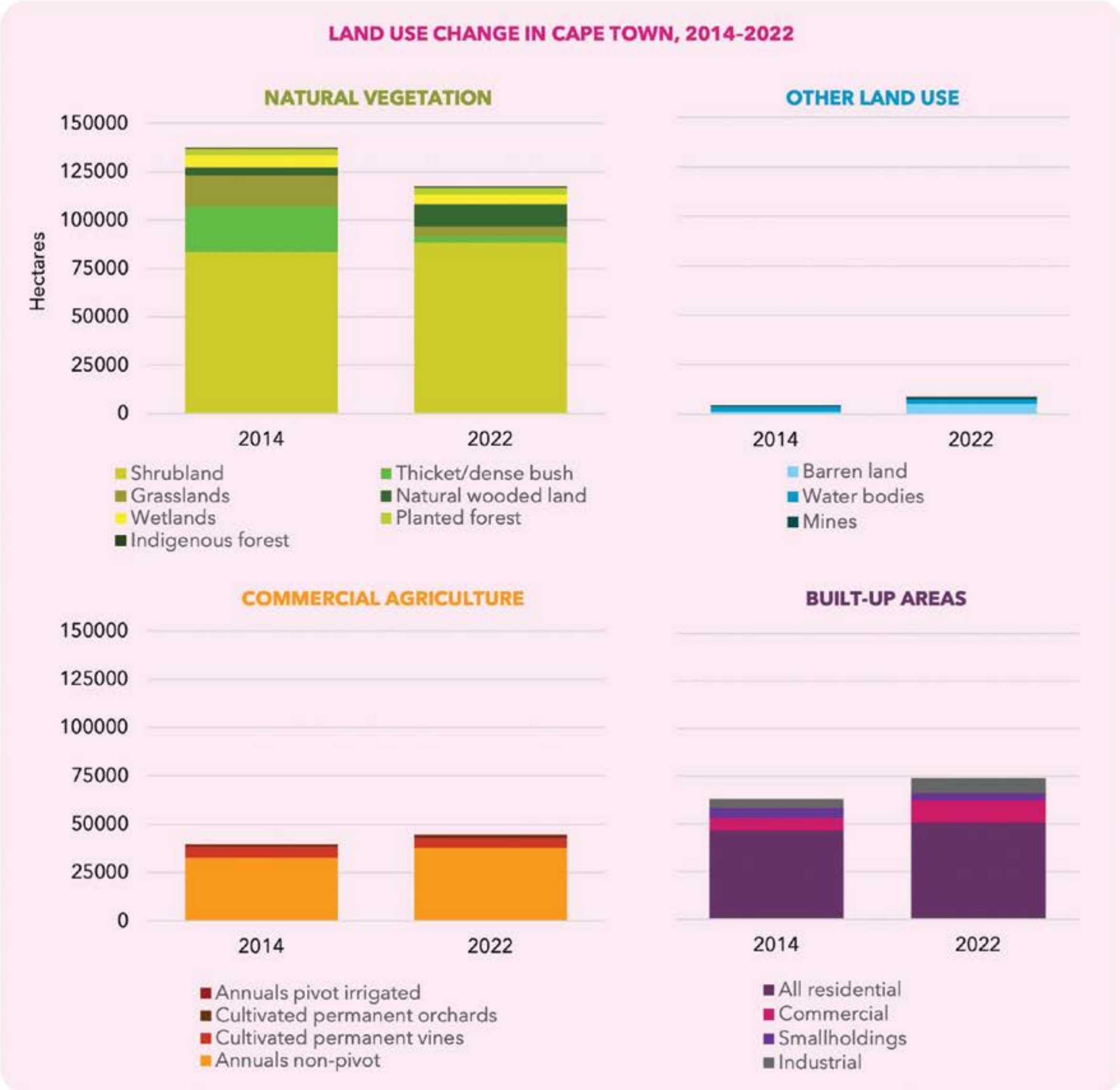
Source: DFFE (2018, 2020, 2022)

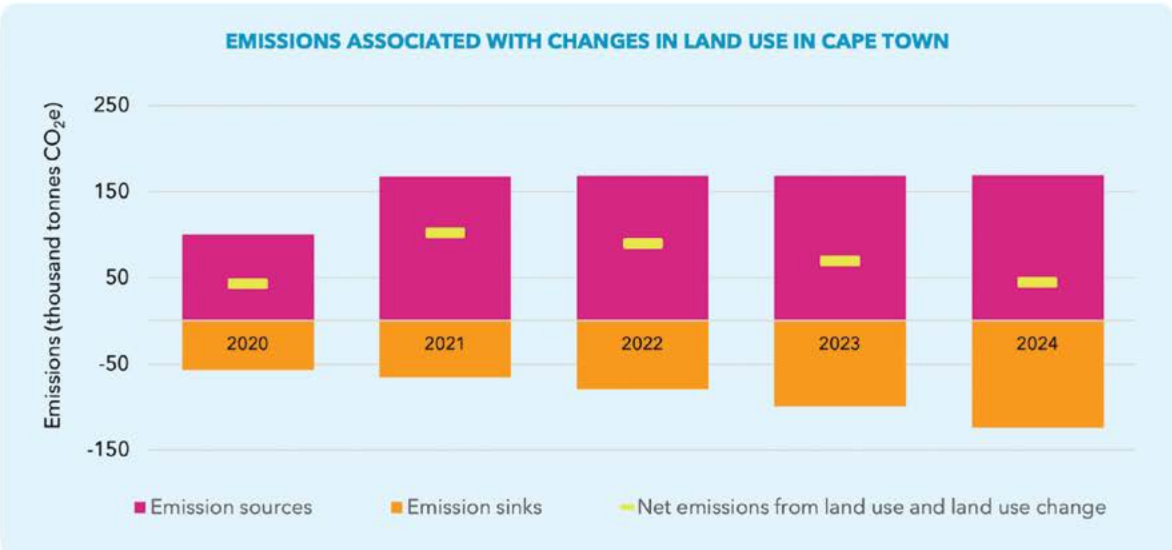
Land use and changes in land use are critical as both sources and sinks of GHG emissions. On the one hand, emissions occur when dense natural vegetation, such as shrubland, forests or thickets, is cleared for grassland or urban settlements, releasing stored carbon from biomass and soils. On the other hand, sequestration occurs when land is converted back to more carbon-dense categories such as wooded land or plantations. Geographic information system-based analysis of changes in land cover between 2014 and 2022 shows that the largest emissions source has been land converted to grassland, accounting for over half of total land-related emissions. This trend is often linked to the clearing of plantations or dense vegetation, including deliberate removals under biodiversity and water management programmes. For example, the clearing of pine plantations around the Steenbras and Wemmershoek catchments has released carbon, but secured critical water resources, with one hectare of cleared pines estimated to save approximately 300 kilolitres of water per year.

Conversely, shrubland converted to forest or plantation land is the city's most significant carbon sink, accounting for more than 90% of sequestered carbon. Some of this change reflects ecological succession in protected areas such as Table Mountain national park, where older fynbos stands have developed into denser thicket and forest vegetation.

Overall, land use change in Cape Town continues to be a net source of emissions, despite the presence of significant carbon sinks and the achievement of a 31% increase in protected and conservation areas between 2009 and 2024 (City of Cape Town, 2025g). In 2023, land cleared or converted to less carbon-dense categories, such as grassland or built-up areas, generated an estimated 163 000 tonnes of CO_2e. By contrast, land converted to denser biomass types, primarily shrubland to forest land, sequestered around 95 000 tonnes of CO_2e. The resulting net emissions from land use and changes in land use were approximately 68 000 tonnes of CO_2e in 2023. These figures underscore both the mitigation and adaptation opportunities and the trade-offs inherent in land management: Although clearing alien pine plantations contributes to emissions, it yields substantial biodiversity and water security benefits, while natural regeneration and reforestation strengthen the city's role as a carbon sink.

Figure 107: Changes in land use, 2014–2022, and associated emissions





Source: DFFE (2018, 2020, 2022)

3.8.3 Aggregate sources and non-CO_2 emissions on land

Aggregate sources and non-CO_2 emissions on land were estimated at 82 189 tonnes CO_2e in 2023, representing 30% of total AFOLU emissions. Given the city's very limited area under cultivation, emissions are modest, accounting for just 7% of the Western Cape's total (Western Cape Government, 2022) and about 3% of the national total (DFFE, 2024b). These emissions arise from a mix of agricultural and land management practices, including the burning of biomass (both controlled burning and wildfires), the application of lime and urea to soils, and the release of nitrous oxide from fertilisers, crop residues, sewage sludge, and manure used as fertilisers.

Emissions are estimated using crop area data, fire surveys, and average inputs per hectare. Notably, Cape Town's inventory includes urea application, which is excluded from the Western Cape inventory, while harvested wood products are excluded, given the absence of large-scale timber harvesting in the city.

The 2023 emissions profile highlights two dominant contributors: biomass burning and fertiliser-related emissions (Figure 108 below). Biomass burning, including the burning of agricultural residues and wildfires, made up roughly a third of emissions in this category. In 2023, the extent of biomass burning increased sharply, with more than 20 000 ha of fynbos burnt, compared to less than 9 000 ha in preceding years. While the natural fire dynamics of the fynbos ecosystem vary, this may reflect increasing fire management pressures (City of Cape Town, 2024c).

Fertiliser use and associated emissions of nitrous oxide accounted for almost half of aggregate source emissions. Direct emissions from fertiliser application (particularly nitrogen-based inputs) and the indirect release of nitrous oxide from soils remain the single largest source in this subsector. Practices such as liming and urea application further contribute to emissions, with particularly high emission intensities associated with grain and vegetable production systems.

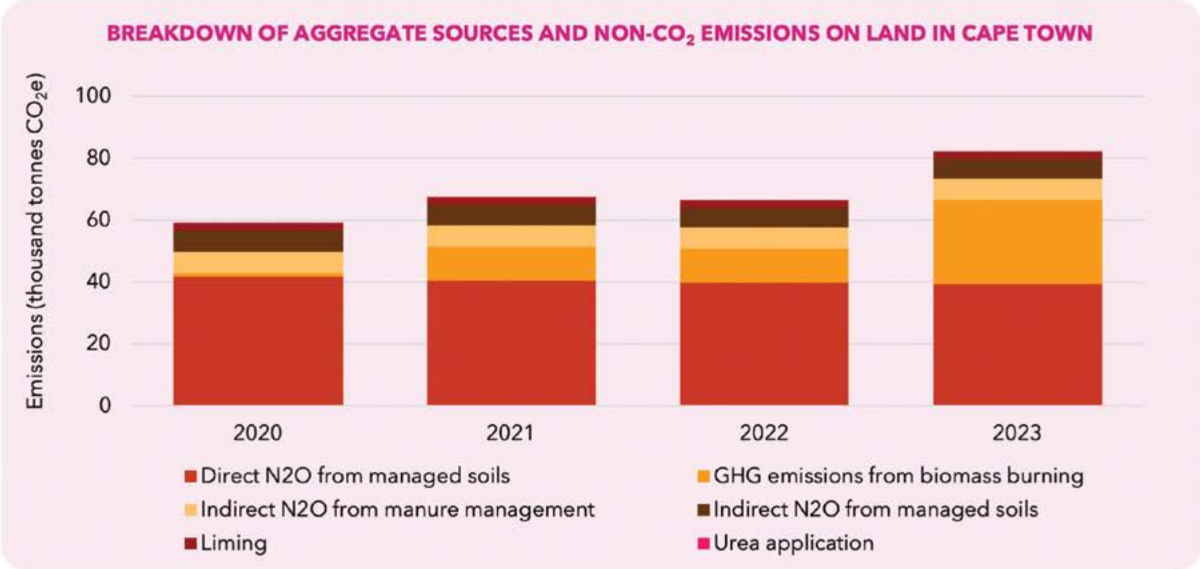
Grains remain the dominant crop type, covering almost 18 000 ha of commercial farmland area in 2023, although this reflects a slight decline (−3%) since 2020. By contrast, areas under oil seeds (+27%) and vegetables (+2%) expanded over the same period, driving increased fertiliser-related emissions in these subsectors. Pastures remain a smaller contributor.

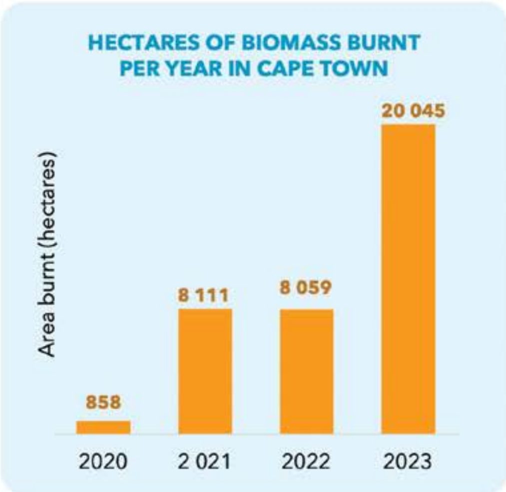
Overall, aggregate and non-CO_2 emissions on land are the result of Cape Town's unique ecological systems, which include fire-prone fynbos landscapes and its agricultural economy.

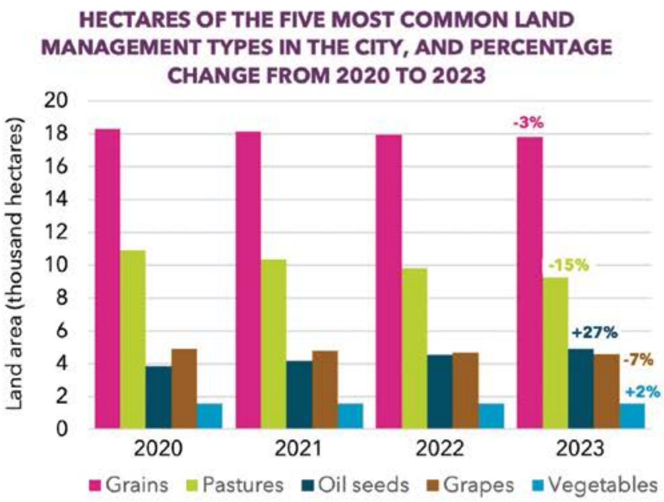
Figure 108: Aggregate sources and non-CO_2 emissions on land

AGGREGATE SOURCE EMISSIONS WERE
82 189
tonnes CO_2e
IN 2023

AGGREGATE SOURCE
EMISSIONS ACCOUNTED FOR
30%
OF **AFOLU** EMISSIONS IN 2023







EMISSION FACTORS FOR FERTILISER APPLICATION AND DIRECT AND INDIRECT EMISSIONS OF NITROUS OXIDE FOR THE FIVE MOST COMMON LAND MANAGEMENT TYPES IN THE CITY

LAND MANAGEMENT TYPE	Liming kg CO_2/ha	Urea kg CO_2/ha	Direct N_2O kg N_2O/ha	Indirect N_2O kg N_2O/ha
Grains	80	3	2,2	0,4
Grapes	69	5	1,8	0,7
Oil seeds	72	1	1,2	0,2
Pastures	0	1	1,1	0,2
Vegetables	89	16	6,8	2,4

Sources: DEA (2016); DFFE (2018, 2020, 2022); NASA EarthData (2025); WCG (2025b)

3.9 Industrial processes and product use (IPPU)

This SOEC marks the first time that IPPU emissions have been systematically quantified and reported for Cape Town at the city level. This demonstrates the City's commitment to ongoing improvements to its GHG accounting methodologies and completeness by aligning with international best practice under the GPC. IPPU emissions accounted for 4% of Cape Town's total BASIC+ emissions, or 1 $MtCO_2e$, in 2023 (Figure 109 below). Within Cape Town's boundaries, GHG emissions arise from a limited range of non-energy-related industrial activities. These include emissions released during physical and chemical transformations in industrial processes, as well as emissions from the use of certain products that contain or release GHG during their lifetime.

Industrial process (IP-only) emissions are small in the city, reflecting the prevalence of lighter manufacturing and service-driven economic activity rather than heavy industry: Only a single large glass producer and some carbonate consumption in the production of mineral products fall within Cape Town's boundaries. By contrast, at the provincial and national levels, cement and steel production are the dominant contributors. This difference means that Cape Town's share of national industrial process emissions is negligible, and even in the Western Cape, its contribution is minor compared to industrial hubs such as the steelworks at Saldanha (when operational) and regional cement plants. Cape Town's industrial processing emissions in 2023 made up just 22% of the Western Cape's total industrial process (IP-only) emissions (based on WCG 2018 inventory).

The majority of Cape Town's IPPU emissions, therefore, come from product use (PU-only), which accounted for over 90% of the subsector's emissions in 2023. The most significant source is fluorinated gases (F-gases), which have been introduced as substitutes for ozone-depleting substances in refrigeration, air conditioning, fire suppression and aerosols since the late 1990s. These gases have a very high global warming potential, meaning that even small leakages can have a large climate impact. Data on F-gas consumption is derived from national import and export balances, combined with sectoral survey data, and then scaled to the city level using IPCC 2019 refinement methodologies. Sulphur hexafluoride (SF_6) is a fluorinated gas used in electrical equipment. Equipment stock turnover for maintenance of the City's electricity network is assumed to emit SF_6, which is scaled to account for use in Eskom-supplied areas. Emissions from non-energy product use, such as lubricants and paraffin wax – volumes data source (DEE, 2023) – are also included, but represent a much smaller share of the total. Cape Town's product use (PU-only) emissions represent around 13% of South Africa's total, closely aligned with the city's share of national GVA. Product use (PU-only) emissions have not been considered in the Western Cape's latest GHG inventory.

Over the period 2020–2023, IPPU emissions are estimated to have increased well above population growth, reflecting the growth in demand for refrigeration and air-conditioning systems across residential, commercial and industrial sectors as well as in vehicles. This trend mirrors global patterns, where increasing urbanisation and higher temperatures are driving greater uptake of cooling technologies.[32]

Although IPPU represents a relatively small fraction of Cape Town's overall emissions, its rising trajectory, driven by product use and the high global warming potential of fluorinated gases, makes it a priority area for monitoring and the consideration of targeted interventions.

[32] *https://www.iea.org/commentaries/staying-cool-without-overheating-the-energy-system.*

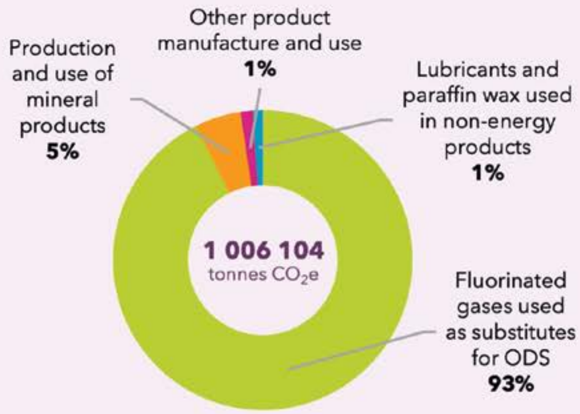
Figure 109: IPPU emissions breakdown in 2023 and trends

WHAT IS IPPU?

GHG emissions can result from **non-energy-related industrial activities and product uses**. These emissions, occurring from industrial processes, product use, and non-energy uses of fossil fuel, are reported under IPPU. The table below provides some IPPU examples that give rise to GHG emissions:

GHG emission source	Example
GHG emissions from industrial processes	• Production and use of mineral products • Production and use of chemicals • Production of metals
GHG emissions from product use	• Lubricants and paraffin waxes used in non-energy products • Fluorocarbon gases used in electronics production • Fluorinated gases used as substitutes for ozone-depleting substances

TOTAL IPPU EMISSIONS AND BREAKDOWN IN CAPE TOWN, 2023



CAPE TOWN'S **IPPU** EMISSIONS ACCOUNTED FOR

4%

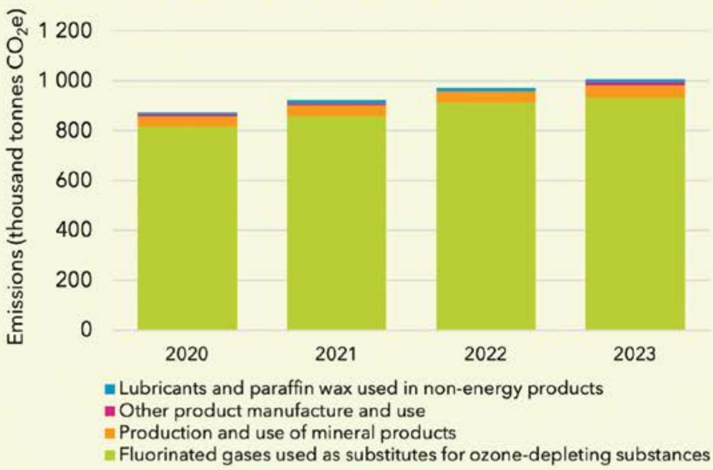
OF THE **CITY'S TOTAL BASIC+ EMISSIONS** IN 2023

CAPE TOWN'S **IPPU** EMISSIONS ACCOUNTED FOR

3%

OF THE **NATIONAL INVENTORY** IN 2022

IPPU EMISSIONS OVER TIME IN CAPE TOWN



Cape Town's **industrial processing** emissions (2023) accounted for only

22%

of the Western Cape's **industrial processing** emissions (2018), showing that large-scale industrial production within the city's boundaries is limited

Sources: City of Cape Town (2025c); DEE (2023); DFFE (n.d); SARS (2025a); Stats SA; Stats SA (2024)

3.10 Green attributes

'Green attributes' is an umbrella term used to cover all carbon currencies that can be traded or used to displace or offset carbon-intensive activities that are liable for a carbon tax or subject to a carbon target. They include carbon credits, benefits, emissions reductions, offsets and allowances. Attributes can be bought and sold on their own, or be bundled in with the underlying physical product (e.g. kWh of electricity sold).

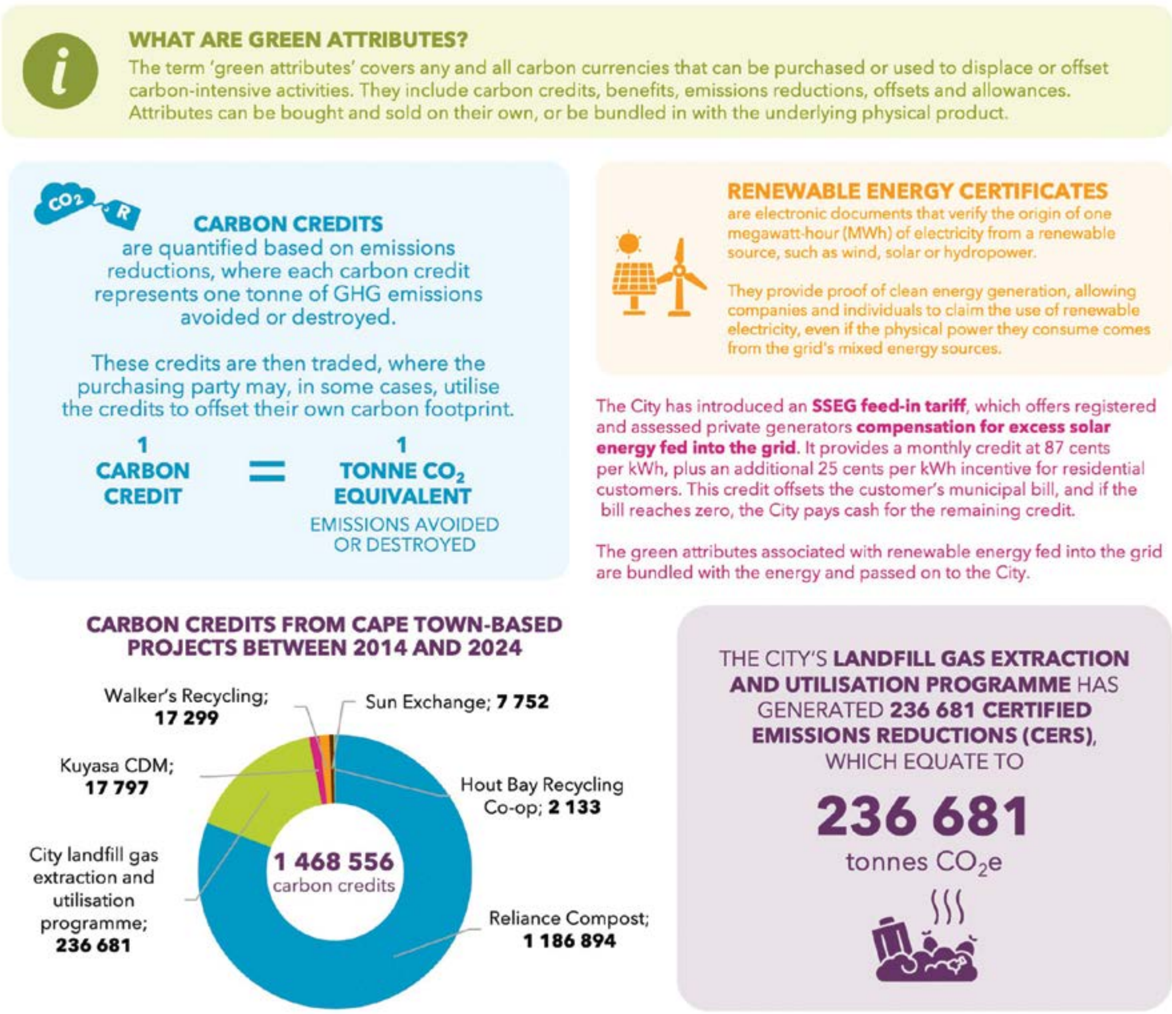
They are essential for ensuring transparency in GHG accounting, enabling claims to be substantiated, and providing incentives for investment in low-carbon initiatives. Therefore, the careful generation, registration, retirement and accounting of these attributes is an increasingly important component of Cape Town's climate governance. Green attributes and the public data for local green attribute generation are summarised in Figure 110 below. The following are the key data headlines and insights:

- About 1,47 million carbon credits were generated in Cape Town by various parties via registries (COAS, Credible Carbon, Verra, UNFCCC CDM) between 2014 and 2023 – 80% from private composting (avoiding methane emissions), 16% from City landfill gas capture and methane destruction through flaring/electricity production, with smaller contributions from recycling and solar PV projects.
- See section 3.7.2 for an overview of flaring at City landfill sites and, more recently, the diversion of landfill gas to electricity generation on-site.
- In 2024, the City auctioned off (landfill gas extraction and flaring) credits accumulated between 2018 and 2020 for approximately R36 million, ring-fencing the funds for Urban Waste Management projects to reduce pollution and improve environmental health.
- As these credits have been sold, the City no longer owns them, and therefore, the GHG accounts need to reflect this according to best practice.
- For transparency, cities must report gross and net emissions separately: Gross emissions include all emissions within the city's GHG boundaries, excluding any carbon credit adjustments. Net emissions equal gross emissions, minus reductions from purchased credits outside the city's boundaries, and plus emissions from credits sold within the city's boundaries (GHG Protocol, 2021).
- The City has had a PPA with Darling since 2002. Between 2008 and 2021, the City sold around 3 GWh of renewable energy certificates (RECs) out of 68 GWh purchased directly to customers. These RECs were not registered independently, as the programme pre-dates the mainstream use of registries.
- Given the small demand and the drop in monthly purchases from Darling, as well as the fact that third-party certification had become the norm, the City ceased sales in 2021, but has continued to donate RECs to events in special circumstances.
- While the City acquired over 33 GWh of bundled electricity green attributes from customer SSEG purchases in 2024/25 alone, equating to around 30 250 tCO_2e, the City has to date not unbundled fast-growing SSEG export purchases and registered them independently as RECs.
- If the green attributes of renewable electricity purchased by the City and sold as grid electricity were unbundled and sold as RECs outside the city's boundaries, the citywide GHG inventory would have to reflect a net increase in emissions.
- The City also has emissions targets for its own buildings, as discussed in section 3.11. The on-site scope 2 emissions footprint of City buildings will require offset by unbundled RECs or by internal wheeling of bundled power. This, however, will reduce the potential to lower the local GEF or offer customers green power, which might become significant as renewable energy imports and embedded generation scale to significant volumes.
- Consequently, the City faces not just a growing accounting challenge at the citywide scale, but a challenge to trade off the competing uses of green attributes at both citywide and City operations scales. Policy is being developed

with the goal of maximising public benefit while maintaining environmental integrity for the City's role as both a consumer and generator of green attributes.

- In 2024, the City conducted a market insight study into selling green electricity. The study found strong interest in a municipal green electricity product, with 81% of customers expressing willingness to participate, and a clear preference for bundled RECs. Customers expect pricing to be competitive with – or cheaper than – current grid or renewable alternatives, resulting in limited appetite for premium-priced offerings. The potential market size is estimated at 187–450 GWh per year, driven largely by sustainability commitments, compliance pressures relating to the European Union's Carbon Border Adjustment Mechanism (CBAM), and the desire for predictable energy costs. Most customers (90%) require certified verification, with RECSA/ZAREC viewed as the most credible option. While the main competitor is wheeling, a City-supplied product could differentiate itself through simpler administration and better accessibility for multi-site, leased-site and smaller-load customers.

Figure 110: Green attributes and projects in Cape Town



Sources: COAS; Credible Carbon; Verra; UNFCCC CDM

3.11 Cape Town's emissions targets: context and progress

Decades of large-scale collaborative research into climate science and related disciplines makes it clear that keeping average global temperature rise below 1,5 °C is essential to avoid the most severe consequences of climate change (IPCC, 2023). The impact of the GHGs already emitted means that human activities need to become 'carbon-neutral' where GHG emissions are 'net zero' (additions = removals) by 2050, with the fastest possible rate of reduction over time. These cumulative emissions between now and 2050 are critical to the impact that society will experience, and are called the 'carbon budget'. The way in which the carbon budget is shared between countries with different levels of historical responsibility and at different stages of development is known as 'burden-sharing', and requires compromise between many views and interests. The need for concerted action over time has led to voluntary and legislated climate plans and targets emerging all over the world at country level and in both private and public organisations at all levels.

South Africa is a signatory to the Paris Agreement and, through its second nationally determined contribution, has committed to a "just transition to net-zero CO_2 emissions by 2050" (DFFE, 2025b). In addition to the devolved responsibilities under national commitments, the City joined over 1 000 cities worldwide in pledging to achieve carbon neutrality by 2050 under a voluntary programme through its membership of the C40 Cities Climate Leadership Group (City of Cape Town, 2020, 2021b). Unfolding from this pledge, targets were set that conform to C40's Deadline 2020 framework (C40, 2016), which recognises Cape Town as an "early-peaking developing city" under its particular burden-sharing scheme – one that may see modest emissions growth until 2030, followed by rapid decarbonisation to at least 80% below current levels by 2050.

Local authorities typically have limited policy levers and mandates to drive technology change at the required scale in emitting sectors. Finances and human resources are necessarily focused on basic service delivery, especially in a developing-country context. In the local context, coal-based national grid power and recent, but now receding, disruptions such as load-shedding and the rail crisis, have all posed risks to achieving the targets set in strategies and plans. However, through target-setting, the City can:

- mainstream climate action across municipal functions through tangible benchmarks;
- harness opportunities in the green economy;
- provide 'civic leadership' for other actors;
- align with national commitments and plans; and
- develop and maintain the technical and governance functions required for concessional finance linked to climate action.

The City's voluntary targets, and progress towards the targets, are shown in Figure 111 and Figure 112 below. These are also reported on annually in the form of the Climate Change Action Plan Implementation Review reports and CDP online submissions. The data headlines and insights are as follows:

- The City has committed to a 9,4% absolute emissions reduction by 2030 (from a 2016 baseline) and an 81% reduction by 2050, aligned with its carbon neutrality commitment.
- Most of the 'residual' 9% of emissions in 2050 are expected to be in the 'hard-to-abate' sectors of transport and industry. Under the Deadline 2020 framework, Cape Town's city typology is not at this time expected to plan for mitigation of residual emissions through offsets or direct capture technologies.
- Importantly, the seemingly modest absolute decline to 2030 is projected to require a large

30% per capita drop because Cape Town's population will likely continue to grow fast due to urbanisation.

- Central to this transition are the following sectoral shifts:
  - Achieving 100% clean electricity supply by 2050, while continuing to incrementally decrease absolute electricity emissions to 2030, supported by deep energy efficiency improvements and expansion of both embedded and wheeled renewable generation
  - Working towards net-zero carbon (NZC) buildings, as per the City's commitment to the C40 Net-Zero Buildings Accelerator, which is embedded in the City's Climate Change Action Plan and includes ensuring that:
    - its new and existing municipal buildings are NZC in operation by 2030; and
    - all new buildings approved citywide are NZC in operation by 2030, and all buildings are NZC by 2050.
  - Electrifying transport, while restoring and expanding public mobility systems enabled by spatial policy
  - Eliminating organic waste to landfill in line with provincial and national targets
- BASIC emissions have declined on a path close to the trajectory line, with 2023 emissions estimated at 19,39 $MtCO_2e$, down from 2016 emissions of around 21 $MtCO_2e$. This does not mean that the target has been met, however, because of the rate of population growth and, potentially, the rate of economic growth in certain sectors.
- The decline in absolute emissions is certainly partly due to the technology and regulatory changes discussed in earlier sections. However, this needs to be viewed with caution because, as widely noted, "South Africa has been stuck in a low-growth trap for more than a decade, reflecting deep-rooted structural rigidities and an inability of policymakers to address them" (Medici, 2025).
- 'Structural' economic problems are, by definition, persistent and difficult to address. They were in place prior to, and have been compounded by, Covid-19 and load-shedding (Fedderke, 2018).
- Declining per capita incomes have limited economic activity, causing emissions growth to stagnate as well as reduce as a result of mitigation. Consequently, emissions may appear favourable under burden-sharing frameworks that prioritise developing-country welfare, even though neither substantial economic development nor substantial decarbonisation has occurred. This creates a risk that regions such as Cape Town will enter the post-2030 period without the financial or institutional capacity needed to transition rapidly, even if low-carbon technologies have matured elsewhere, or wealthier households and corporations have already begun transitioning.
- More positively, pragmatic technology change could provide South African cities with the opportunity for 'green growth' leading up to 2030 and beyond, and therefore, the theory of change underpinning the City's planning is to harness these opportunities as they arise. This is reflected in the Energy Strategy, which positions Cape Town to seek the best possible economic and environmental outcomes from the unfolding global energy transition.
- The National Just Transition Framework endorses this broader principle, namely that climate action must support energy poverty alleviation, job creation across broader society, and an improved quality of life for all Capetonians (PCC, 2022).

Figure 111: The City's climate change mitigation targets

WHAT IS CARBON NEUTRALITY?

Being carbon-neutral means that, after taking into account any potential carbon sinks (vegetation that absorbs carbon), the net greenhouse gas (GHG) emissions from all sources are zero.

WHAT IS NET-ZERO CARBON?

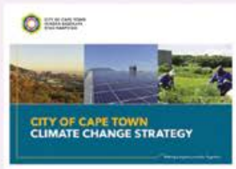
Net-zero carbon emissions means than an activity releases net-zero carbon emissions into the atmosphere.

THE CITY'S COMMITMENTS AND TARGETS

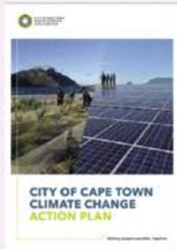
- **Carbon neutrality by 2050:** Net-zero greenhouse gas emissions across all sources, after accounting for carbon sinks
- **Interim 2030 target:** 9,4% absolute cut in emissions from 2016 baseline → equivalent to a 31% reduction in per capita emissions
- **Net-zero carbon for municipal operations by 2030:** All new and existing municipal buildings (excluding industrial plants and utilities) to be net-zero carbon by 2030
- **Electricity transition:** 100% clean electricity supply by 2050, with up to 35% of maximum demand met from alternative sources by 2030 (~650 MW)
- **Citywide net-zero new buildings:** All new buildings carbon-neutral by 2030, and all existing buildings carbon-neutral by 2050
- **Green and Healthy Streets declaration:** Transition to EV bus procurement and the creation of a zero-emissions zone
- **Province's organic waste diversion target:** 100% diversion of organic waste from landfill by 2027, and 55% diversion of recyclables by 2030

THE DOCUMENTS CONTAINING THE CITY'S COMMITMENTS

The City of Cape Town's Carbon-Neutral 2050 Commitment

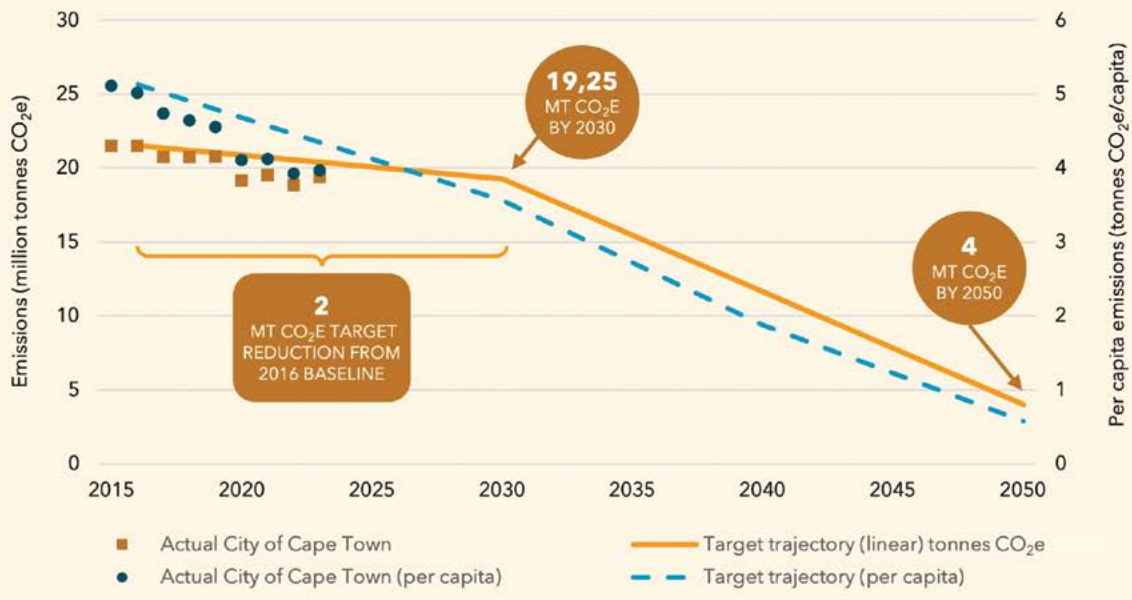


City of Cape Town Climate Change Strategy



City of Cape Town Climate Change Action Plan

CAPE TOWN'S PROGRESS AGAINST CARBON TARGETS



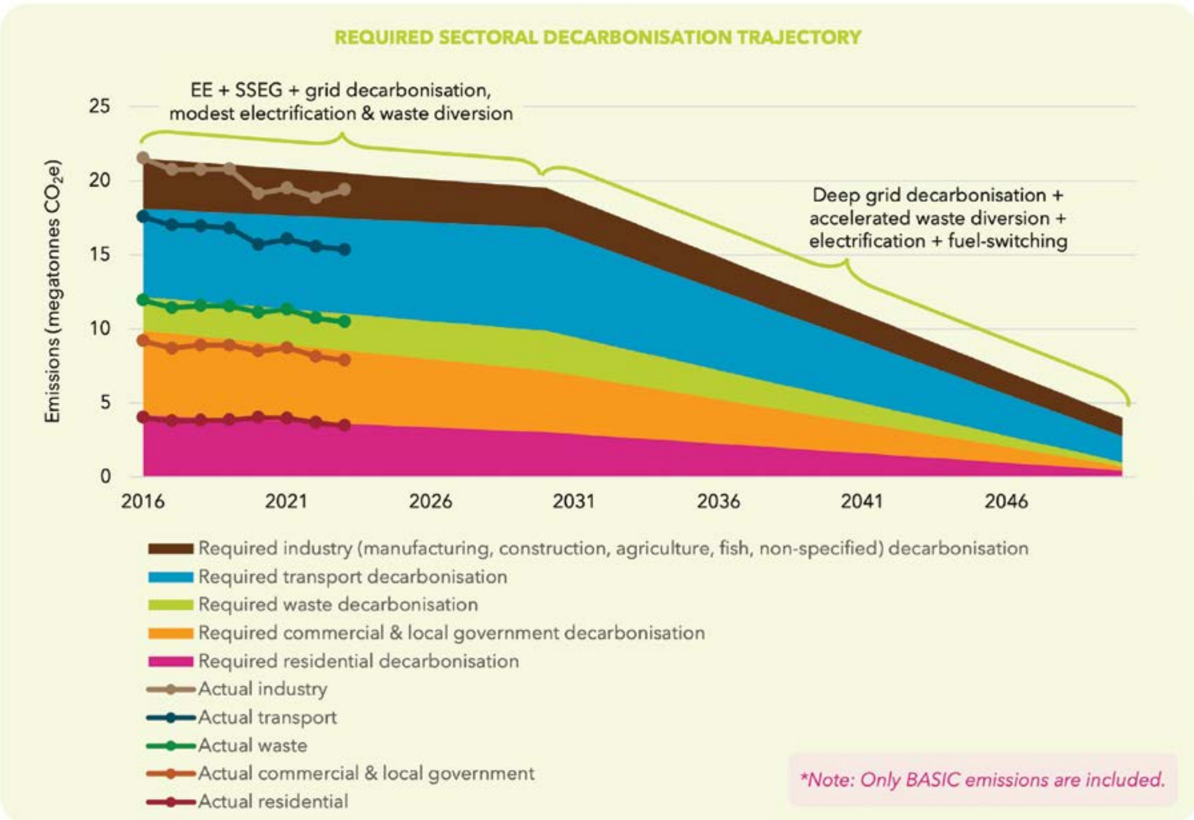
**Note: Only BASIC emissions are included.*

Source: City of Cape Town (2025c)

Figure 112: Cape Town's total emissions summary with targets

Sources: ACSA (2025); City of Cape Town (2023a, 2025c); DEE (2023); Eskom (2025a); LEAP model; NASA EarthData (2025); DFFE (n.d); SARS (2025a); SAWIC; Stats SA (2024, 2025a); Transnet (2025); WCG (2025b)

Figure 113: Cape Town's sectoral decarbonisation trajectory and progress since 2016



Source: City of Cape Town (2025c)

4 State of Energy and Carbon overview for City operations (local government sector)

The City is a large local government that employs nearly 30 000 staff and has an annual budget of R84,1 billion (2025/26). The following large infrastructure systems drive energy and carbon in City operations:

- The water and wastewater systems described in section 3.3.1
- The solid waste system described in section 3.3.2
- More than 2 000 municipal facilities, including plant
- A fleet of 2 599 passenger vehicles, 1 967 light commercial vehicles, 729 medium and heavy trucks, 1 385 off-road vehicles and 5 883 petroleum-fuelled auxiliary machines such as chainsaws (based on 2024 figures)
- Contracted vehicle operating companies operating 353 MyCiTi commuter buses (based on 2024 figures)

In providing services, these large systems and their associated equipment account for about 1,5% of Cape Town's overall energy consumption and contribute 2% of total citywide GHG emissions. While relatively small, this footprint is among the largest of any single entity and is linked to a network of thousands of suppliers, creating many opportunities for knock-on mitigation actions and 'civic leadership', which can have a magnified effect.

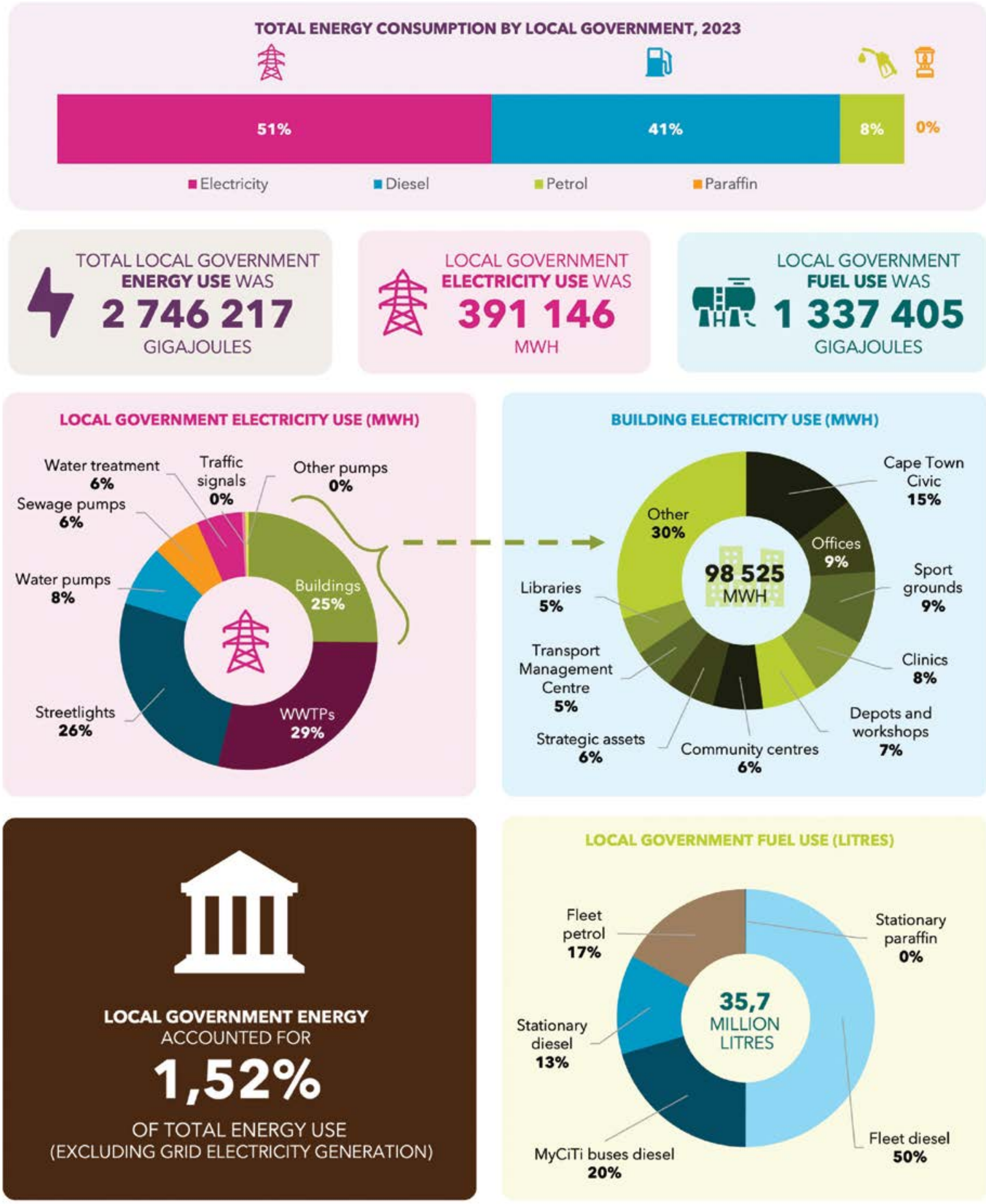
In recognition of this responsibility, the City has developed and implemented a wide range of initiatives, including the diversification of its energy sources, improvements to the energy efficiency of its services, and the introduction of EVs in its transport fleet. This section presents data on current energy consumption (section 4.1) and carbon emissions (section 4.2). Initiatives to manage consumption and emissions are discussed in section 4.3.

4.1 Energy consumption by City operations

Energy use by City operations is presented in Figure 114 and Figure 115 below. The following are the data headlines:

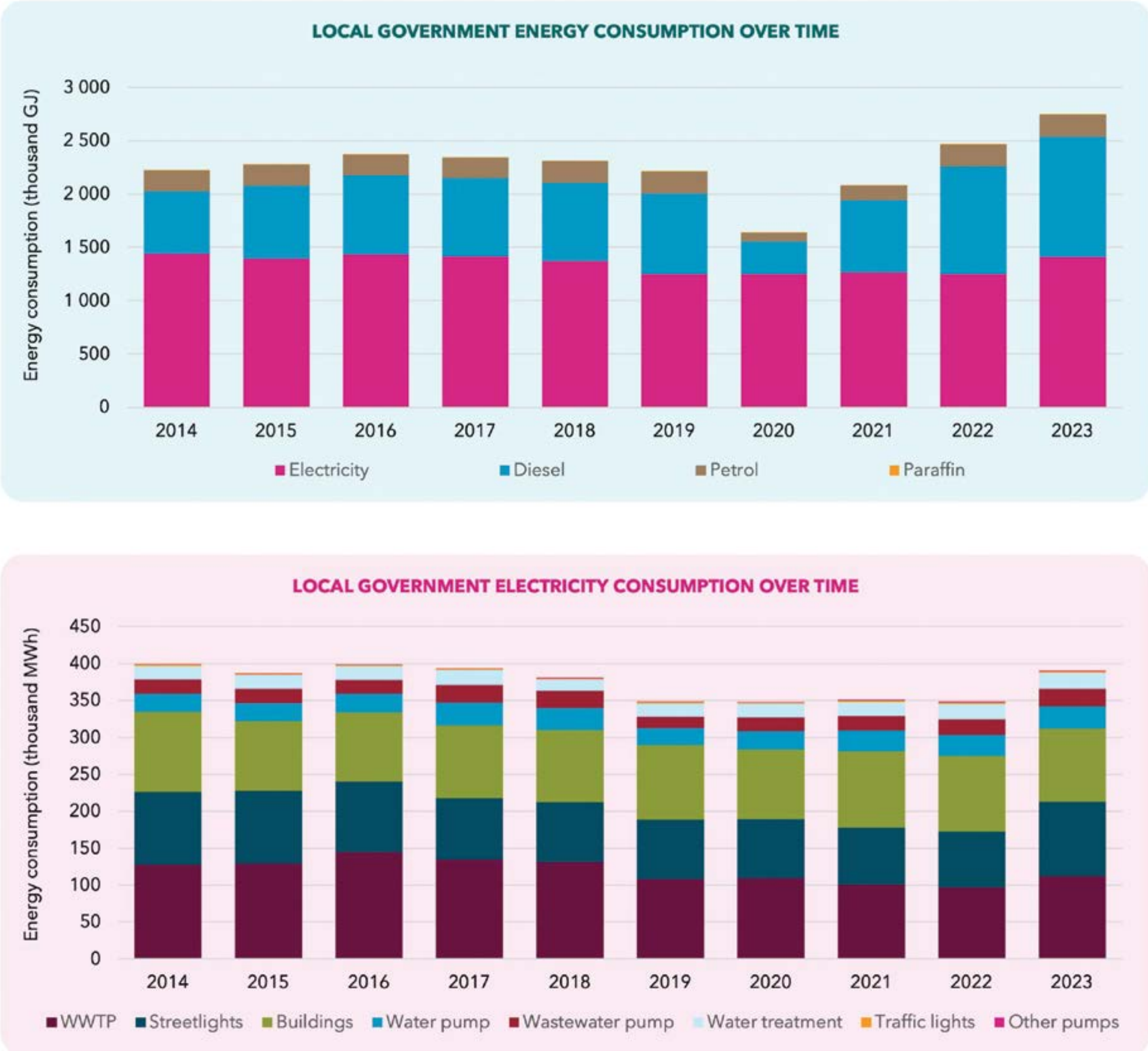
- City energy data is acquired from various sources, including automated electricity meters, e-fuelling vendors and the Enterprise Resource Planning system for stationary fuel transactions. Not all infrastructure is metered, although a 12-year programme has progressively metered an estimated 80% of facility electricity demand. Isolating billing data for facilities in Eskom areas from the complex array of transactions with Eskom has proved challenging. Streetlights are estimated based on rating and operational hours, as are a raft of other unmetered loads, including cameras and signage. Therefore, year-on-year variance is partly attributable to improved metering and methodologies for estimating missing data.
- The 2,7 million GJ energy consumption by City operations in 2023 was almost evenly split between electricity (51%) and petroleum fuels (49%: diesel 41% and petrol 8%), while other fuels make only marginal contributions.
- Electricity use totalled 391 146 MWh in 2023, consumed by a range of essential services that keep the City functioning and delivering services. The largest users were WWTPs (29%), streetlights (26%) and buildings (25%). Smaller yet significant portions of consumption were for water treatment, pumping infrastructure and traffic signals.
- In the building category, electricity use by municipal offices and the Cape Town Civic approached a share of one third (24% combined). Unspecified/other uses comprised another third, with the remainder spread across clinics, community facilities, depots, fire stations and sport grounds.
- Fuel use totalled 1,34 million GJ in 2023, with fleet diesel (50%) the single largest source, reflecting the scale of service delivery operations that require heavy-duty vehicles. MyCiTi buses accounted for 20% of all fuel use by municipal services. Fleet petrol (17%) and stationary diesel (13%) for small-scale generators and boilers made up most of the balance.
- The data suggests a steady decline in electricity consumption by City operations, falling from around 400 GWh in 2014 to under 380 GWh at the onset of Covid. However, a strong rebound back to 400 GWh in 2023 is evident, mainly driven by improvement in streetlight burning rate, which had dropped due to maintenance challenges during Covid, and the completion of WWTP upgrades to expand capacity.
- The City's large water and wastewater infrastructure programme in response to rapid urban growth is likely to continue to drive electricity consumption, despite efficiency programmes.
- Diesel consumption has been the energy carrier most sensitive to shocks: In 2020, it dropped by 60% with the onset of Covid; in 2022, however, it swung back sharply to 33% higher than in 2019, and in 2023, to 50% more than in 2019. These latter increases were driven by investment in diesel generators and storage at scale across directorates, especially for water and wastewater pumping to keep essential systems running in the face of severe load-shedding. The impact on the diversion of public money to both fuel and capital equipment will have knock-on effects long after the load-shedding crisis itself.

Figure 114: Snapshot of local government energy consumption, 2023



Source: City of Cape Town (2025c)

Figure 115: Trends in local government energy consumption



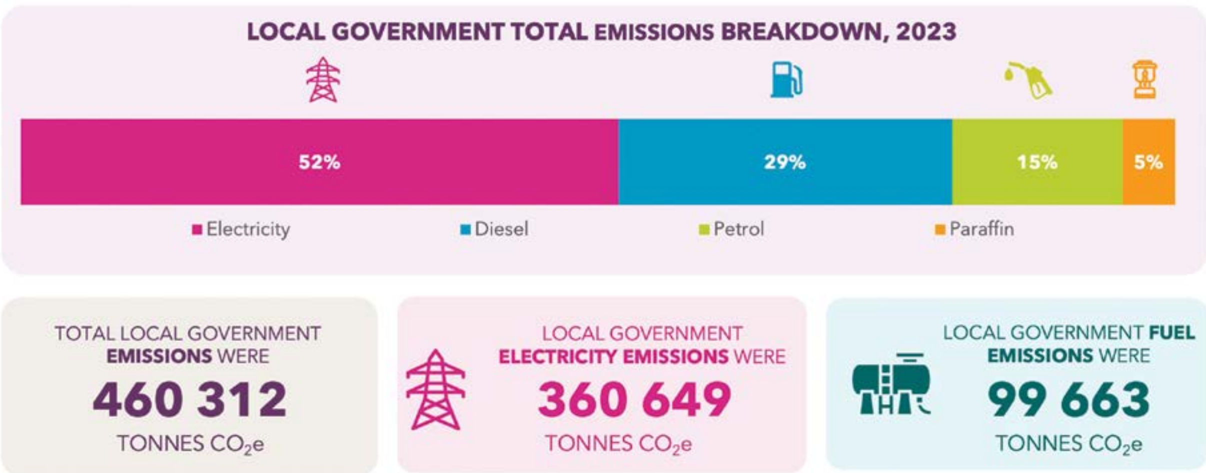
Source: City of Cape Town (2025c)

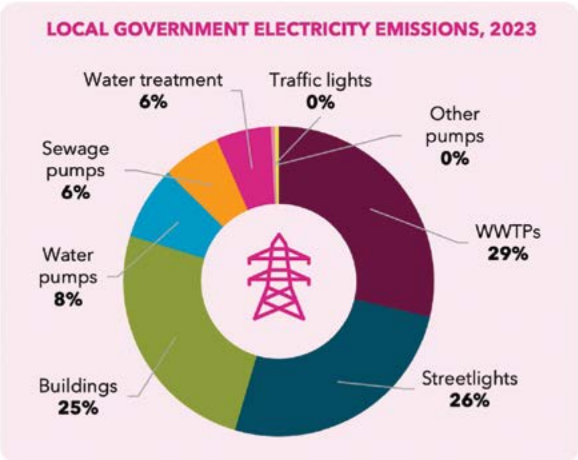
4.2 GHG emissions from City operations (local government sector)

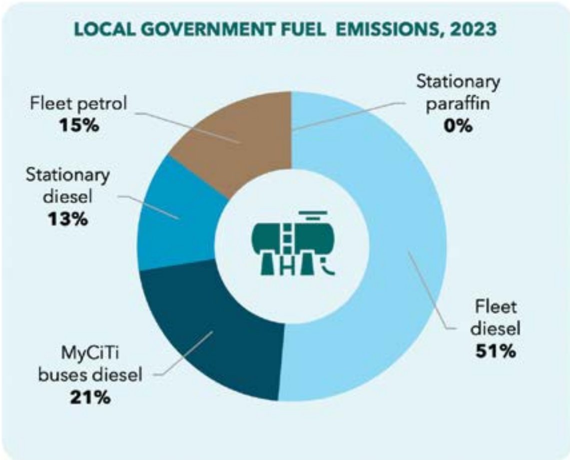
The City operations emissions presented in Figure 116 below are concentrated in the energy-intensive services outlined above. The following are the data headlines:

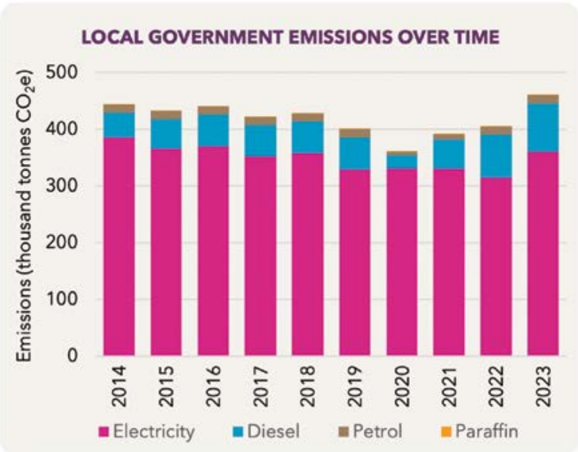
- Municipal operations in Cape Town emitted 460 ktCO_2e in 2023, accounting for just under 2% of citywide BASIC+ emissions.
- Emissions arose primarily from electricity use (52%), with the remainder from fuel use – mainly diesel (29%) and petrol (15%) for vehicles and public transport.
- Fleet diesel consumption was the largest source of emissions from fuels (51%), followed by MyCiTi diesel bus services (21%), fleet petrol (15%) and stationary diesel (13%).
- The largest electricity-related emitters were WWTPs (29%), streetlighting (26%) and municipal buildings (25%).
- Local government emissions estimates declined steadily from 2014 to 2020, likely driven by efficiency improvements and a dropping GEF. The ensuing shocks, however, obscure a conclusive trend, with emissions in 2023 reaching 460 ktCO_2e, exceeding 2015 levels.
- While system shocks make it difficult to clearly assess absolute emissions trends in City operations, per capita emissions indicate a significant drop with higher certainty, from 108 kg CO_2e per person (2014) to 94 kgCO_2e per person (2023). This decline, even with the large diesel increase from load-shedding, indicates improved energy efficiency relative to the population served. The large capital budget pipeline, which is partly in response to population pressures, may slow this trend.

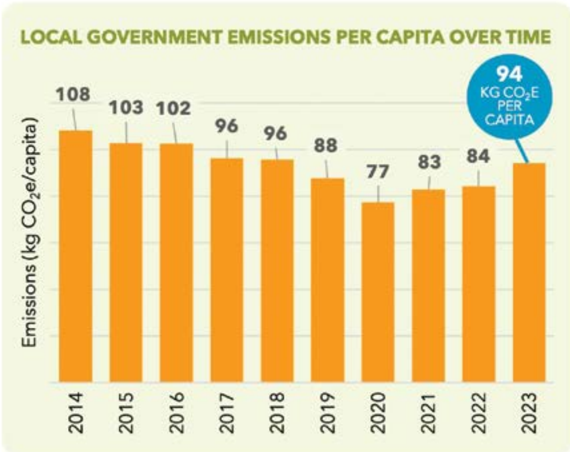
Figure 116: Snapshot of local government GHG emissions, 2023











LOCAL GOVERNMENT EMISSIONS ACCOUNTED FOR **2,4%** OF TOTAL BASIC EMISSIONS

Source: City of Cape Town (2025c)

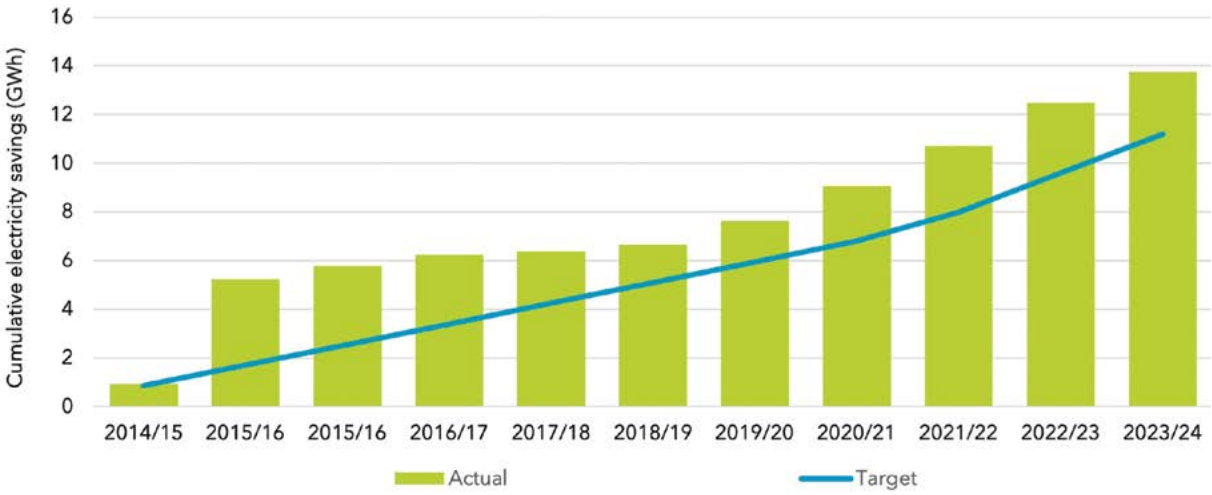
4.3 Interventions to reduce energy and emissions in operations

Continued monitoring and management of the trends showed above will not only ensure cost savings for the City, but will also demonstrate leadership in the transition to a more sustainable and resilient energy system. As part of the City's NZC buildings commitment and overall GHG emissions reduction goals, it has developed and implemented multiple mitigation measures, including the following:

- **Measurement and tracking:** The City measures electricity consumption and renewable energy generation through smart meter devices installed at municipal facilities. The data is tracked and displayed through an intranet digital platform called SmartFacility, a tool for municipal facilities managers to monitor, report on and manage building resource consumption.
- **Energy efficiency (City operations):** Since the launch of its municipal energy efficiency programme in 2009, the City has achieved estimated cumulative electricity savings of 427 GWh, equivalent to 423 ktCO_2e emissions, reducing costs by an estimated R625 million. Supported by energy audits, these savings

have been achieved through multiple interventions, including retrofits of 177 municipal buildings with energy-efficient lighting and energy-efficient air-conditioning units, photocells and occupancy sensors, the retrofit of streetlighting (ongoing), the retrofit of traffic signals with light-emitting diode (LED) fittings, and the replacement of process equipment such as variable-speed drives at WWTWs. Resource efficiency measures have also been integral to the Water and Sanitation Directorate's achievement of ISO SANS50001:2018 standard certification. The City's energy efficiency initiatives have been supported annually by National Treasury via the Division of Revenue Act Energy Efficiency and Demand Side Management (EEDSM) grant.

Figure 117 : Cumulative electricity savings from energy efficiency projects in City operations



Source: City of Cape Town (2025c)

- **Diversification of energy supply:** As noted in section 2.2, most electricity distributed within Cape Town's municipal boundaries is supplied wholesale by Eskom, either directly to customers or to the City, being a licensed distributor. While the national grid is steadily decarbonising, the GEF remains close to 1 kg CO_2/kWh, and the coal-based fleet will dominate for some time to come. There are many reasons to diversify supply in addition to decarbonisation, including security of supply and price stability. Given enabling legal reforms, rapid growth in private power projects, the emergence of licensed traders, an imminent wholesale market, and residential electricity prices firmly in the third quartile of world prices (globalpetrolprices.com, n.d.), it makes sense for the City to diversify its bulk energy supply. The City is concluding agreements with IPPs to purchase 180 MW of renewable energy in a first round of procurement, with a second round to follow shortly.
- **Own generation:** Diversification of supply includes own-build options and the construction of the solar PV farm in Atlantis. Among the first of its kind to be constructed by a South African municipality, the 7 MW Atlantis plant will be owned and operated by the City. Once fully operational, the plant will provide around 11,5 GWh of electricity, or about 3% of the electricity consumed by City operations, with the potential to scale up to 10 MW.
- **Embedded generation (non-City buildings):** Following the introduction of the first registration system and feed-in tariffs in 2013, the City has from 2021 more actively promoted and incentivised the installation of SSEG by homeowners and commercial properties. These enabling measures for SSEG include the

approval of a lower-cost bidirectional energy meter to support export, the introduction of an additional feed-in tariff incentive of 25c/kWh, and a simplified online platform for SSEG system design and connection applications. More than 16 000 grid-tied SSEG systems have been registered through the City's system as of December 2025, and just over 2 400 exporting customers are receiving SSEG incentives. In addition, the City has introduced regulations and piloted systems for the wheeling of renewable energy from one site to another.

- **Embedded generation (City buildings):** Just over 100 municipal buildings have been equipped with embedded solar with a total capacity of 2,64 MWp. These include three larger systems installed in the 2024 financial year as part of the Phase 1 SSEG installation programme, namely 990 kWp at the Kraaifontein WWTP, 338 kWp at the Goodwood Transport Management Centre, and 125 kWp at the Gugulethu Electricity depot. Phase 2 projects in progress are anticipated to increase capacity to 7 MWp by the end of 2028.
- **Operational fleet:** After a pilot and research phase that included the procurement of five light passenger EVs and the installation of two City-owned solar-supported charging stations (see section 2.5.4.1), the City has been preparing to engage the market more broadly on new-energy vehicles for its vehicle fleet. In principle, these would include hybrid and fuel-cell technology. Given short trip distances and rapidly dropping prices of EV technology, much of the fleet's direct fossil fuel use can be expected to be economically substituted by electric drive in the medium to long term, although certain off-road and heavy-duty applications may remain petroleum-fuelled in the long term.
- **MyCiTi bus service:** After a thorough assessment of economic viability in the local context, and consideration of the Green and Healthy Streets declaration (see section 3.11), the City has awarded a tender for delivery of thirty 12 m low-entry battery-electric MyCiTi buses in 2027.
- **Net-zero carbon commitment for municipal buildings by 2030:** In terms of this commitment, all new and existing City municipal buildings should be net zero by 2030 (see section 3.11). The continued rollout of on-site renewable energy and energy-efficient technologies required to approach this target is generally economically viable, but wheeling of electricity between sites or from renewable generators will likely need to be significant, given the local context.

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6 Annexures

6.1 Annexure A: Collecting data - the issues

Reliable and transparent data is the foundation of evidence-based energy and climate planning. For a city such as Cape Town, with its international profile, ambitious energy strategy, and commitment to reporting, the integrity of its data is central to both credibility and effective decision-making.

6.1.1 Mandates for reporting

The City has a clear mandate to produce an annual GHG inventory for the entire municipal area, including electricity supplied by Eskom within Cape Town's municipal boundaries. This requirement arises from multiple sources:

- **Municipal Finance Management Act (MFMA):** Treasury's Circular 88 indicators require municipalities to undertake climate change needs assessments and implementation plans, which, in turn, depend on a robust GHG inventory.
- **National Greenhouse Gas Emissions Reporting Regulations (NGER) (2017, 2020 amendment) under the National Environmental Management: Air Quality Act of 2004:** Introduced a single national reporting system for the transparent reporting of GHG emissions. This helps South Africa update and maintain a national GHG inventory and meet the Paris Agreement targets and other national commitments regarding emissions reductions. Entities (including municipalities that operate emissions sources) must report GHG emissions annually to the DFFE (DFFE, 2020).
- **Carbon Tax Act 15 of 2019:** Gives effect to the polluter-pays principle for large emitters and aims to ensure that firms and consumers take the negative adverse costs (externalities) into account in their future production, consumption and investment decisions. The Act further encourages a low-carbon transition by imposing a cost on carbon emissions, and incentivises businesses and consumers to adopt cleaner technologies and practices. The **Taxation Laws Amendment Act 34 of 2019** furthermore introduced an important change by amending the definition of 'person' in section 1 of the Carbon Tax Act to the extent that municipalities are now regarded liable to pay a carbon tax.
- **Climate Change Act 22 of 2024:** Mandates metropolitan municipalities to base climate change response plans on the best available science and integrate mitigation and adaptation measures into their integrated development plans.
- **CDP (Carbon Disclosure Project):** A global, independent non-profit system that enables companies, cities, states and regions to measure and disclose their environmental data, including climate change. Along with many prominent corporates and cities, the City has voluntarily reported since as early as 2014 as a member of the C40 Cities Climate Leadership Group. It has consistently retained an A-rating since the introduction of the rating system in 2018, which requires full inventory coverage.

These obligations align with national frameworks, international commitments and global practice, where cities are expected to publish transparent, comprehensive energy and emissions data as part of their contribution to national and international climate commitments.

6.1.2 Current challenges

Despite this clear mandate, the City faces practical challenges in securing all required data, particularly electricity sales data from Eskom's distribution network in Cape Town. While some progress has been made through bilateral agreements and non-disclosure agreements, delays and non-delivery of data undermine the ability to produce high-quality reporting. In this SOEC, the City was compelled to rely on scaling estimates from 2020 Eskom data to represent scope 2 emissions, while flagging the quality as 'scarce' and incomplete in metadata.

This highlights the limitations of ad hoc or bilateral arrangements for intergovernmental data-sharing. While non-disclosure agreements, memorandums of understanding and other agreements may provide a stopgap, they remain vulnerable to delays, conflicting interests, or resource constraints. A more systemic approach is needed, with open data as the preferred standard, and a strong legal mandate for data-sharing as the fallback.

6.1.3 Towards better data governance

International best practice shows that modern energy and climate governance requires data practices that are open, standardised, and resilient. For South Africa, this would involve:

- Developing metadata and quality standards across government entities to ensure that data is well documented and reliable
- Building specialised data skills and career paths in public service to enhance consistency and institutional memory
- Clarifying rights to commodity data (electricity, fuels, water, vehicles) so that it is shared by default, unless legitimate exemptions apply
- Enhancing procurement and intellectual property practices to avoid vendor lock-in and ensure continuity of government data systems
- Expanding open data responsibilities and targets across all state entities, supported by a national repository for data access

For Cape Town, advancing these principles would mean that the GHG inventory, which is already published on the City's Open Data Portal, could be strengthened with direct inputs from Eskom, national departments and other stakeholders, ensuring transparency and alignment with global standards.

The credibility of Cape Town's SOEC depends not only on the robustness of its energy and emissions analysis, but also on the strength of the data systems that underpin it. By championing open, standardised and mandated data-sharing practices, the City can ensure that its reporting continues to set the benchmark nationally, while also contributing to the broader reform of South Africa's data governance landscape.

6.1.4 Data gaps and anomalies identified during the SOEC project

A broad spectrum of data was collected. Identifying what we do not know is useful for improving data collection. The following is a sample, and the team will welcome further suggestions during stakeholder engagement after publication:

Gap: The actual price of electricity paid by backyarders connected through a main account holder and charged informally

Anomaly: The data shows registered passenger vehicles for Cape Town dropping per capita for the first time in available records, but not for the Western Cape more broadly. This seems improbable.

6.2 Annexure B: Statistical tables of the energy and carbon balance for Cape Town, 2023

Table 7: GHG emissions (GPC) balance (tCO_2e), Cape Town (2023)

GHG emissions (tonnes CO_2e)	GPC code	Scope 1	Scope 2	Scope 3	Total BASIC	Total BASIC+
Stationary energy						
Residential buildings	I.1	214 075	3 237 772	108 469	3 451 848	3 560 317
Commercial buildings	I.2	151 865	3 885 013	117 410	4 036 878	4 154 288
Local government	I.2	12 758	360 649	13 053	373 407	386 460
Manufacturing industries and construction	I.3	537 699	1 176 112	39 898	1 713 812	1 753 710
Energy industries	I.4	738 061	176	5	738 237	738 242
Energy generation supplied to the grid	I.4	1 305 988				
Agriculture, forestry and fishing activities	I.5	220 153	225 359	12 614	445 512	458 127
Non-specified sources	I.6	105 289	1 006 537	12	1 111 826	1 111 838
Fugitive emissions from mining, processing, storage and transportation of coal	I.7	NO				
Fugitive emissions from oil and natural gas systems	I.8	32 824			32 824	32 824
SUBTOTAL	**City-induced frame**	**2 012 725**	**9 891 620**	**291 461**	**11 904 345**	**12 195 805**
Transportation						
On-road transportation	II.1.1	4 625 802	IE	625 965	4 625 802	5 278 767
Railways	II.2.1	NO	NE	NE		
Waterborne navigation	II.3.1	82 741	NO	654 291	82 741	737 033
Aviation	II.4.1	172 241	NO	1 168 616	172 241	1 340 858
Off-road transportation	II.5.1	IE	IE	NO		
SUBTOTAL	**City-induced frame**	**4 880 785**		**2 475 872**	**4 880 785**	**7 356 657**
Waste						
Solid waste generated in the city	III.1.1	2 302 431			2 302 431	2 302 431
Biological waste generated in the city	III.2.1	9 177			9 177	9 177
Incinerated and burned waste generated in the city	III.3.1	3 102			3 102	3 102
Wastewater generated in the city	III.4.1	289 528			289 528	289 528
Solid waste generated in the city, treated out of boundary	III.1.2			NO		
Biological waste generated in the city, treated out of boundary	III.2.2			NO		
Incinerated and burned waste generated in the city, treated out of boundary	III.3.2			NO		
Wastewater generated in the city but treated, treated out of boundary	III.4.2			NO		
Solid waste generated outside the city, treated in-boundary	III.1.3	38 279				
Biological waste generated outside the city, treated in-boundary	III.2.3	673				
Incinerated and burned waste generated outside the city, treated in-boundary	III.3.3	NO				
Wastewater generated outside the city, treated in-boundary	III.4.3	NO				
SUBTOTAL	**City-induced frame**	**2 604 239**			**2 604 239**	**2 604 239**
IPPU						
Emissions from industrial processes occurring in the city boundary	IV.1	49 806				49 806
Emissions from product use occurring within the city boundary	IV.2	956 299				956 299
SUBTOTAL	**City-induced frame**	**1 006 104**				**1 006 104**
AFOLU						
Emissions from livestock	V.1	125 056				125 056
Emissions from land	V.2	69 770				69 770
Emissions from aggregate sources and non-CO_2 emission sources on land	V.3	82 189				82 189
SUBTOTAL	**City-induced frame**	**277 015**				**277 015**
TOTAL	**City-induced frame**	**10 780 868**	**9 891 620**	**2 767 333**	**19 389 368**	**23 439 821**

Key

		Sources required for BASIC reporting
		Sources required for BASIC+ reporting
		Sources required for territorial total but not for BASIC/BASIC+ reporting

Source: City of Cape Town (2025c)

Table 8: Energy balance (GJ), Cape Town (2023)

Energy source	Acetylene	Aviation gasoline	Biogas	Bitumen	Crude oil	Diesel	Fuel oil	Jet-A1	LNG
SUPPLY	**25**	**3 118**	**75 627**	**–**	**170 919 960**	**55 617 128**	**11 256 194**	**18 616 898**	**121 087**
Liquid and gas fuel distributors	25	3 118	75 627	–	–	55 617 128	11 256 194	18 616 898	121 087
Solid fuel distributors	–	–	–	–	–	–	–	–	–
Crude oil imports	–	–	–	–	170 919 960	–	–	–	–
Electricity – National grid	–	–	–	–	–	–	–	–	–
Electricity – Darling IPP	–	–	–	–	–	–	–	–	–
Electricity – SSEG	–	–	–	–	–	–	–	–	–
Electricity – City generation	–	–	–	–	–	–	–	–	–
TRANSFORMATIONS	–	–	–	–	**170 919 960**	**17 564 650**			
Refinery transformations					170 919 960				
Energy industries – Electricity generation						17 564 650			
FINAL CONSUMPTION	**25**	**3 118**	**75 627**	–	–	**38 052 478**	**11 256 194**	**18 616 898**	**121 087**
Residential buildings	–	–	–	–	–	–	–	–	–
Commercial buildings	–	–	–	–	–	1 816 404	5 438	–	–
Institutional facilities	–	–	–	–	–	170 142	–	–	–
Manufacturing industries and construction	1	–	–	–	–	341 919	1 905 689	12 186	121 087
Energy industries	–	–	–	–	–	20 869	937 283	480	–
Agriculture, forestry and fishing activites	24	–	–	–	–	747 668	18 969	–	–
Non-specified sources	–	–	–	–	–	204 091	–	–	–
On-road	–	–	–	–	–	32 710 851	–	–	–
On-road – institutional	–	–	–	–	–	959 141	–	–	–
Aviation	–	3 118	–	–	–	–	–	18 604 232	–
Waterborne navigation	–	–	–	–	–	1 081 393	8 388 815	–	–
Losses – City distribution									
Losses – Eskom transmission and distribution									
Density (kg/m³)	**786**	**710**	**1**	**1 350**	**853**	**845**	**958**	**790**	**452**
Net calorific value (MJ/kg)	**40**	**48**	**50**	**40**	**42**	**45**	**45**	**47**	**46**

Source: City of Cape Town (2025c)

LPG	Other	Paraffin	Petrol	Refinery gas	Waste oil	Anthracite	Coal	Coke	Wood	Electricity	Total (excl. Crude)
2 904 753	1 641	3 885 585	37 779 614	9 097 926	-	-	4 379 418	1 459 820	284 293	40 319 659	185 802 787
2 904 753	1 641	3 885 585	37 779 614	9 097 926	–	–	–	–	–	–	139 359 596
–	–	–	–	–	–	–	4 379 418	1 459 820	284 293	–	6 123 531
–	–	–	–	–	–	–	–	–	–	–	170 919 960
–	–	–	–	–	–	–	–	–	–	39 921 670	39 921 670
–	–	–	–	–	–	–	–	–	–	4 563	4 563
–	–	–	–	–	–	–	–	–	–	647 558	647 558
–	–	–	–	–	–	–	–	–	–	254 131	254 131
–	–	–	–	–	–	–	–	–	–	–	17 564 650
											170 919 960
											17 564 650
2 904 753	1 641	3 885 585	37 779 614	9 097 926	-	-	4 379 418	1 459 820	284 293	40 319 659	168 238 136
2 209 875	–	958 384	–	–	–	–	21 614	–	284 293	12 779 605	16 253 771
13 156	1 641	143 850	–	–	–	–	47 974	–	–	15 541 626	17 570 089
–	–	990	–	–	–	–	–	–	–	1 409 127	1 580 258
362 696	–	470 984	–	–	–	–	3 096 096	–	–	4 641 305	11 027 591
6 197	–	-	–	9 097 926	–	–	–	1 459 820	–	687	11 523 262
223 653	–	287 268	–	-	–	–	1 213 734	–	–	883 699	3 375 014
89 176	–	1 166 766	–	–	–	–	–	–	–	1 801	1 461 834
–	–	857 343	37 572 481	–	–	–	–	–	–		71 140 675
–	–	-	207 133	–	–	–	–	–	–		1 166 273
–	–	–	-	–	–	–	–	–	–		18 607 350
–	–	–	–	–	–	–	–	–	–		9 470 208
										3 301 250	3 301 250
										1 760 559	1 760 559
555	786	790	750	786	786						
46	40	47	46	50	40	27	24	28	17		

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