
# Accelerating a Market Transition in South Africa: Insights into the Bus Industry and Emerging Electric Bus Models

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C40 CITIES
climateworks FOUNDATION
tumi E-Bus Mission
icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION
ZEBRA ZERO EMISSION BUS

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# Acronyms and terminology

BAU – business as usual

BEB – battery electric bus (plural: BEBs)

BESS – battery energy storage system

BOC – bus operating company

BRT – bus rapid transit

BRT bus is defined in 2.1 (p.28)

BYD – Chinese vehicle manufacturing company

C40 – is a global network of leading cities tackling climate change

CBI – climates bond initiative

CCAP – Climate Change Action Plan

CCT – Cape Town

CIF – Climate Investment Funds

City – regarding a South African city generally means a metropolitan municipality ("Metro") as described in 1.2 (p. 26)

CKD – completely knocked down

CNG – compressed natural gas

CoE – City of Ekurhuleni

CoJ – City of Johannesburg

CoT – City of Tshwane

Commuter bus is defined at 2.1 (p. 28)

CTF – Clean Technology Fund

DBSA – Development Bank of Southern Africa

DCCS – Durban Climate Change Strategy

DDF – diesel dual fuel

DFIs – International development finance institutions

DTI – Department of Trade and Industry

e-Bus – electric bus, in this report primarily BEB, unless context suggests otherwise

ESKOM – SA state owned power utility

ESS – energy storage system

EU – European Union

EV – electric vehicle

GABS – Golden Arrow Bus Services

GCAP – Green City Action Plan

GCF – Green Climate Fund

GDP – gross domestic product

GDS – Growth and Development Strategy

GEF – Global Environment Facility

GEPF – Government Employees Pension Fund

GTS – Green Transport Strategy

Group A to E – the classification of bus services as described in 8.1 (p. 65)

ICCT – International Council on Clean Transportation

ICE – internal combustion engine

IDC – Industrial Development Corporation

IDP – Integrated Development Plan

IFC – International Finance Corporation

IPAP – Industrial Policy Action Plan

IPG – International Partners Group

IPTN – Integrated Public Transport Plan, required in terms of the NLTA

IRPTN – Integrated Rapid Public Transport Plan, term sometimes used to refer to BRT plans

ITP – Integrated Transport Plan

JET-IP – South Africa's Just Energy Transition Implementation Plan

JHB – Johannesburg

LDCF – Least Developed Countries Fund

loadshedding – where the national grid operator reduces power to some parts of the grid, as explained in Section 6.1 (p. 51)

MBT – minibus-taxi

MDB – multi-lateral development bank

Metro – metropolitan municipality, as described in 1.2 (p. 26)

MTMPS – medium term budget policy statement

MTEF – medium term expenditure framework

MJT – multi-journey tickets

NaTIS – National Traffic Information System, a national register managed by the Road Traffic Management Corporation that records and enforces all the requirements of the relevant legislation. eNatis is the digital version of NaTIS

NDOT – National Department of Transport

NDP – National Development Plan

NEV – new energy vehicles

NGO – non-governmental organization

NHTS – National Household Travel Survey

NLTA – National Land Transport Act (2009)

NLTTA – National Land Transport Transition Act (2000)

NTTT – national taxi task team

NMT – non-motorized transport

OEM – original equipment manufacturers

p/a – per annum (i.e. per year)

PPP – public-private partnership

PRASA – Passenger Rail Agency of South Africa

PT – public transport

PTNG – Public Transport Network Grant

PTOG – Public Transport Operating Grant

PTSAP – Public Transport Strategy and Action Plan

PUTCO - Public Utility Transport Corporation is a provider of commuter bus services in Gauteng

RFI – request for information

RTMC – Road Traffic Management Corporation

SABOA – South African Bus Operators Association

SABRATA – South African Bus Rapid Transit Association

SACTWU – Southern African Clothing and Textile Workers'

sXX (i.e. "s" followed by a number) – section in a law

SALGA – South African Local Government Association

SANEDI – South African National Energy Development Institute

SANTACO – South African National Taxi Council

SCCF – Special Climate Change Fund

SMME – small, medium, and micro enterprise businesses

SOE – state owned enterprise

taxi – in South Africa is usually referring to a minibus-taxi, rather than a metered taxi or similar e-hailing service

TCO – total cost of ownership

transit – public transport

UJ – University of Johannesburg

UK – United Kingdom

UN – United Nations

UNDP – United Nations Development Programme

UNFCCC – Framework Convention on Climate Change

US – United States

USD – United States dollars; for exchange rate, see 1.4 (p. 27)

VDL – manufacturing company

VOC – vehicle operating company

WWF – World Wildlife Fund

ZAR – South African rand

# Executive summary

## 1. Introduction and key conclusions

This report analyses and documents the state of the South African bus market, highlighting the opportunities available in the country to provide support to cities and bus operators on the deployment of electric buses (referred in this report as e-buses or battery-electric buses, BEBs).

It has been drafted by independent public transport specialists with no loyalty to any particular propulsion technology and is based on extensive collection of primary and secondary data, as well as interviews with key stakeholders. It focuses on the five South African cities that are members of C40, namely the three metropolitan governments ("metros") of the Gauteng province – Johannesburg, Ekurhuleni and Tshwane – as well as Cape Town and eThekwini (which includes Durban) as shown in Figure 1. These metro's constitute local government in these cities. The findings will be relevant to other cities in South Africa, too.

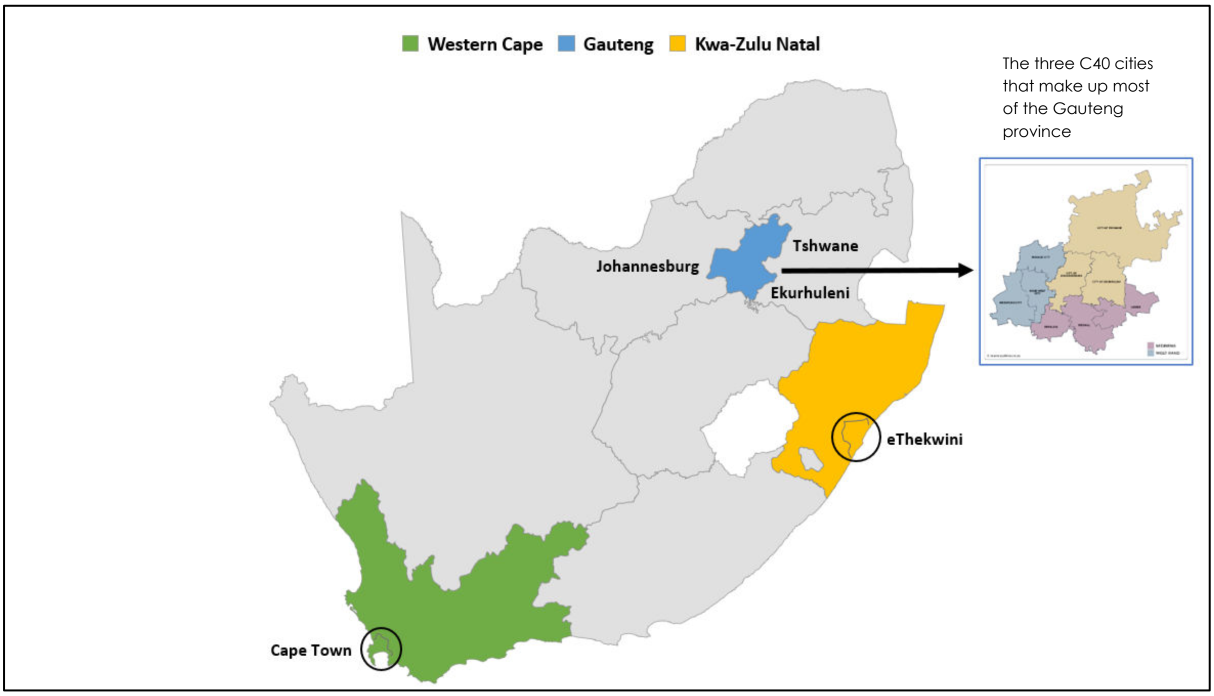



*Figure 1: Location of the C40 cities in South Africa and their provinces*

The key conclusion of this report is highly encouraging for those seeking to expand e-bus deployment: a transition from diesel to battery electric buses (BEBs) can already be justified purely on financial grounds under a reasonably wide range of circumstances. Moreover, given that e-bus costs are falling as global trends shift, driven by environmental and other motivations, the arguments for cities and individual operators to adopt this technology are powerful. That said, context and operational conditions differ, and therefore individual feasibility studies in each case are needed before deciding when and how to shift to electric vehicles (EVs).

There are various ways whereby government can support this shift, but the most important perhaps is to provide greater clarity about the future of bus contracting and subsidisation in South Africa, regardless of any BEB related initiative. Further measures by government and other stakeholders can help accelerate the shift, such as lowering financing costs, adjusting import taxes, investing in electricity infrastructure to facilitate charging, and developing business models better attuned to the demands of the new technology.

The basis for the shift is that, while the capital cost of an electric bus is currently significantly higher than a diesel bus, its operating costs are much lower. Thus, where buses are used sufficiently intensively and have a reasonably long useful life, the total cost of ownership (TCO) of e-buses is lower than that of diesel buses. Our modelling, explained in detail in section 15, shows that, under a realistic set of operating conditions, where buses are financed over 10 years at an 11% interest rate, and are driven for an average 50 000 kilometres per year for 12 years, the cost of e-buses is currently marginally higher than diesel buses; however, as kilometres per year increase and/or the useful life is extended, the TCO of e-buses becomes progressively cheaper than diesel buses. As technology and economies of scale improve, this is likely over time to tip significantly further in favour of e-buses.

The challenge then becomes funding the upfront capital costs of e-buses and the electricity supply and charging infrastructure that the new technology requires. To address this, securing lower interest rates, particularly through climate mitigation mechanisms, is vital. This financial support is essential to counterbalance the higher initial expenses. Alongside favourable financial conditions, establishing certainty in contracting conditions is equally crucial. By ensuring a supportive financial and contractual environment, the transition to e-buses becomes more feasible, allowing for a sustainable shift in public transportation infrastructure.

## 2. Context for e-bus deployment

### a) Modal split

The public transport sector in the five C40 cities consists of three main modes of transport:

- the traditional commuter rail system; and the Gautrain high-speed rail service between Johannesburg, Tshwane, and the Oliver Tambo International Airport;
- the subsidised and unsubsidised formal commuter bus industry, including the Bus Rapid Transit (BRT) systems;[1] and
- a growing and increasingly dominant informal minibus-taxi industry, using mostly 16-seater minibuses.

Figure 2 Compares the main modes of travel used nationally by households in 2013 and 2020 (Stats SA, 2020). It shows a relative decline in bus and train usage and a concomitant rise in use of private cars and informal minibus-taxis.

[1] A "commuter bus" is typically a conventional regular-service bus used for public transport, designed to ferry passengers on daily commutes, usually between residential areas and places of work or education. It differs from a BRT (Bus Rapid Transit) bus, which typically operates within a dedicated, segregated lane or road system designed for high-capacity, high-frequency public transit, often with stations for pre-board validation and level fast boarding, offering a faster and sometimes more efficient service than conventional buses. Commuter buses usually integrate into regular traffic and may have varied routes, whereas BRT buses typically follow specific, often exclusive, corridors with limited stops, although in South Africa some BRT systems include some routes in mixed traffic.

Here, however, the term “commuter bus industry” is used with a broader meaning, including BRT.

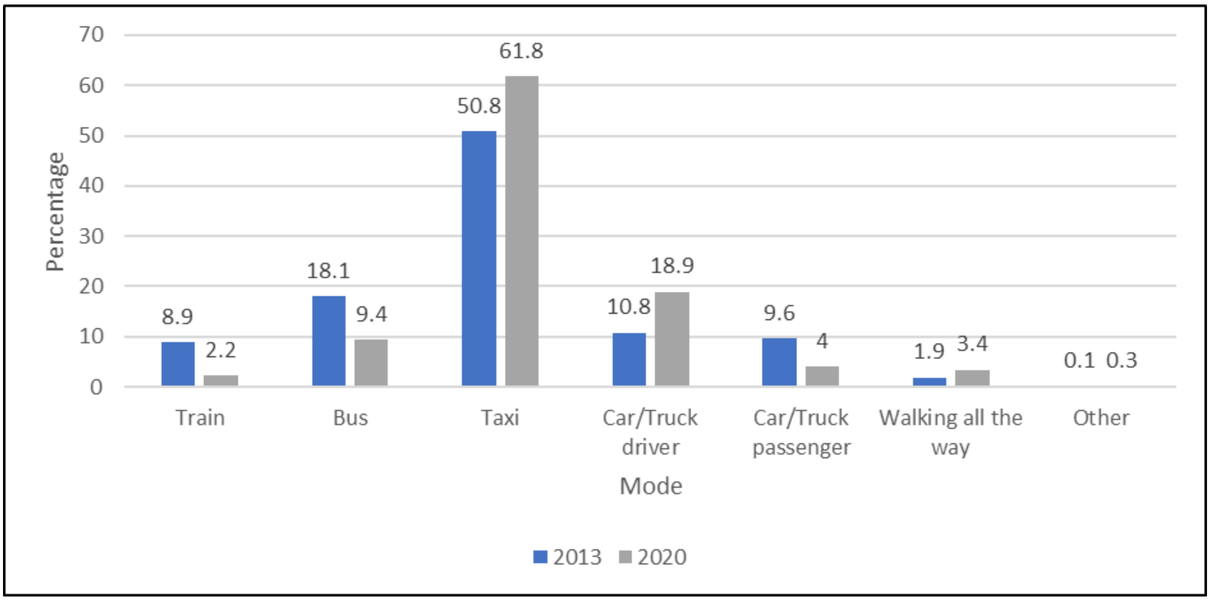



*Figure 2: Main mode of travel used by households in 2013 and 2020 (national figures).*

*(Stats SA, 2020).*

### b) Mobility patterns and key policy responses

South Africa's apartheid history, which sought to configure social geography to divide the country by race, has resulted in very long commuting distances for many workers. In addition, there has been a strong private car orientation, including substantial freeway development from the 1970s, which has exacerbated the urban dispersion, resulting in long commutes.

The apartheid government of the past implemented mass transit solutions to address this, including subsidised bus services and the extension of subsidised commuter rail to some key areas. Under the democratic government there has been uncertainty around how to reform the legacy system in a post-apartheid era. This has led to stagnation, which has undermined the formal, subsidised public transport system.

A key aspect of the democratic dispensation under the Constitution, adopted in 1996, is decentralisation, which has sought to create strong city governments with widely drawn boundaries able to reconfigure urban geography over time through assigning them substantial constitutional powers over the built environment, backed by significant financial resources, including own revenues. Initiatives to devolve responsibility for public transport have formed part of this approach.

Other important policy initiatives have included:

- Rationalising the way urban public transport services are provided by introducing regulated competition for public transport routes based on well-designed transport plans and structured tendering and concessioning of routes defined by these plans.
- Improving the governance and quality of the informal minibus-taxi sector.
- Adopting a Public Transport Strategy and Action Plan (PTSAP) in 2007 that emphasizes the need to establish comprehensive public transport networks actively controlled and managed by a strong public network entity linked to the city authority and comprised mainly of rail and bus rapid transit.

### c) Patchy implementation creates uncertainty

The implementation of these policies and legislation has been patchy. Firstly, attempts to formally retender and contract subsidised bus services (or renegotiate them as permitted under certain limited circumstances) in line with the NLTTA (2000) proved difficult to implement. Secondly, despite very significant resources having been directed at reviving commuter rail, results have thus far been poor. Thirdly, the BRT initiatives at municipal level funded by the PTNG grant have proven complex and slow to implement, and expensive in relation to their impact. Fourthly, the implementation of decentralisation has been and remains contested for a variety of reasons.

Under these circumstances the formal conventional bus services have mostly stagnated for the last two decades, with contracts rolled over on a short-term basis in the face of deadlock around their decentralisation to municipalities and other reform intentions. While this allows bus companies to continue operations without having to tender, termination of contracts could happen at relatively short notice, making recapitalisation of the fleet risky for operators contracted within this model.

This is compounded by ongoing uncertainty about the future of subsidies, with the national Department of Transport recently circulating a new draft subsidy policy that could have significant adverse implications for the subsidised bus industry, although it is still subject to revision.

### d) Different responses to uncertainty

Despite this uncertainty, some bus companies have continued to recapitalise fleets. For example, Golden Arrow Bus Services (GABS) in Cape Town has continued to recapitalise its fleet of 1 100 vehicles to the tune of approximately 60 buses per year, and has now committing to do so with e-buses. It is understood that PUTCO in Gauteng, on the other hand, with a current fleet of roughly 1 400 buses, has not been recapitalising at the same rate, although currently not with e-buses.

### e) Public finance

Any proposed strategy for deploying e-buses must consider the current challenging fiscal environment at a national and local government level.

While in the first dozen or so years after the democratic transition economic growth was reasonably strong, this was reversed with the global financial crisis and has not subsequently recovered. Patterns of fiscal stress are evident in the increase in government debt as a proportion of GDP since 2009, as shown in Figure 3. Apart from constraining public expenditure, this pushes interest rates higher, which impacts on borrowing, an essential element of e-bus deployment.

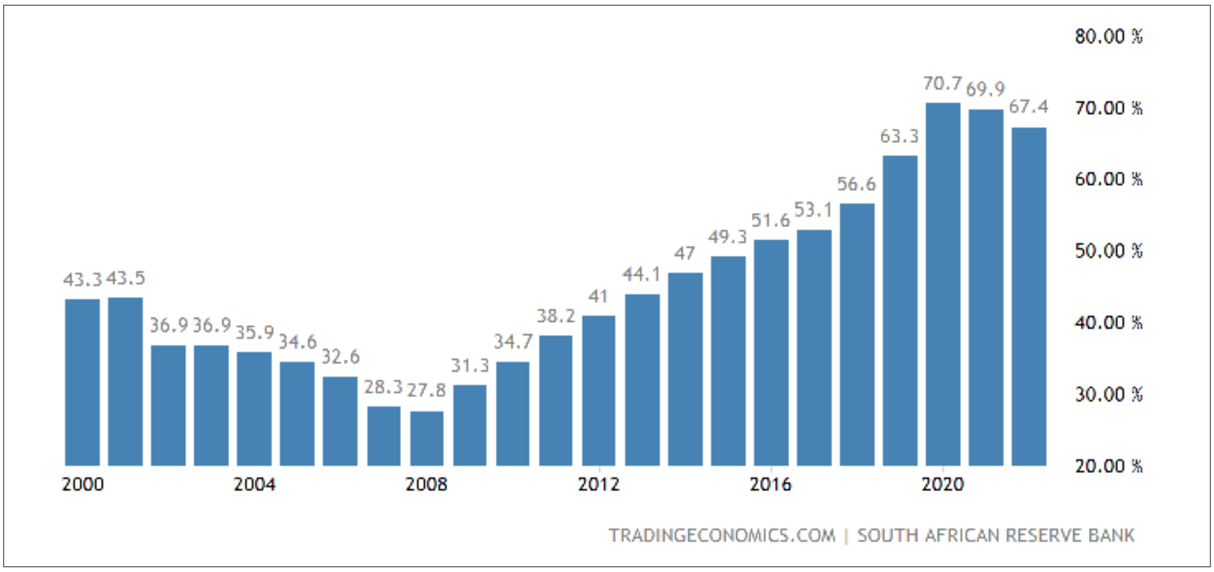



*Figure 3: Total government debt as a percentage of GDP (2000 to 2022)*

*Source: Tradingeconomics.com (sourced 2023/08/04)*

Because of the decentralised approach, borrowing for bus purchases by local government is often against local government balance sheets; while borrowing by bus operators dependent on recurrent subsidies must consider projected local finances and anticipated grant flows.

Financing of urban local government in South Africa is relatively well developed for a country of its overall level of development, with metropolitan governments (such as the C40 cities) collecting a large proportion of their revenue themselves, rather than relying on grants from national government. However, there are significant challenges in a number of cities; service delivery has deteriorated in recent years, including in areas such as electricity and water distribution as well as road maintenance. Meanwhile local revenue collection has come under pressure. Unstable coalition governments have exacerbated challenges in already weakened local administrations. The country's National Treasury reports on key high-level indicators of financial stress show pressure to a greater or milder degree across all five C40 cities.

**f) Electricity supply crisis**

South Africa is also currently experiencing a severe electricity supply crisis. Unless resolved, this will impact the potential for introducing e-buses in the country. South Africa first experienced what it terms 'load shedding' in 2007. Although there have been long periods since then without loadshedding, it has intensified from 2018 and reached critical levels in the last two years, especially during 2023.

South Africa has had a highly centralised electricity sector, with almost all generation and transmission and a large share of distribution undertaken by a state-owned corporation, Eskom, which has deteriorated significantly over the last 15 years.

Various measures have been or are now being introduced to address the crisis, with the single most important decision having been taken in July 2022 to open up generation to the private sector. This is leading to a surge in private renewable energy projects suggesting that, along with other initiatives such as the separation of Eskom into three independent companies for generation, transmission, and distribution, matters are improving. Some cities are actively involved in encouraging private sector suppliers and are likely to contract to purchase electricity from them.

**g) *Just Energy Transition* Investment and Implementation Plan**

Part of the response to the electricity crisis has been to develop strategies that use addressing the crisis to leverage a major shift from coal fired generation to renewables. South Africa's Just Energy Transition Investment Plan (JET-IP) lies at the core of this and was published in November 2022.

The JET-Partnership and associated plan have been conceived by the South African government, ESKOM, and a collection of international partners that have pledged support to South Africa's energy transition mostly in the form of lower interest loans and loan guarantees to support a 'Just Energy Transition'. As of late September 2023, the pledged amount was US$11.8 billion.[2] A selection of other countries is now beginning to adopt a similar approach.

While most of the current plan is aimed at transformation of the electricity supply sector, the two other foci are new energy vehicles and green hydrogen. This initiative has potential for expanding e-bus manufacture in South Africa and lowering the cost of capital for e-buses, although specific mechanisms in this regard are not yet in place.

A year after the publication of the JET-IP, in November 2023, the Just Energy Transition *Implementation* Plan (JET ImpP) was issued providing more detail.

**h) National and local environmental policies**

The need to reduce emissions, including in transport, has been recognized in various government policy documents. These include:

- Green Transport Strategy for South Africa (2018-2050);
- Auto Green Paper on Advancement of New Energy Vehicles in South Africa (published by the government for comment); and
- National Department of Transport's Green Procurement Guidelines for Government Vehicle Fleet.

As this C40 report was being finalised, cabinet approved and published:

- Electric Vehicles White Paper (dated November 2023).

As stated in its foreword, the White Paper 'is grounded in the principle that decarbonisation should not lead to de-industrialisation but rather be leveraged for growth, deepening the automotive value chain, fostering growth of local industry, and ensuring the transition aligns with economic priorities'. Central to its approach is 'the primacy of domestic production of EVs', which it views as 'the cornerstone of the transition, fortified by tailored market development interventions'.

All five C40 cities have adopted 'climate change action plans' aimed at accelerating a shift to lower emissions.

[2] www.news24.com 29 September 2023

Meanwhile the Development Bank of Southern Africa (DBSA) has embarked on a Global Environment Facility (GEF) funded project to explore through pilots the introduction of e-buses in some of the C40 cities.

## 3. Current bus industry in C40 cities

### a) Business models in the bus industry in C40 cities

There are six identifiable different business models for public buses in the five C40 cities which are summarised below.

Procurement can be either by the public sector, or by private operators operating under government contracts or concessions, or independently.

- **Group A**. Formal private operators contracted and subsidised via mainly provincial government using a national grant, for example, private sector operators who also own their own fleet such as PUTCO and GABS.
- **Group B**. Legacy conventional municipal bus services: Within this group are two models: Municipally owned and operated, and municipally owned but privately operated (Durban municipal bus services).
- **Group C**. Bus rapid transit systems or related – These are also municipally contracted but have different institutional origins and arrangements from the legacy conventional municipal bus services. There are various models within this group, but we identify two key variations: BRT with private operators using their own vehicles, and BRT with private operators using municipally owned vehicles.
- **Group D**. Scholar transport: These are the services contracted by various public education departments to transport school children to and from school in some areas.
- **Group E**. Informal, private small operators (informal minibus-taxi sector)
- **Group F**. Other, private, unsubsidised bus operators: This consists of a large number of vehicles operating under many different circumstances but mostly outside the core of the public transport sector. They include, for example, the tourist coach industry.
- **Group G**. Feeder bus services to another mode of public transport, contracted by the authority running such other mode. The Gautrain feeder service is the main example, and forms part of a provincial concession to the contacted rail concessionaire.
- **Group H**. Buses operated not by a dedicated bus operator but by the public or private sector for their own internal use, such as for transporting their own employees.

### b) Bus numbers and age distribution

According to the latest available national vehicle ownership register (NaTIS), the current conventional bus fleet in South African C40 cities (excluding the informal minibus-taxi sector) comprises 11 881 buses registered to both government and private owners. Over 50% of the buses have a capacity ranging from 71 to 94 passengers, while 25% of the buses accommodate between 51 to 70 passengers. A small number of buses have a capacity exceeding 110 passengers. According to the register, only 11 of these buses are currently green technology buses.

Figure 4 illustrates the distribution of buses among the five cities. Gauteng has the highest number of registered buses with 10% of the total C40 cities bus fleet operating in Ekurhuleni, 26% in Johannesburg, and 33% in Tshwane. The City of Cape Town has a significant fleet, accounting for 17% of the total, while eThekwini has 14% of the total

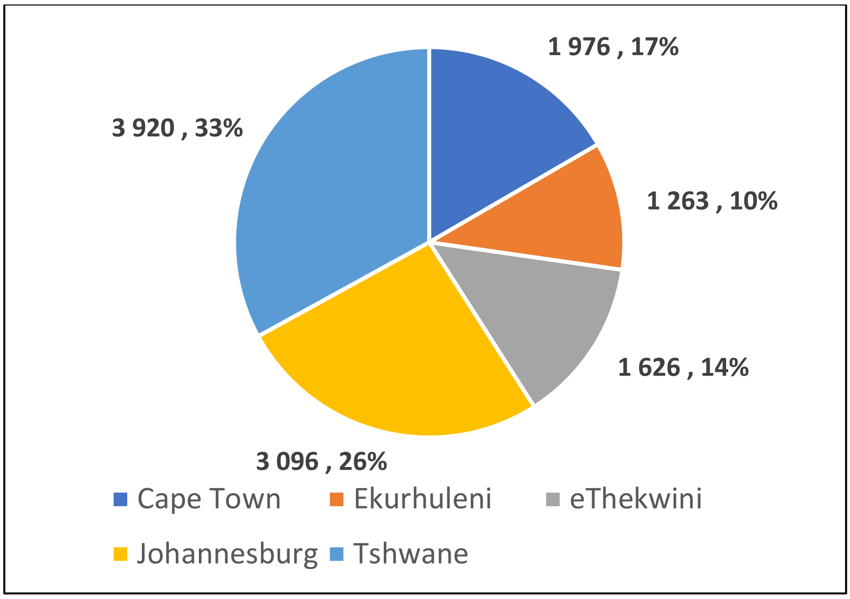
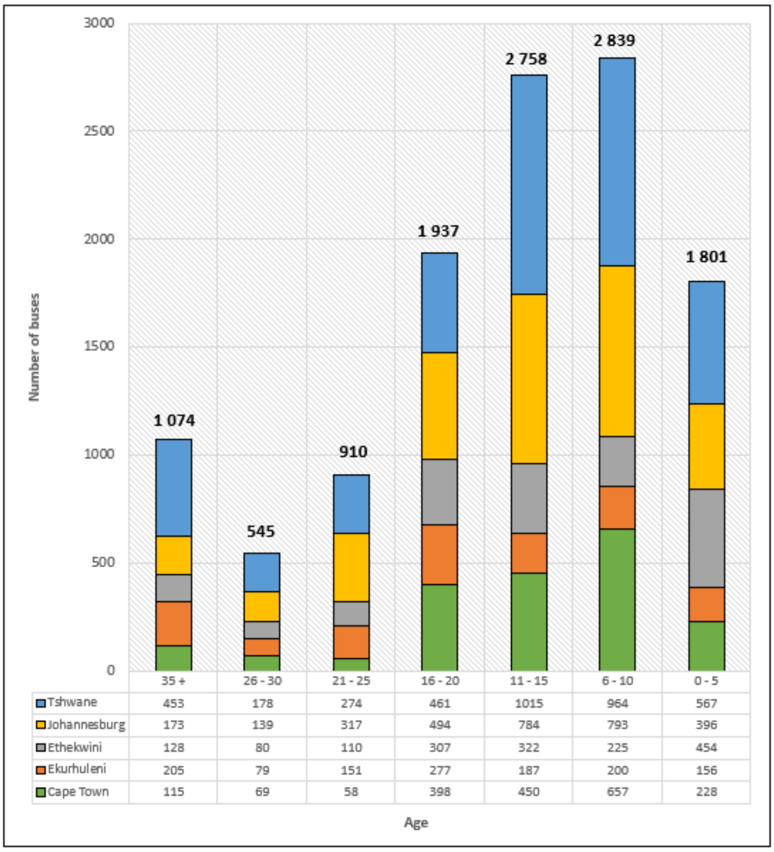



*Figure 4: Total number of buses in each C40 city*

*Extrapolated from NaTIS vehicle registration data, 2023*

Figure 5 shows the age of buses in the South African C40 cities. Most vehicles are 6 to 10 years old, followed by vehicles 11 to 15 years old. The average bus age in the C40 cities is 17 years.




| | 35 + | 26 - 30 | 21 - 25 | 16 - 20 | 11 - 15 | 6 - 10 | 0 - 5 |
|---|---|---|---|---|---|---|---|
| Tshwane | 453 | 178 | 274 | 461 | 1015 | 964 | 567 |
| Johannesburg | 173 | 139 | 317 | 494 | 784 | 793 | 396 |
| Ethekwini | 128 | 80 | 110 | 307 | 322 | 225 | 454 |
| Ekurhuleni | 205 | 79 | 151 | 277 | 187 | 200 | 156 |
| Cape Town | 115 | 69 | 58 | 398 | 450 | 657 | 228 |

*Figure 5: Age of buses in South African C40 cities*

*Extrapolated from NaTIS vehicle registration data, 2023*

### c) Bus builders and suppliers

South Africa has major bus body builders (including Busmark, Marcopolo SA, MVC SA and Busco). These bus body builders can manufacture bodies for imported chassis, working with bus suppliers.

It has major bus suppliers, including MAN SA, MB Truck City, Mercedes Benz, MiPower, Real African Works, Scania and Volvo SA. Some of these suppliers are gearing up to provide e-buses to the South African market. There are further programmes aimed at encouraging the manufacture of electric engines in South Africa, which may be relevant to the manufacture of e-buses in the country.

Figure 6 shows the market share of buses in South Africa by manufacturer, this data was obtained from the 2023 NaTIS vehicle registration data. The results show that Mercedes Benz holds the largest share, followed by MAN, and Volkswagen.  Note that this analysis is of all registered buses with passenger capacity of more than 35, not only those vehicles that were registered in recent years.

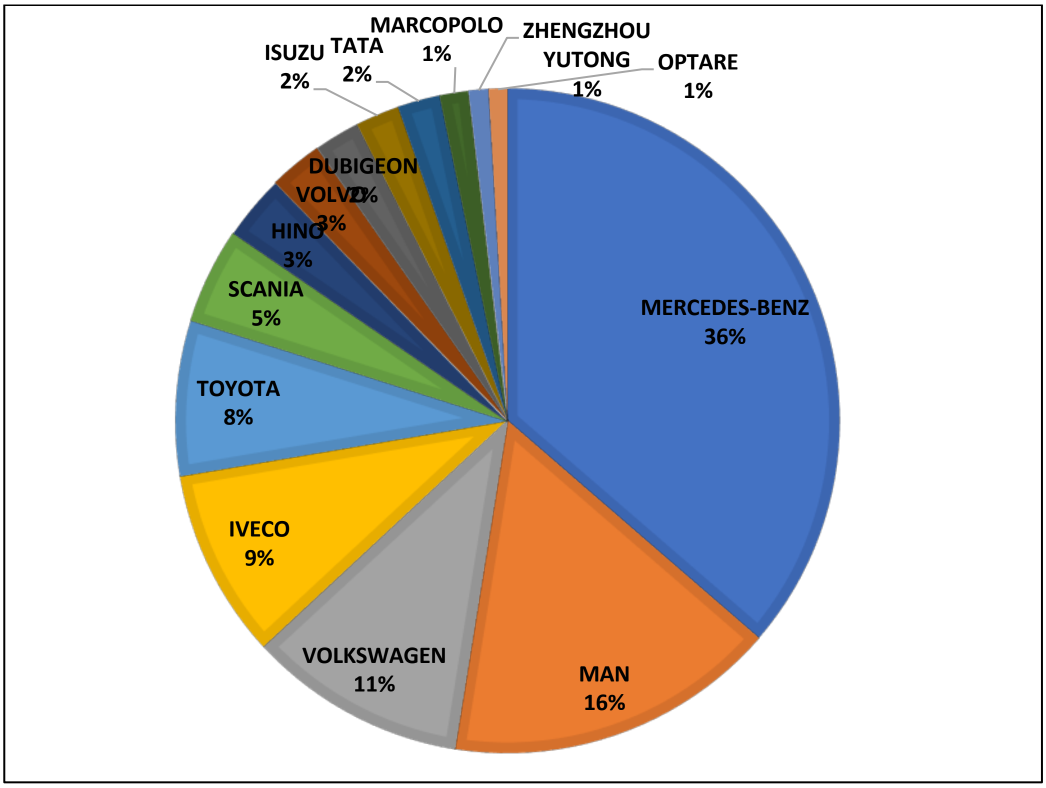



*Figure 6: South African bus market share by manufacturer*

*Extrapolated from NaTIS vehicle registration data, 2023*

### d) Capital cost of buses

The capital cost of buses is a significant purchase criterion for cities and operators. However, cost figures are highly context-specific and often vary between countries or regions due to different circumstances, such as taxation, fees, buying incentives, or subsidies.

Table 24 in the body of the report (p. 92) provides an estimate of the purchase cost for diesel and e-buses in South Africa. It indicates that for a standard commuter bus (about 12m in length), the purchase price of an e-bus is close to double that of the cost of its diesel counterpart.

However, the higher capital costs are offset to a greater or lesser degree by lower operating costs, as discussed in 4 b) regarding the cost model outcomes.

Because the core capital cost of e-buses is higher, a number of additional factors drive the TCO up even more, such as VAT (since, given the way public transport is treated for VAT, input VAT cannot be reclaimed), as well as insurance.

One factor currently making e-buses in South Africa more expensive, especially for initial pilot projects or roll-out when e-buses may need to be imported fully built, is the import tax regime. Fully built-up vehicles attract high additional taxes compared to vehicles that are manufactured – or at least assembled – locally. Diesel buses are built locally, reducing the tax burden; however, the local e-bus industry has not yet developed, although such industry is likely to develop once adequate orders for e-buses are placed.

**e) Anticipated bus replacement per year**

The total number of buses likely to be purchased in future is an important factor that will inform strategies of bus suppliers regarding local manufacture, since it gives an indication of possible economies of scale.

Based on an analysis of fleet age and assuming various bus replacement and public transport expansion scenarios discussed in section 11, Table 1 sets out the projected number of buses likely to be replaced in C40 cities every year between 2024 and 2050, in each case with the total projected bus numbers for the period in the first column shown in brackets.

Table 1: Projected average annual bus purchases in C40 cities – growth rate scenarios

| Period | Years in period | Business as Usual: 2.7% Annual (period totals) | Realistic growth: 3.1% Annual (period totals) | Aspirational growth: 8.1% Annual (period totals) |
|---|---|---|---|---|
| 2024-2025 | 2 | 721 (1 441) | 747 (1 494) | 1 116 (2 233) |
| 2026-2030 | 5 | 767 (3 834) | 796 (3 981) | 1 210 (6 048) |
| 2031-2035 | 5 | 715 (3 575) | 746 (3 730) | 1 206 (6 031) |
| 2036-2040 | 5 | 852 (4 259) | 900 (4 500) | 1 687 (8 436) |
| 2041-2045 | 5 | 746 (3 729) | 802 (4 012) | 1 851 (9 255) |
| 2046-2050 | 5 | 1 202 (6 008) | 1 306 (6 531) | 3 328 (16 639) |

*(Period totals shown in brackets)*

*Extrapolated from NaTIS vehicle registration data, 2023*

In the five C40 cities, the number of new buses to be purchased per year is projected to grow as follows:

- Scenario 1 (business as usual), 721 new buses per year in 2030 to 1 202 by 2050;
- Scenario 2 (realistic growth), 747 new buses per year in 2030 to 1 306 by 2050;
- Scenario 3 (aspirational growth), 1 116 new buses per year in 2030 to 3 328 by 2050.

Nationally, the number of new buses to be purchased per year is projected to grow as set out below (for detail, see p.98):

- Scenario 1 (business as usual), 1 009 new buses per year in 2030 to 1 044 by 2050;
- Scenario 2 (realistic growth), 1046 new buses per year in 2030 to 1 123 by 2050;
- Scenario 3 (aspirational growth), 1 563 new buses per year in 2030 to 2 591 by 2050.

## 4. The feasibility of e-bus deployment in South Africa

### a) The GABS e-bus pilot

In assessing the scope for e-bus deployment in South Africa, the most important initiative is the pilot project undertaken by the Golden Arrow Bus Company, run from 2021.

GABS began the pilot with an electric 36-seater BYD vehicle. In 2022 it procured an additional electric 65-seater BYD commuter bus, which was better suited to their operational requirements in terms of seat capacity, and was imported fully assembled. A year-long pilot trial of the new electric 65-seater BYD commuter bus was run to compare the energy efficiency results obtained from the initial 37-seater e-bus trial, and to learn other necessary lessons. It basically confirmed the efficiencies of e-buses from the initial pilot.

The field tests have found the following:

- E-bus battery range has been confirmed at 300 km on a full charge;
- It takes 2 to 3 hours to fully charge these e-buses;
- Energy efficiency was found to be around 1.05 kWh per km for a 36-seater BYD bus and 1.10 kWh per km for a 65-seater BYD bus;
- Energy cost savings of almost 69% was achieved compared to a conventional diesel bus by the 36-seater and energy cost savings of 70% was achieved by the 65-seater bus;
- Performance along local topography was confirmed to be good;
- Maintenance impact showed a 50% savings in spare parts, 30% savings in labour, and 80% savings in oils and lubricants for both e-bus sizes;
- Passengers reported a quiet and comfortable ride with improved air quality at bus stops due to the reduction in fumes.

GABS projected a saving of about R660 000 in fuel costs per bus per year by switching from a diesel bus to an e-bus (using May 2023 prices). Despite the higher purchase cost of an e-bus, which is roughly double that of a diesel bus (including import duties and ad valorem taxes), the bus fleet operator would still benefit from the fuel savings accrued – as well as other savings on operations.

Based on findings thus far GABS envisages replacing its existing fleet with 60 e-buses every year, starting from 2024, until its full fleet of 1 100 diesel buses has been replaced. This represents an estimated annual investment of approximately R360 million.

GABS' conclusion is that this would allow the e-bus to pay for itself over 8 to 12 years. This means that thereafter operating profits per bus would be significant, until the bus needs replacement.

Since GABS raises its own capital funding and takes direct financial responsibility for such a decision, its resolve to switch to e-buses shows its confidence in e-buses being more cost-effective than diesel buses over the life of the bus.

### b) Financial modelling of e-bus deployment

The findings of the GABS pilot generally correspond with financial modelling that has been carried out in this study to test the feasibility of general e-bus deployment in South Africa. The framework for the model is shown in Figure 7.

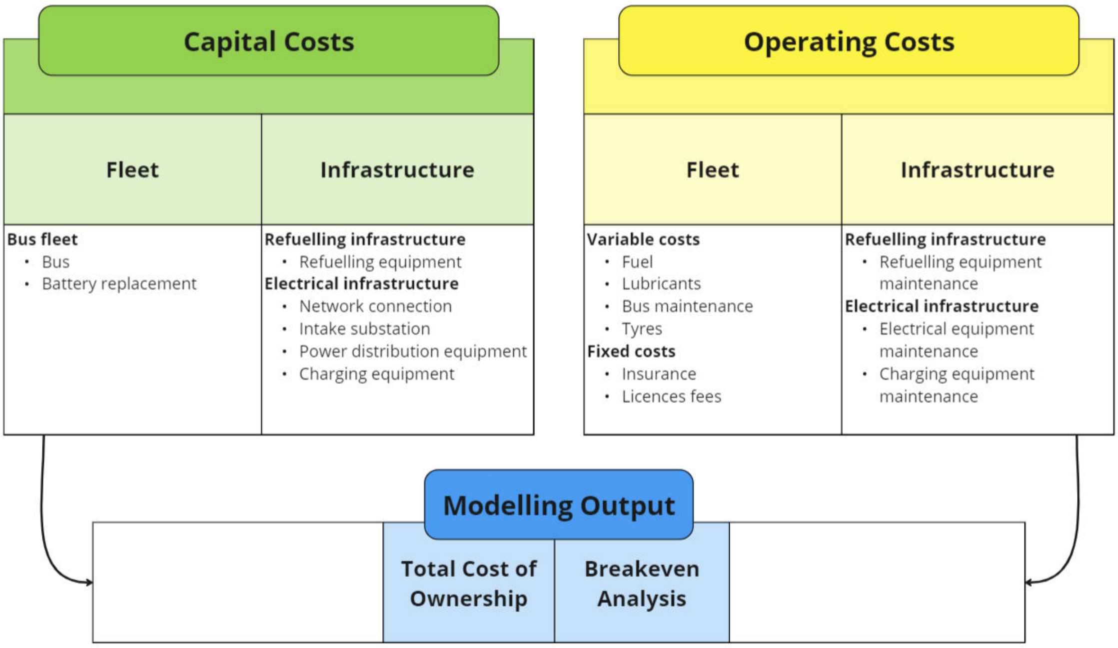



*Figure 7: C40 SA cost model framework.*

*Source: C40 SA Financial Model.*

Based on the base case scenario assumptions, the modelling results are shown in Figure 8, indicating that the overall total cost of ownership (TCO) of a BEB (R37.62 per km) and a Euro VI diesel bus (R37.56 per km) are very similar. The TCO of a diesel bus is driven substantially by its higher operating costs, specifically the cost of fuel and maintenance. In case of the e-bus, a significant portion of the bus cost is due to the initial and replacement battery. Additionally, infrastructure cost e-buses (supply of electricity and charging) is much higher than infrastructure costs required for a diesel bus fleet.

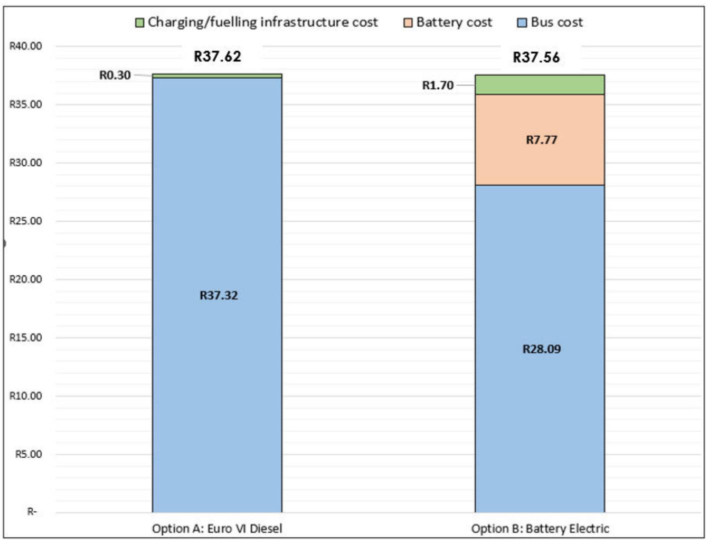



*Figure 8: Total cost of ownership (TCO) (R/km) (all bus and infrastructure costs included)*

*Source: C40 SA Financial Model.*

Figure 9 shows that, when considering the cumulative TCO for bus and infrastructure costs over a 16-year period, the cost of an e-bus gradually decreases compared to that of a diesel bus. For BEBs, the high initial costs associated with supplying the electrical charging infrastructure are balanced by lower operational costs, with an e-bus becoming more cost-effective than a diesel bus from year 13.

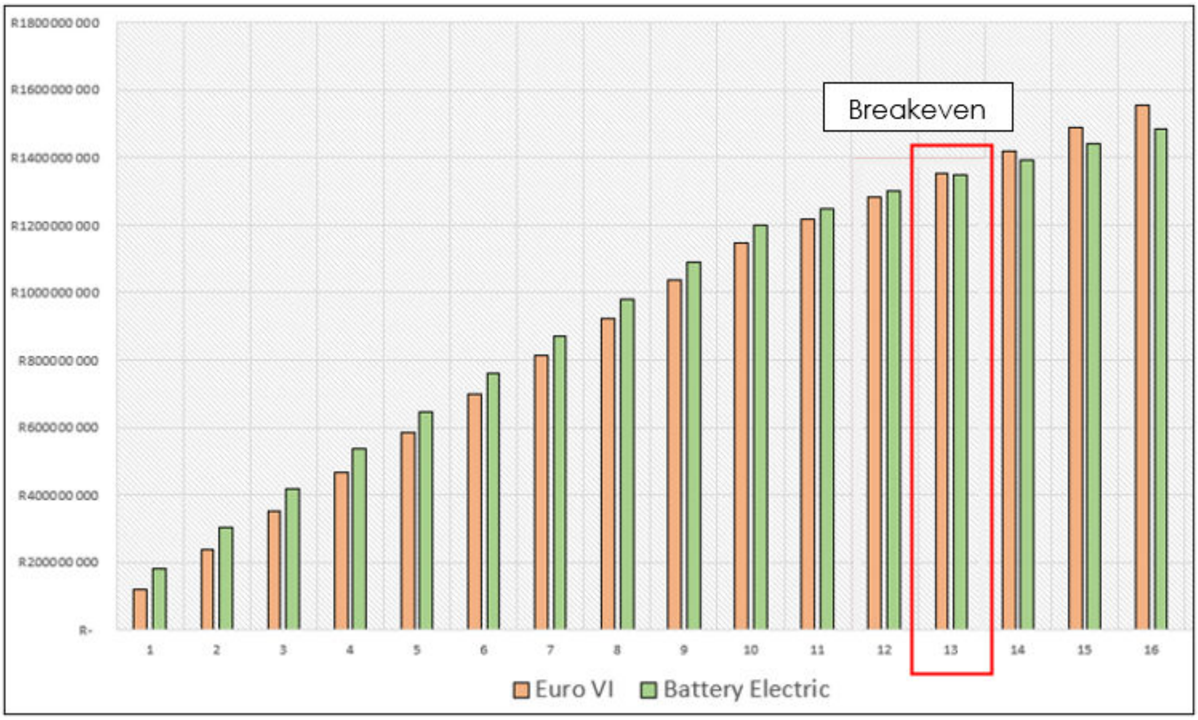



*Figure 9: Cumulative annual TCO (all bus & infrastructure costs included)*

*Source: C40 SA Financial Model*

Figure 10 shows the bus purchase and operating costs only on a cost-per-kilometre basis. As one would expect, if infrastructure costs for charging and fuelling are excluded (e.g. where a municipality covers the cost of enhanced electricity supply required for charging, and related costs), the cost of a BEB over a 16-year useful life of the bus is lower than a diesel bus – and this at 4% (R35.86 vs R37.32 per km).

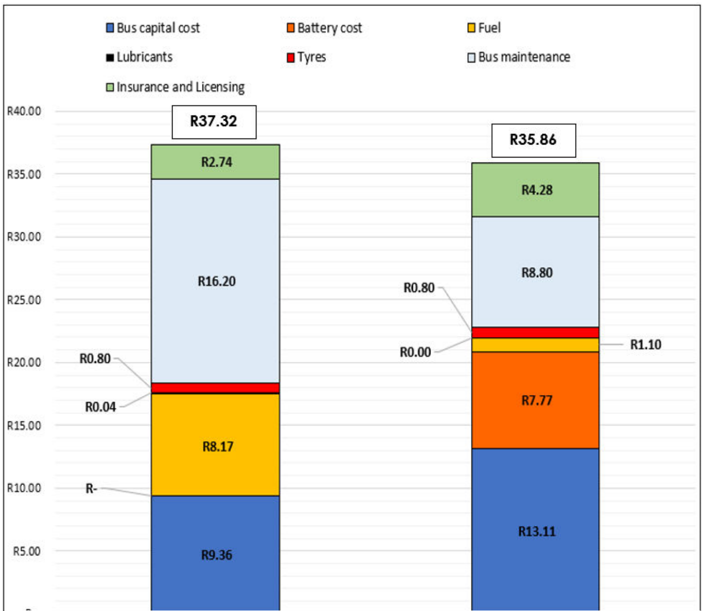



*Figure 10: Bus ownership and operating costs only (infrastructure costs excluded)*

*Source: C40 SA Financial Model*

As mentioned, the largest cost component of a diesel bus is fuel and maintenance. The analysis shows that at a fuel price of R21.50 per litre and an electricity price of R0.99 per kWh, the fuel / propulsion cost of a diesel bus is significantly more expensive than that of an e-bus.

Similarly, regarding maintenance costs, a diesel bus is approximately 55% more expensive to maintain when compared to an e-bus.

Figure 11 shows the cumulative bus capital and operating costs, excluding charging / fuelling infrastructure, over a 16-year period. As expected, when one excludes infrastructure costs (e.g. where a municipality covers the cost of enhanced electricity supply required for charging, and related costs), the cumulative annual cost for a BEB breaks even with the annual cost for diesel buses in year 9 (as opposed to year 13 when infrastructure costs are included). Given the volatile price of diesel, it may be possible to achieve this breakeven point sooner.

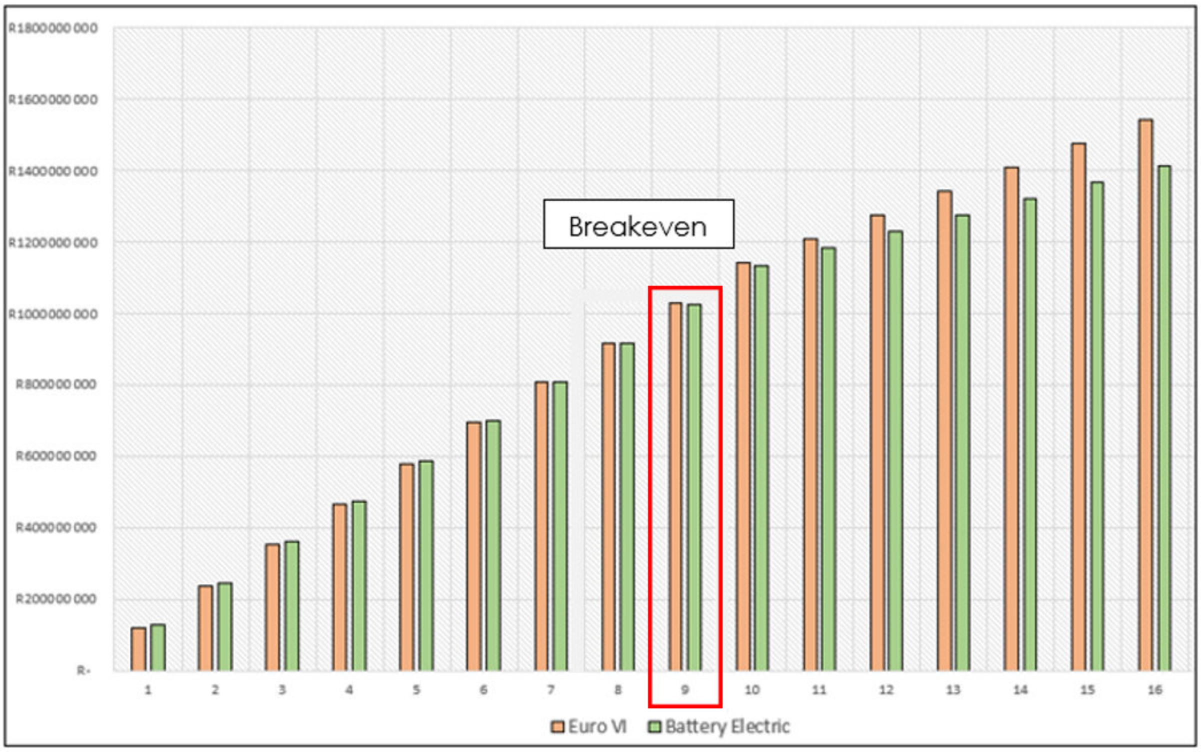



*Figure 11: Cumulative annual bus ownership & operating costs only (infrastructure costs excl.)*

*Source: C40 SA Financial Model*

The findings from this C40 South African model confirm that of most literature on the topic, namely that:

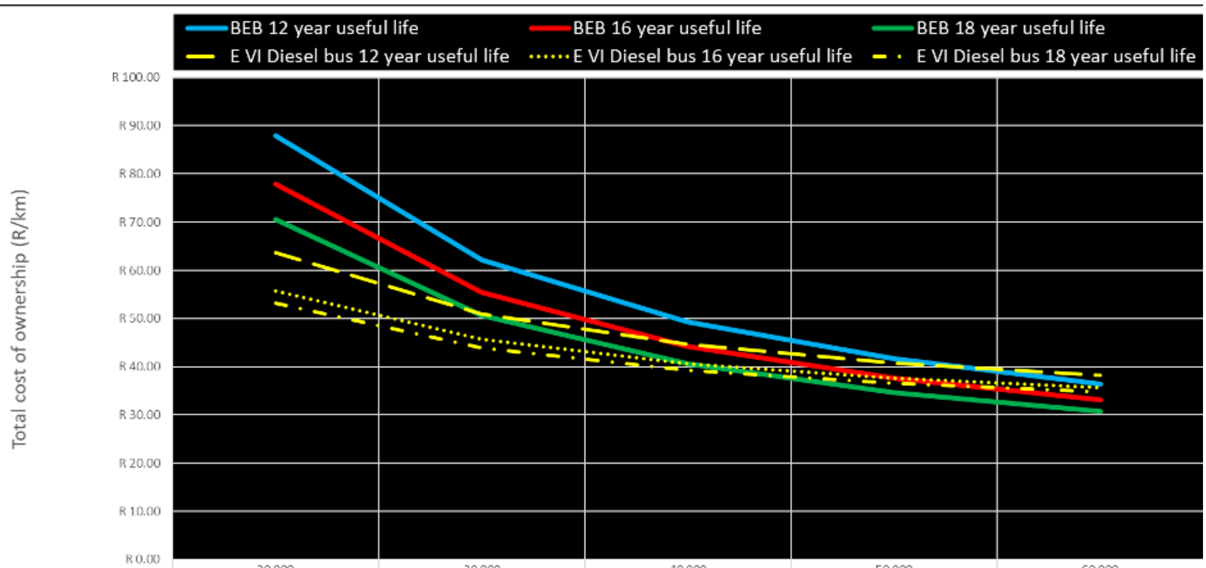
- e-buses have a high upfront capital cost primarily associated with an expensive battery and the need for battery replacement after 8 years, as well as the high cost of supplying charging infrastructure;
- e-buses are more cost-effective to operate than conventional buses, offering significant long-term financial benefits.

This study shows that, when all costs are considered (including charging and other infrastructure costs) over a longer operational period, the TCOs between these two bus propulsion options are essentially on par – since the extra capital costs regarding e-buses are recouped by year 13. If charging and infrastructure costs are excluded (e.g. if they are funded by other means), the cost of the higher capital cost of e-buses are recouped by year 9.

In addition, the cost, lifespan, and weight of the batteries is continuously improving. So, while today's cost model is based on current battery technology for the battery replacement costs, the likely improved battery technology in future will result in lower costs. It is important that cities consider that the output of models using today's numbers is therefore likely to be conservative, and the costs of e-buses are likely to become even lower as technology improves.

The potential economic and environmental benefits of BEB are promising, yet their successful realisation hinges on specific conditions.

In summary, both the length of the useful life of a bus and its annual kilometres greatly influence operational cost-effectiveness, regardless of bus type. Specifically, the TCO of a BEB bus becomes increasingly competitive compared to diesel as annual kilometres increase (becoming more economical from around 40,000 kilometres per year onwards) and as useful life increase.




| | 20 000 | 30 000 | 40 000 | 50 000 | 60 000 |
|---|---|---|---|---|---|
| BEB 12 year useful life | R 87.96 | R 62.21 | R 49.33 | R 41.60 | R 36.45 |
| BEB 16 year useful life | R 77.85 | R 55.47 | R 44.28 | R 37.56 | R 33.08 |
| BEB 18 year useful life | R 70.60 | R 50.63 | R 40.65 | R 34.66 | R 30.66 |
| E VI Diesel bus 12 year useful life | R 63.71 | R 50.98 | R 44.61 | R 40.79 | R 38.24 |
| E VI Diesel bus 16 year useful life | R 55.78 | R 45.69 | R 40.65 | R 37.62 | R 35.60 |
| E VI Diesel bus 18 year useful life | R 53.14 | R 43.93 | R 39.33 | R 36.56 | R 34.72 |

Annual Operating Kilometres per Bus

*Figure 12: Varying annual operating kilometres for different BEB useful life scenarios*

*Source: C40 SA Financial Model*

Taking this into account, a beneficial scenario for immediate BEB deployment could be characterised in relation to three key factors: an annual operating distance of 50,000 kilometres per bus (or at least 40 000km), a bus lifespan extending to 16 years (or at least 12 years), and the adoption of cost saving strategies that are influenced by the capital cost of buses, such as a self-insurance strategy. These variables represent critical considerations in achieving the cost-effectiveness and sustainability goals associated with BEB adoption in a public transport system.

## 5. Creating the conditions for e-bus deployment

### a) Obstacles to e-bus deployment

Notwithstanding the positive results from the GABS pilot, there are significant obstacles to e-bus deployment in South Africa, as summarised in the following table.

*Table* 2: Obstacles to e-bus deployment in South African C40 cities.

| Category | Obstacle | Description | Severity |
|---|---|---|---|
| Vehicles | High upfront costs | In South Africa, e-buses cost approximately twice their equivalent diesel counterparts. This higher cost is primarily attributable to the expensive battery, which accounts for about 30% of the total bus cost. Furthermore, components specific to e-buses, such as electric motors and power electronics, can be more expensive than their diesel counterparts. Additionally, e-bus manufacturing processes often require specialised technology and expertise, further increasing production costs (GABS interview, 2023). | |
| | High import tariffs | EVs are subject to higher customs and excise import duties, and other *ad valorum* taxes in comparison to ICE vehicles. Higher import taxes for e-buses distort the market, increasing the capital costs compared to diesel buses.<br>The reason for these higher taxes is that because there is no e-bus manufacturing industry in South Africa, e-buses are currently imported fully built, while diesel buses are built in South Africa. Local manufacture of e-buses must be encouraged to reduce the purchase price over time; so removing these taxes may be counter-productive. However, there is a strong argument for interim relaxation of such taxes for a short period to accelerate the initial shift to e-buses. | |
| | Procure-ment challenges | Procurement models, particularly in the public sector, typically focus on upfront cost, while requiring the flexibility of considering the TCO (total cost of ownership) over the lifespan of the e-bus. | |
| Charging & grid infra-structure | Capital costs | E-buses require significant capital investments in grid and charging infrastructure. These investments entail not only procuring charging stations but also undertaking preparatory work, such as enhancing or expanding underground utility connections, and upgrading electrical systems, including distribution transformers and substations. | |
| | Grid instability | A lack of grid stability is currently a barrier for cities that have inadequate or unreliable electricity networks. The challenge lies in ensuring that local distribution utilities can provide a reliable flow of electricity for e-bus operations. The renewable energy can be used in addition to the traditional energy network to reduce instability, but it is costly to implement. | |
| | Depot space require-ments | Space at depots is often very limited, and creating additional depots is prohibitively expensive in some urban areas. It is estimated that the charging infrastructure and related parking may require depots to be larger to accommodate new e-buses and charging infrastructure, although future chargers may have a smaller footprint. | |

### b) Further considerations in deploying e-buses in C40 cities

Apart from these obstacles there are further significant considerations in deploying e-buses in South African cities.

Firstly, apart from uncertainties around bus contracts as described already, the National Land Transport Act of 2009 (NLTA) generally allows a maximum contract length of seven years. This is very short if the high capital costs of e-buses are to be recovered. This restriction would have been mitigated if the market were sufficiently broad and deep to support a regular flow of new contracts where existing buses could continue to be deployed, but this is not currently the case in South Africa.

Secondly, as explained above, electricity supply is unreliable. This must be addressed if there is to be a substantial support for a shift to e-buses. If the period available for charging is shortened by lack of electricity supply, the capacity of the charging infrastructure must be concomitantly greater to enable the fleet to be charged in the available time. This adds costs, while the uncertainty adds further logistical complications. The approach of GABS suggests, however, that it has confidence that this issue can be resolved before there is significant e-bus fleet expansion. This is probably a correct approach, especially in cities that are effectively driving the issue of ensuring reliable electricity supply.

On the positive side, a third consideration is the opportunity offered for daytime charging by South African cities' highly peaked demand patterns. South African cities' public transport demand peak is more peaked[3] than the peak in many other cities globally. This creates inefficiencies in the sector through vehicles remaining idle for long periods during the day; however, this long downtime can be turned to some advantage if using daytime charging, permitting smaller and cheaper batteries to be deployed and enabling charging directly from solar generation. This suggests that key support could be given to the industry, including by municipalities, in helping to enable the creation of charging facilities in appropriate locations for daytime off-peak charging.

**c) Financing the transition to e-buses**

The higher capital cost of e-buses compared to diesel buses heightens the significance of capital availability and capital costs (i.e. payment of interest and principal), underscoring the financing challenge. If the operational savings, however, cover the higher capital costs (as has been concluded by GABS) the shift is warranted (although there may be a cashflow challenge if the cost savings are only realised over a longer period than the length of any loan). Clearly, if the cost and availability of capital is improved – including loan duration – the feasibility of a switch improves.

Irrespective of what technology is used – whether diesel or electric – there are critical factors affecting the availability and cost of capital for all buses in South Africa. Any proposals must therefore address the e-bus financing challenge within the wider financing context. The challenge involves three distinct challenges:

- Creating a suitable external contracting environment for bus financing, irrespective of technology or bus operator;
- Enhancing characteristics of bus operators that influence their ability to raise finance, irrespective of technology;
- Financing to support the shift from diesel to e-buses.

There are some financiers amongst those listed in (g) below that may be able to offer better terms if the loan supports a shift from fossil fuels to e-buses.

The financing requirements are not necessarily restricted to the bus operations themselves. Transitioning to e-buses also requires ensuring a reliable electricity supply in locations where buses need to be charged. In the C40 cities responsibility for distribution of electricity generally lie with the C40 municipalities and Eskom. Thus, financing a transition to e-buses, broadly

[3] I.e. the peak demand for public transport in the morning and afternoon is higher and shorter than the peak in most other cities.

understood, includes making finance available to the electricity sector.

**d) Creating a suitable external contracting environment to support bus financing**

If the service model is based on private operators owning their own vehicles and providing services on contract or by concession to the authorities, then the contract and associated subsidies must be secure for a sufficiently long period to enable financing to be raised on reasonable terms. Furthermore, there ought to be a reasonable level of predictability regarding the market served and the knowledge that the service will not have to encounter new, extensive and unregulated competition.

The environment in South Africa largely fails to meet these requirements; there is significant uncertainty ahead that will constrain the availability of reasonably priced finance for new buses in future. Government needs to address this uncertainty, including determining:

- which part of government will be responsible for the contracts in future;
- how long the contracts will be;
- how contracts will be structured, and operators procured; and
- what the short- medium- and long-term subsidy arrangements will be.

**e) Enhancing bus operator characteristics to support bus financing**

Within the five C40 cities in South Africa there are at least two well-established operators – GABS and PUTCO – easily capable of arranging finance for their fleets, especially if the right external conditions are created in terms of contract length and terms.

However, many bus operators or potential operators do not fall within this category. Given the national government's need to increase the number of operators and its desire to establish new firms with roots in the minibus-taxi sector which would not as easily be able to raise capital for new buses, the separation of bus ownership from operations is likely to be a key feature of the bus industry in future. Bus operators would lease buses owned by the public sector or a third party.

The NDOT's draft subsidy policy envisages the state purchasing and owning buses which are then operated by independent private operators. However, the approach contradicts certain current government policies (such as the grant conditions of the PTNG, a key public transport grant), and is still to be finalised. Optimally, an approach is required to procurement and contracting that enables both ownership models to co-exist comfortably so that the country benefits from the expertise and capacity of those firms that are able to raise finance, while creating opportunities for new bus companies to become established.

**f) Financing to support the shift to e-buses**

As with all buses, the financing of e-buses is dependent on creditworthy companies and creating the right external environment. New options that arise specifically in relation to financing e-buses are rooted in new potential business models for e-buses.

Key potential models include:

- Separate battery ownership / on-bus power supply;
- Independent charging entities;
- Concessional loans aimed at advancing the environmental agenda.

### g) Key funding and financing sources

Potential sources of funding for e-buses are discussed in the body of the report, and include:

- Farebox revenue and grants;
- Tax benefits;
- Green bonds;
- Vendor financing; and
- Export credits.

### h) Key climate oriented international financing sources

There are several international financing sources that support the introduction of e-buses due to their benefits for air quality and the climate, discussed in the body of the report. These include:

- Clean Technology Fund;
- Green Climate Fund; and
- Global Environment Facility.

The GEF was established on the eve of the 1992 Rio Earth Summit to assist in protecting the global environment and promoting environmentally sustainable development.

### i) South Africa's Just Energy Transition Investment and Implementation Plans

South Africa's Just Energy Transition Investment and Implementation Plans (JET-IP) and the subsequent JET Implementation Plan (JET-ImpP) have been conceived as a mechanism for supporting the transition to a low carbon future, especially by lowering the cost of capital for relevant investments, with an emphasis on the provision and distribution of electricity. Shifting to e-buses should logically form a part of its agenda.

A process is currently underway, facilitated by the JET Partnership secretariat, to identify projects and secure financing arrangements consistent with the JET ImpP. In general, these opportunities will be accessed through public and private financial institutions operating in South Africa, which will construct the actual deals. The larger bus companies already have relationships with such institutions – as do South Africa's municipalities.

The Development Bank of Southern Africa (DBSA) has been designated the lead institution in working with all the relevant sectors, including provinces, municipalities, bus operators and the Department of Transport in pursuing these opportunities.

### j) South Africa's financial sector

South Africa's largest banks by asset size in 2023 were:

| Bank | Tier 1 Capital (US$ million) | Global Ranking by size |
|---|---|---|
| Standard Bank Group | 11 690 | 155 |
| FirstRand | 10 087 | 171 |
| Absa Bank | 8 041 | 203 |
| Nedbank | 5 925 | 255 |

| | | |
|---|---|---|
| Investec Bank | 2 528 | 469 |
| Capitec Bank | 1 900 | 562 |

*Source:* BusinessTech, 2023

Each of the banks have a variety of divisions specialising in different forms of banking. All have a corporate lending arm, which sometimes has a different brand name.

Further important institutions to note are the Government Employees Pension Fund (GEPF), and the national development finance institutions, of which the most significant for e-bus deployment are the Development Bank of Southern Africa (DBSA); and the Industrial Development Corporation (IDC).

## 6. Recommendations

The information provided by this report informs various potential courses of action which may be different in different cities. However, the following broad recommendations are made to government, the C40 cities, bus operators and the financial services industry:

### a) Cities to model the cost of e-buses in their operational environments, and to work to reduce key costs

Cities and bus operators should study this report's findings, which indicate that the total cost of ownership (TCO) for battery electric buses (BEBs) is likely to be lower than diesel buses. Due to the likely ongoing, incremental increase in financial benefits from transitioning from diesel buses to e-buses, there is a strong argument for immediately starting this transition where local modelling is favourable, rather than waiting for further pilot study outcomes.

This study shows that cities and bus operators are likely to achieve a beneficial scenario for *immediate* BEB deployment if they have an operational plan with efficient bus utilisation (with the kilometres per bus on average amounting to more than 40 000 per year), procure and maintain buses such that they have a longer useful life (preferably 16 years or longer) and implement the cost saving measures which are influenced by the capital cost of buses, such as a self-insurance strategy.

In addition the operational efficiencies and significantly lower running expenses for e-buses, as compared to diesel alternatives, will help offset the initial capital costs. However, cities and operators are encouraged to first conduct their own TCO assessments, considering their specific operational plans, as costs and benefits will vary.

Continued budget planning should include provisions for battery replacement around every 8 years, based on current technology. This significant aspect of the TCO is poised to become less frequent and less costly with advancing technology. Given the likely increase in financial benefits to cities and operators from steadily transitioning from diesel buses to e-buses, provided they have assessed costs in relation to their operational plan, it is potentially appropriate to immediately start this transition to e-buses, rather than waiting for the outcomes of further pilot studies. When data from pilot studies become available, they should be worked into the model, allowing for adjustments to the original plans.

Two cities, Tshwane and eThekwini, are initiating pilot studies with the Development Bank of South Africa's support. These cities should progressively release their findings annually, contributing to the C40 e-bus cost model's ongoing update as new data from these studies emerge.

The initial high investment in e-buses is anticipated to decrease as technology advances. This includes the costs of vehicles, batteries, charging infrastructure, and electrical connections, some of which have a long lifespan. Improving battery technology will likely reduce costs per kilometre, possibly making today's financial models conservative.

Cities and operators should stay updated with these advancements to ensure their investments remain economically advantageous.

It is recommended that C40 support these efforts by the following cost modelling steps:

- Publishing the C40 cost model for comment and improvement by all stakeholders, including cities;
- Enhancing the cost model based on stakeholder input, and by further developing sensitivity analyses that will assist stakeholders in better understanding the model's sensitivities to different cost-related decisions;
- Reviewing the cost model annually, as new data and analyses become available, which should include:
    - Considering findings and lessons learned from any relevant pilot studies, including those of Tshwane and eThekwini;
    - Assessing the cost implications of new and improved technology;
- Assisting cities and bus operators, upon request, with their own cost modelling, aimed at informing their decisions and planning.

**b) Ensure reliable power supply at appropriate locations**

C40 cities should prioritise securing reliable electricity supply to localities where e-bus charging facilities are to be installed. Bus operators and cities are unlikely to take major steps towards conversion to e-buses unless they have a high level of certainty that electricity availability challenges will be resolved.

There are two dimensions to this, namely the generation of electricity and the network connections to charging locations. While municipalities can play some role in relation to the former, as electricity distributors it is the latter where their focus is critical. Hopefully, the loadshedding currently being experienced will be addressed by relevant stakeholders within the next two years – at which point constraints on connections to suitable charging locations become most important.

It is also recommended that the C40 cities investigate playing an active role in the provision of charging infrastructure close to morning destinations, in locations that support charging during the daytime off-peak for use across bus operators to do inter-peak charging before buses depart on afternoon trips. This should reduce the required battery size, reduce capital and some operating costs, and will allow greater use of renewable solar power for BEB charging.

#### c) Consider temporary reducing in import taxes on e-buses and reconsider treatment of VAT in public transport

There have been calls to reduce import and related taxes on e-buses (such as ad valorem-taxes) to reduce the cost of e-bus pilot projects, where fully-built e-buses are imported in the absence of locally manufactured / assembled e-buses.

The quantum of ad valorem taxes is very large, rendering pilot projects extremely expensive, which could disincentivise such tests. Pilots are important to test use of these buses under local conditions, which is likely to stimulate the take-up of the new technology pending the establishment of new e-bus manufacturing capacity.

However, the establishment of a local e-bus manufacturing industry is very important in the long term for reducing bus and parts costs and improving their availability, and for national economic development.

It is arguable that the GABS pilot plus the Tshwane and eThekwini pilots (for which costs are already allowed), will provide sufficient pilot information, and that extensive new pilot projects may not be required.

On balance, there is an argument to be made for temporary exception from ad valorem taxes on electric buses used in pilot projects, thus, to allow the importation of fully assembled buses for such tests.

Turning to VAT: The very high purchase cost of BEB places financial stress on the transition to e-buses, and this exacerbated because of the treatment of VAT on public transport. In essence, VAT paid on the purchase price of a bus cannot be claimed as input VAT, rendering e-buses and related infrastructure even more expensive. It is recommended that National Treasury investigate zero-rating VAT in public transport, which would mean that municipalities would be able to claim VAT paid for e-buses and charging infrastructure back.

#### d) Provide certainty regarding contracting of bus services, including the assignment of legacy bus contracts to cities

Urgent steps are required to resolve the uncertainty regarding the future of the contracted, subsidised bus industry in South Africa. This includes resolving challenges relating to the assignment of legacy bus contracts from provinces to cities.

Bus operators will be reticent to commit to the long-term obligations that arise from electric bus deployment unless such uncertainties are resolved.

#### e) Amend the NLTA to permit longer contract terms

The NLTA should be amended to allow a maximum legal contract term of longer than seven years. This will correspond better with the expected life of e-buses and support better financing arrangements that will lower the cost of capital.

#### f) Settle the government subsidy policy, and the related approach to bus ownership, including incentives to shift to e-buses

It is recommended that national government takes urgent steps to resolve the apparent contradiction between the draft subsidy policy, which envisages the state purchasing and owning buses, and the grant framework of the PTNG which envisages that operators should own buses. Bus operators are strongly opposed to this subsidy policy and may litigate on this matter.

An approach is recommended permitting both ownership models to co-exist comfortably, with the one or the other being deployed where appropriate.

Now that government has adopted the Electric Vehicles White Paper, consideration must also be given to using the subsidies to incentivise a shift to e-buses in alignment with this official policy.

#### g) Innovative business models for e-bus deployment: allocating responsibilities and risks

The deployment of e-buses introduces distinct cost structures and risks, differing from the traditional diesel bus industry. This shift necessitates consideration of innovative business and financing models from operators, governments, and financiers, tailored to the evolving technology.

In South Africa, the transition to BEB technology, although advancing, presents some uncertainty regarding the potential role of third-party battery owners or charging providers in the successful adoption of e-buses.

It could be beneficial for stakeholders, including the government, to consider models like third-party ownership or on-bus power provision, especially with the potential integration of renewable energy sources.

Such models allow operators to potentially benefit from future technological improvements in batteries, up front. In such an agreement, battery payments could be included in fixed service fees for the asset's lifetime or another defined period. The responsibility for upgrading or replacing batteries then rests with the service provider, enabling an expert in battery technology to anticipate and incorporate likely advancements, effectively reducing the upfront costs of batteries compared to current technology prices.

Additionally, an operator could consider leasing batteries, thereby distributing the high initial costs over time, offsetting them with operational savings, unless they have easy access to low-cost finance.

Considering this, C40 cities should evaluate the feasibility of engaging private service providers for battery supply, ownership, and charging infrastructure. This approach could streamline the transition to e-buses, ensuring a smoother integration of this sustainable transportation method.

#### h) Drive implementation of the actions to manufacture EVs White Paper action plan

Government needs to drive its Electric Vehicle White Paper’s action plan for manufacturing of EV, summarised in 7.2.5. It needs to do so with a focus on BEBs.

As such, the following action in support of the development of a South African market for EVs should take priority: “Developing and implementing a framework for fleets to transition to SA-produced new energy vehicles, including government-owned, public transport, … ”

### i) The financial services industry to pro-actively explore mechanisms to lower the cost of financing e-buses and related infrastructure

The private financial services industry and the development finance institutions, especially DBSA and IDC, must proactively explore mechanisms to lower the cost of e-buses and related infrastructure, including lowering the cost of financing the capital cost of e-buses.

This is of particular importance for the shift to e-buses where capital costs represent such a large portion of the total cost of ownership.

An area of special focus should be the opportunities offered by the JET Partnership through which significant favourable financing has been offered by the international community to support a shift from fossil fuel to renewable energy technologies. Although this study has not sought to address this issue in depth, we have encountered some scepticism as to whether the pledges translate into actual benefits to the activities supposedly being supported.

It is important both for the shift away from fossil fuels, including through the deployment of e-buses, as well as the legitimacy of international pledges in terms of the JET Partnership and other mechanisms, that practical mechanisms are developed to realise apparently available benefits.

The local South African financial services industry, including the private sector and parastatal lenders such as the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation working with international JET Partnership stakeholders have a key role to play in this regard.

# Part A Introduction

## 1 Introduction

### 1.1 Background

The purpose of this report is to analyse and document the state of the South African bus market, highlighting the opportunities available in the country to provide support to cities on electric bus deployment. In this report, battery electric buses (BEBs) are referred to as e-buses.

While devising new models for e-bus deployment forms part of the effort required and is one of the foci of this body of work, accelerating e-bus deployment in South Africa requires a much wider set of actions, most notably, the creation of much greater clarity in how bus services will be contracted and subsidised in future, irrespective of the technology used.

This report is based on extensive collection of primary and secondary data, as well as interviews with key stakeholders.[4]

The key conclusion reached through the work done, is that while context and operational conditions differ so that individual feasibility studies are needed before deciding when and how to shift to electric vehicles (EVs) in each case, a transition from diesel to e-buses is justified on financial grounds under a wide range of circumstances.

The basis for the shift based on cost alone is that, while the capital cost of an electric bus is currently significantly higher than a diesel bus, its operating costs are much lower. Thus, where buses are used sufficiently intensively and are built and operated to have a reasonably long useful life, the TCO of e-buses is lower than that of diesel buses. Our modelling, explained in detail in section 16, shows that, under a realistic set of operating conditions, where buses are financed over 10 years at an 11% interest rate, and are used on average 50 000 kilometres per year for 12 years, the cost of e-buses is currently marginally higher than diesel buses; however, as kilometres per year increase and/or the useful life is extended, the TCO of e-buses becomes progressively cheaper than diesel buses.

Moreover, the relative e-bus TCO is likely to fall with the global shift towards e-buses, driven by environmental and other motivations, strengthening the motivation for individual operators to adopt this technology.

As explained in this report, there are various ways whereby government can support this shift, but perhaps the most important is simply to provide greater clarity about the future of bus contracting and subsidisation in South Africa, regardless of any e-bus related initiative. Other measures by government and other stakeholders can help accelerate the shift, such as lowering financing costs, adjusting import taxes, investing in electricity infrastructure to facilitate charging, and developing business models better attuned to the demands of the new technology. Further recommendations are set out in section 18.

[4] The preparatory work was written up in three papers which were then consolidated into this report containing the key insights. The first paper is entitled 'E-Bus Context in South Africa,' the second paper 'E-Bus Operator Landscape in South Africa,' and the third paper 'Commercial and Financing Arrangements'.

## 1.2 The five C40 cities

The five C40 member cities in South Africa are:

- the three metropolitan governments of the Gauteng province:
    - Johannesburg
    - Ekurhuleni (including Germiston, Boksburg, Kempton Park, Benoni, Springs), and
    - Tshwane (including Pretoria);
- Cape Town, in the Western Cape; and
- eThekwini (including Durban), in KwaZulu-Natal.

These are shown in the map in Figure 13.

In terms of the South African Constitution, these cities are Metropolitan Municipalities (often referred to as "metros" or "metropolitan areas") and have higher levels of decision-making power than other municipalities. We will refer to these cities in this report either as cities or metros.

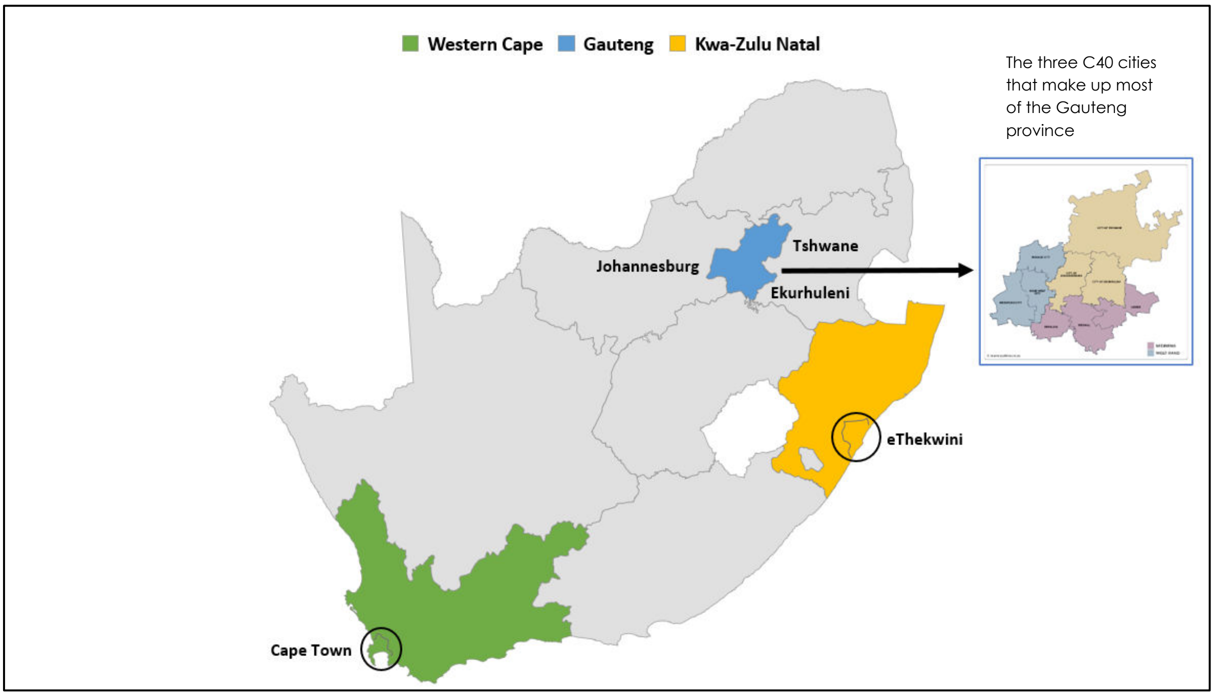



*Figure 13: Location of the five C40 cities in South Africa, and their provinces.*

## 1.3 Structure of the report

**PART A** sets the context relevant for this report by providing an overview of the public transport sector in the C40 cities. It offers a brief account of each mode and its relevant market share. Furthermore, it includes a table of key stakeholders who will play a role in e-bus deployment in South Africa. Part A also focuses on the policy and legislative landscape in C40 cities, as well as strategies and commitments aimed at accelerating the uptake of EVs. The fiscal and financial context is also described, along with uncertainties in the bus industry, specifically surrounding PTOG contracts and minibus-taxis.

**PART B** describes on the bus industry in C40 cities. It discusses the various groups of business models currently being employed in the five C40 cities and provides examples of operators employing each business model. It also includes an analysis of the latest national vehicle registration data of the National Traffic Information System (NaTIS) regarding the distribution of buses among the C40 cities, including key attributes, such as vehicle age and capacity. Part B also analyses the bus manufacturing landscape in South Africa, focusing on the bus body builders and bus suppliers, listing the companies currently involved or interested in electric vehicle manufacturing in South Africa. It concludes with an estimate of the projected number of buses to be procured from 2023-2050.

**PART C** describes the piloting of e-buses in South Africa with a specific focus on the GABS e-bus initiative. It discusses the outcomes of this pilot project, including vehicle operations, performance, and the charging strategy. It also described the imminent further pilot studies by C40 cities.

Additionally, it provides an overview of the modelled costs associated with the deployment of e-buses in South Africa based on the best available data, including from the GABS pilot. The cost model compares a 12m Euro VI diesel bus and an equivalent 12m BEB. These two options have been modelled to determine issues such as (a) the total cost of ownership (TCO) over the life of the bus, and (b) the breakeven point where an e-bus becomes more cost-effective than a diesel bus (if so).

**PART D** focuses on the scope and conditions for e-bus deployment. It begins by identifying obstacles to e-bus deployment in South Africa, as well as the requirements for scaled BEB deployment and investment, and appropriate commercial arrangements. It also addresses the financial and funding requirements.

**PART E** contains the conclusions and key recommendations emerging from this study.

## 1.4 US Dollar exchange rate

This report contains extensive financial information. This is given in South African Rands (ZAR).

An international reader could understand these numbers using the ZAR / US Dollar exchange rate that applied in early November 2023 (when this report was finalised), of roughly R18.50 per US Dollar.

We have chosen not to present figures in US Dollars since most amounts have been originally denominated in South African Rands and remain generally constant in this currency. Given the volatility of the ZAR /US Dollar exchange rate, translating the figures into US Dollars will give misleading results as soon as the exchange rate shifts.

# Part B Context

## 2 Public transport sector in the C40 cities

### 2.1 Modal split in South Africa

In South Africa, the public transport sector in the five C40 cities consists of three main modes of transport:

- the traditional commuter rail system (which is very seriously degraded) and the Gautrain high-speed rail between Johannesburg, Tshwane, and the Oliver Tambo International Airport;
- the subsidised and unsubsidised commuter bus industry, including the Bus Rapid Transit (BRT) systems now present in many major cities, and
- a growing minibus-taxi industry, using mostly 16-seater minibuses, with some midi-buses with up to 35 seats.

Figure 14 shows the main modes of travel used nationally by households in 2013 and 2020 (Stats SA, 2020).[5] It shows a major decline in people using buses and trains, and a very significant increase in the use of taxis and private vehicles.

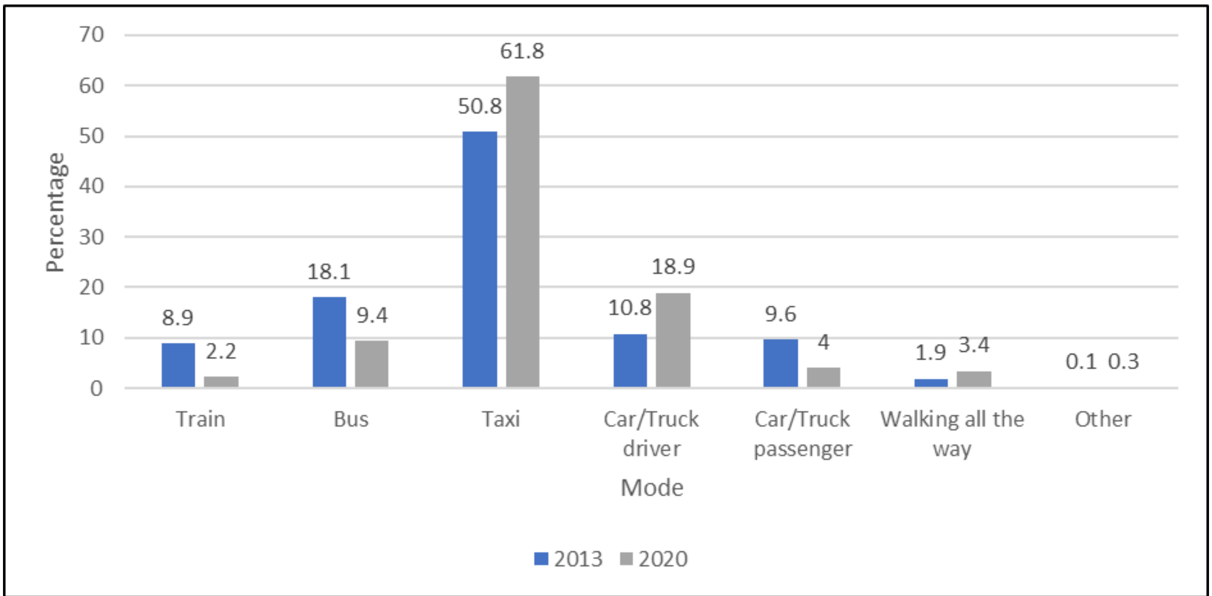



*Figure 14: Main mode of travel used by households in 2013 and 2020.*

*(Stats SA, 2020).*

[5] While StatsSA's report on the National Household Travel Survey (NHTS) of 2020 reports the main modes of travel for all trip purposes, the 2013 NHTS report only tabulates travel for work and education purposes. Therefore, for comparative purposes, travel for the latter two purposes was selected for this graph, as they were reported in both years. This serves as a good proxy to show the modal choice as well as the changes from 2013 to 2020. Note that in the NHTS, 'taxis' include minibus-taxis, which form the overwhelming mode in this category.

In 2020 the four main modes were minibus-taxis (61.8%), private vehicles as the driver (18.9%), buses (9.4%), and private cars as passengers (4%).

## 2.2 Travel in C40 cities based on National Household Travel Survey, 2020

NHTS were conducted in 2003, 2013 and 2020. While the data was only analysed by Statistics South Africa (StasSA) on a provincial basis, this report has used the raw data to generate travel statistics for each of the five metros under review for the 2020 survey years.

Table 3 provides data on the total number of daily trips in 2020 for work and educational purposes by mode aggregated across the 5 cities combined, and Table 4 shows the share of each mode in the total. Population figures for 2020 are estimated here by applying the annual growth rates published by Stats SA.

*Table 3: Daily travel for work and educational purposes in 2020 by metros*

| Mode | CPT | EKU | ETH | JHB | TSH | Total |
|---|---|---|---|---|---|---|
| Train | 57 154 | 39 709 | 25 838 | 37 484 | 20 109 | **180 295** |
| Bus | 164 567 | 118 860 | 126 115 | 144 427 | 141 388 | **695 356** |
| Taxi | 561 985 | 793 308 | 481 432 | 1 258 269 | 769 906 | **3 864 900** |
| **Subtotal** | **783 706** | **951 877** | **633 384** | **1 440 180** | **931 403** | **4 740 550** |
| Car | 395 063 | 386 115 | 235 570 | 404 708 | 284 628 | **1 706 084** |
| Walk | 571 477 | 528 664 | 444 903 | 786 849 | 403 560 | **2 735 453** |
| Other | 8 628 | 21 846 | 31 028 | 249 231 | 52 742 | **363 474** |
| **Subtotal** | **975 168** | **936 624** | **711 500** | **1 440 788** | **740 930** | **4 805 011** |
| **Total** | **1 758 874** | **1 888 501** | **1 344 885** | **2 880 968** | **1 672 333** | **9 545 561** |

*(Source: Extracted for this report from the NHTS 2020, StatsSA)*

*Table 4: Modal split for daily travel for work and educational purposes by metros in 2020*

| Mode | CPT | EKU | ETH | JHB | TSH | Total |
|---|---|---|---|---|---|---|
| Train | 3.25% | 2.10% | 1.92% | 1.30% | 1.20% | **1.89%** |
| Bus | 9.36% | 6.29% | 9.38% | 5.01% | 8.45% | **7.28%** |
| Taxi | 31.95% | 42.01% | 35.80% | 43.68% | 46.04% | **40.49%** |
| **Subtotal** | **44.56%** | **50.40%** | **47.10%** | **49.99%** | **55.69%** | **49.66%** |
| Car | 22.46% | 20.45% | 17.52% | 14.05% | 17.02% | **17.87%** |
| Walk | 32.49% | 27.99% | 33.08% | 27.31% | 24.13% | **28.66%** |
| Other | 0.49% | 1.16% | 2.31% | 8.65% | 3.15% | **3.81%** |
| **Subtotal** | **55.44%** | **49.60%** | **52.90%** | **50.01%** | **44.31%** | **50.34%** |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

*(Source: Extracted for this report from the NHTS 2020, StatsSA)*

It is evident from the data that there are significant differences in both current travel patterns and trends amongst the different metropolitan areas. Some key aspects of the differences across metropolitan areas are:

- The reliance upon private cars is greatest in Cape Town (22.5%) and lowest in Johannesburg (14.0%).
- The reliance upon walking all the way is highest in eThekwini (33.1%) and Cape Town (32.5%) and lowest in Tshwane (24.1%)
- The reliance upon minibus-taxis is highest in Tshwane (46.0%) and lowest in Cape Town (32.0%) and eThekwini (35.8%). Cape Town is a relatively low figure as the share of minibus-taxis exceeds 40% in all other cities;
- The reliance upon trains is highest in Cape Town (3.3%) and lowest in Tshwane (1.2%);
- The reliance upon buses is highest in eThekwini and Cape Town (9.4%) and lowest in Johannesburg (5.1%).

It is also important to note that Table 3 and Table 4 report on the main mode of travel for work and educational purposes. The high percentage of 'walking' does not necessarily mean that passengers are walking the entire way; in most cases, passengers use multiple modes of transport but consider 'walking' their main mode.

## 2.3 Buses

The NHTS figures identify buses as a single category – although distinguished from minibus-taxis. However, buses largely consist of three distinct categories of buses in the 5 metros under consideration.

- Conventional commuter buses contracted to and subsidised by government but run by the private sector,
- Municipal bus companies run in-house by municipalities,
- Bus rapid transit services, mostly contracted to private sector companies and relatively newly formed by mainly the affected minibus-taxi industry.

The conventional commuter buses run by the private sector in terms of contracts with government represent the majority of current diesel bus operations in the five cities and are therefore a key focus of this study.

These bus systems arose in the context of South Africa's segregationist 'apartheid' system which was in place from 1948 till the early 1990s and which established black residential areas at a significant distance from the urban core, resulting in long commuter distances. While there are exceptions, these bus services consist therefore mostly of long line-haul routes between black townships and central business districts. They are mostly contracted by provincial government and subsidised through a national grant known as the 'Public Transport Operating Grant' (PTOG).

In the three Gauteng metros (Johannesburg, Tshwane and Ekurhuleni) there are legacy municipal bus services. During the apartheid period the municipal bus services mostly served the white residential suburbs and operated more like traditional municipal bus services found internationally, running shorter routes between suburbs and downtown areas. These services are now smaller than the PTOG funded commuter services.

In eThekwini there is a bus service known as Durban Transport, which derives from the City's original municipal bus service, but which is now privately run; although the municipality owns the buses. This service in eThekwini (Durban) is, in essence a combination of the longer distant routes from the central city to the legacy black townships and the shorter distant services traditionally associated with municipal bus services. It benefits from PTOG funding as well as municipal support. There are a few other much smaller bus services covering relatively long routes which also receive PTOG grant.

Cape Town's history is different in that there is no conventional municipal service separate from the PTOG funded commuter services; they are consolidated as in eThekwini (Durban). But unlike in eThekwini the service is privately owned and operates under a provincial government contract and receives PTOG funding.

Following the 2007 Public Transport Strategy and Action Plan (PTSAP) a national initiative was initiated to support bigger cities in introducing bus rapid transit services, which have enjoyed substantial financial support from national government. There are currently some BRT services operating in Johannesburg (Rea Vaya), Cape Town (MyCiTi), Tshwane (A Re Yeng) and Ekurhuleni[6] (Harambee). A project to implement BRT is underway in eThekwini, but it is not yet operational.

## 2.4 Minibus-taxis

The minibus-taxi industry in South Africa is mostly not composed of companies but rather individual owners and drivers who are required to operate within associations. The routes are weakly regulated by provincial and municipal authorities, allowing the associations to control the routes and protect their members from competition.

Although the operations of this industry are informal and mostly not effectively regulated, minibus-taxis play an integral role in both rural and urban public transportation systems, both in terms of mobility and economics (Machobane, 2021).

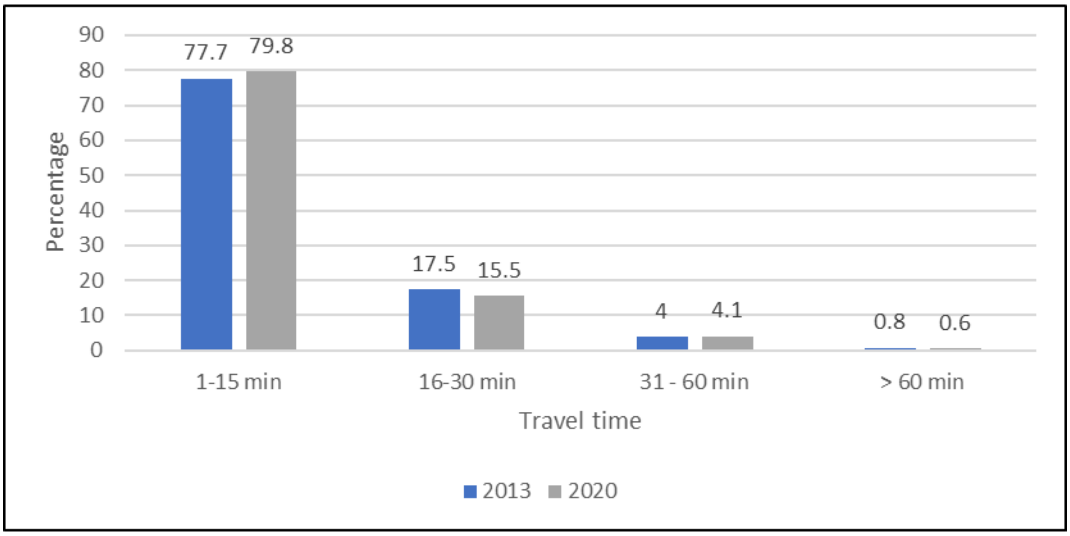



*Figure 15: Time taken to walk to the nearest minibus-taxi rank / route, station or stop*

*(Stats SA, 2020)*

[6] An initial starter service, utilising 40 buses, is operational (Harambee website)

Minibus-taxis are the main mode of transport in South Africa, with more than 60% of households using taxis and approximately 15 million commuter trips made daily for work, schools, universities, healthcare access, and leisure. Minibus-taxis are the preferred mode of transport for most South Africans because they are more efficient, flexible, and widely available compared to buses and trains. Figure 15 shows that almost 80% of households walk for fifteen minutes or less to reach their nearest taxi rank from their home, with a small number of people needing to walk for more than 30 minutes (Stats SA, 2020).

## 2.5 Commuter rail

The Passenger Rail Association of South Africa (PRASA) is a state-owned enterprise responsible for most passenger rail services in South Africa, providing rail services through its subsidiary, Metrorail.

South Africa has witnessed a significant decline in its commuter train services, with the total number of daily train commuters in the country dropping to its lowest level on record since the introduction of the NHTS by Statistics SA in 2003 (Stats SA, 2020).[7]

- In the 2013 NHTS, approximately 700,000 South Africans, which represented 13% of the employed population, regularly utilised trains for their daily commute to and from work.
- By 2020, this figure had plummeted by nearly 80%, leaving only 150,000 workers still reliant on trains.

Figure 16 illustrates the collapse in Metrorail passenger rail trips. Between 1998/99 and 2008/09, there were an average of 43-million rail passenger trips per month, peaking in 2008/09 an average of 54-million passenger trips per month.

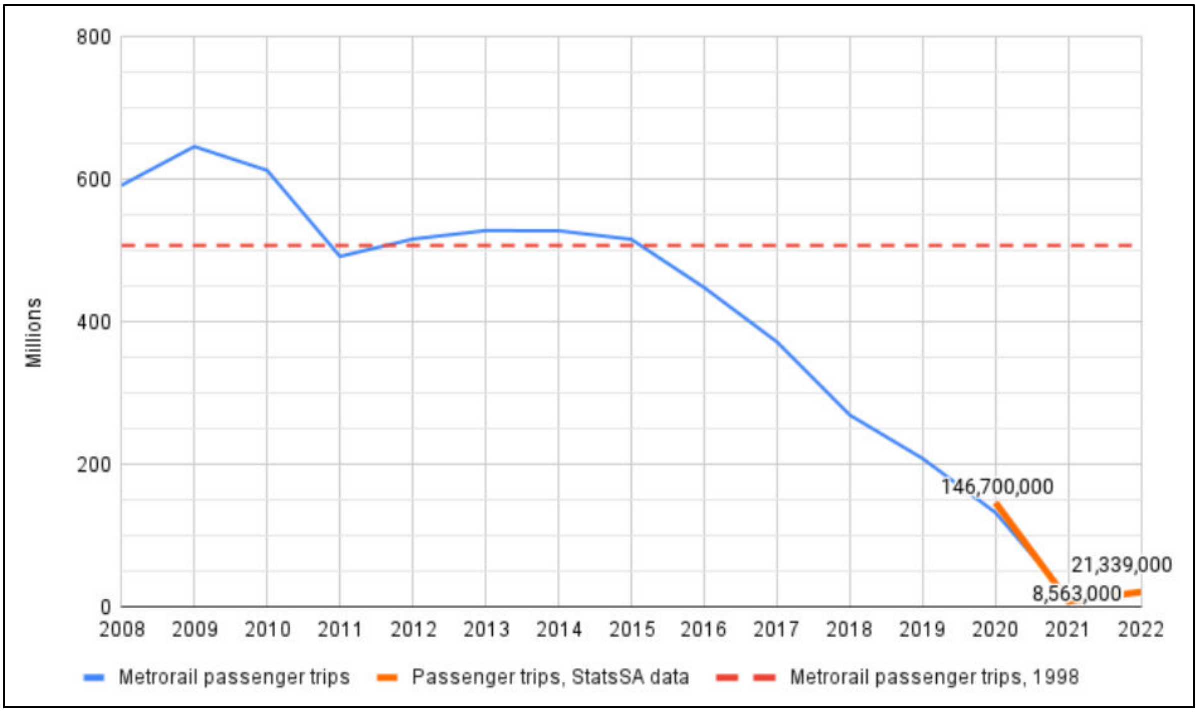



*Figure 16: Change in passenger trips on Metrorail trains*

*(Stent, 2022)*

7 The only service which has managed to escape the dismantling of the system unscathed has been the Gautrain.

The decline in passengers has to a large degree been because of insufficient trains, compounded by signalling and other challenges. For example, in January 2020, the Western Cape Metrorail's fleet, which at the time required 85 trains to adequately service approximately 100 stations, was depleted to just 32 trains mainly due to vandalism and arson attacks but also to deterioration of old rolling stock. This reduced operating capacity, coupled with long travelling times and delays, led to overcrowding on the limited carriages becoming a serious problem. In addition to this, more than 60% of commuters cited safety concerns aboard trains as a serious issue.

Difficulties were seriously exacerbated during the COVID-19 pandemic when Metrorail operations were suspended. At the same time, a major security contract was suspended because of procurement challenges. The combination of suspended operations and absence of security resulted in devastating vandalism and theft of many Metrorail assets. The reduction in passenger numbers in the most recent years reflects this.

In recent months new trains have begun to operate. These are being built in Gauteng as part of a rail revitalisation project begun more than a decade ago which aims to improve infrastructure and operations and build trains locally. More progress is likely in coming months and years, although the devastation that has been allowed to develop in recent years will take a considerable amount of time to address.

## 3 Key stakeholders regarding e-bus deployment

Table 5 lists key categories of stakeholders regarding e-bus deployment.

*Table 5. Key stakeholders regarding e-bus deployment*

| Operators | Organisations of bus operators | Bus suppliers & manufacturers | NGOs | Government | | | Financing and funding | |
|---|---|---|---|---|---|---|---|---|
| | | | | Cities | Provinces | National | Development financiers | Private sector financiers |
| Municipal bus services operated by cities | | Manufacturers making bus chassis (incl engines) in SA | World Wildlife Fund: SA Electric bus programme Member of Climate Alliance | City public transport planning and regulations. Contracting public transport. Funding. | Provincial public transport regulation and planning. Contracting (legacy contracts through NLTTA) | National Department of Transport (NDOT): National policy. National regulation. National funding. National norms & standards | Development Bank of SA (DBSA): Devt finance, incl re electric buses. Run pilot projects with SA cities regarding electric buses. | Commercial banks |
| Bus operators contracted by Cities | BRT operators contracted by cities organised through South African Bus Rapid Transit Association (SABRATA), linked to MBT industry | Manufacturers building bus bodies in SA | C40: NGO that works with nearly 100 mayors of the world's leading cities to deliver urgent action to confront the climate crisis | Spatial planning. Roads. Municipal housing. Municipal law enforcement | Funding (channel for much of the national PTOG) | Department of Trade & Industry: Incentivising national manufacture Set local content requirements | World Bank: working with the South African government to implement approaches to achieve climate sustainability | |

| Operators | Organisations of bus operators | Bus suppliers & manufacturers | NGOs | Government | | | Financing and funding | |
|---|---|---|---|---|---|---|---|---|
| | | | | Cities | Provinces | National | Development financiers | Private sector financiers |
| Large bus operators funded from PTOG | Southern African Bus Operators Association (SABOA), national body that represents the interests of the bus and coach industry | International suppliers of buses to SA market (full bus or chassis or kits to build) | Alliances for Climate Action-South Africa: coalition including local governments, investors, and businesses | | | National Treasury: Providing funding through NDOT<br>Settign standards re finances and procurement | African Development Bank | |
| Scholar transport | The Southern African Bus Operators Association (SABOA) is the official body that represents the interests of the South African Bus and Coach industry | | Other similar NGOs and alliances | | | Department of Environment: National programmes on environement, incl climate change | | |
| Minibus-taxis (MBTs): individual operators, companies and taxi associations | Organised through South African National Taxi Council (SANTACO) and the National Taxi Alliance (NTA) | Various suppliers, but industry dominated by Toyota | | Cities have responsibilities for some ranks and interchan-ges which could offer charging facilities | Responsible for regulation including issuing of operating licences in conjunction with Cities | Funds the minibus-taxi recapitalisation program | DBSA is exploring mechanisms to support formalisation but no shift to electric at this stage | |

# 4 The policy and legislative context including devolution to cities

## 4.1 Mobility patterns and policy and legislative responses

### 4.1.1 South Africa's urban geography and key responses

South Africa's apartheid history, which sought to configure social geography to divide the country by race, has had a profound long-term impact on mobility patterns. Through these segregationist policies, which were dominant during the critical post-war period of urbanisation between 1950 and 1990, residential areas for the majority black population were established on the outskirts of cities, away from white areas, and in some cases, at distances of over 100 kilometres from the urban core. This led to 'displaced urbanisation' and has resulted in very long commuting distances for many workers. While these policies were ended in the early 1990's, much of the fundamental structure of urban geography that they created remains in place.

This has been overlain by a strong private car orientation, including substantial freeway development from the 1970s, which has exacerbated the urban dispersion. Until that time most commercial development occurred in central business districts, but especially from the 1980s it began dispersing across a wider range of locations, including more suburban areas.

Under the apartheid government mass transit solutions were implemented to support the long commutes. This included subsidised bus services – mostly provided by private companies – and the extension of subsidised commuter rail to some key areas. These services have continued to exist, largely unchanged, under the current regime, with the bus subsidy now known as the Public Transport Operating Grant (PTOG). This program is managed by provincial governments, which, as discussed below, is a subject of contestation.

Initially, most movement was along line-haul routes with relatively concentrated origins and destinations. However, with the expansion of urban townships and the dispersion of economic activity public transport mobility patterns have also become more varied and dispersed. This has reduced the efficacy of the conventional bus and rail systems and has been one of a number of factors driving the expansion of the minibus-taxi industry, which, with its smaller vehicles and informal business model, is able to operate much more flexibly across a dispersed set of origins and destinations.

Uncertainty around how to reform the legacy system in a post-apartheid era has led to stagnation which has further undermined the formal, subsidised system.

### 4.1.2 Post-apartheid policy responses

Conceptually, South Africa's post-apartheid responses have been coherent. A key aspect of the democratic dispensation under the Constitution, adopted in 1996, has been decentralisation, which has sought to create strong city governments able to reconfigure urban geography over time through assigning them substantial constitutional powers over the built environment, backed by significant financial resources, including own revenues.

These city governments have widely drawn boundaries able to encompass business districts, and both white and black residential areas within a single municipality. In the bigger cities, including all five C40 cities, single tier local governments, referred to as metropolitan governments, were established measuring in some cases over 100 kms across and encompassing within them both rich and poor areas that form part of the functional region.

Numerous policies have been adopted that have sought to devolve powers over public transport to these local governments, especially metropolitan governments, starting with a White Paper on National Transport Policy adopted in 1996.

Alongside this key theme of decentralisation there have been three other important policy initiatives in public transport. The first has been to rationalise the way urban public transport services are provided by introducing regulated competition for public transport routes based on well-designed transport plans and structured tendering and concessioning of routes defined by these plans. The 1996 White Paper paid considerable attention to this.

The second has been directed at improving the governance and quality of the informal minibus-taxi sector. Faced with high levels of violence in the sector, a National Taxi Task Team (NTTT) was established to develop strategies to better manage the minibus-taxi sector. It issued its report and recommendations in 1996.

The NTTT understood the roots of the violence to lie in overtrading and competition over routes. It recommended a system of route-based permits for the minibus-taxi sector. The local planning authority – which in the metropolitan areas is now defined as the metropolitan municipality – was to determine on a scientific basis how many permits should be issued for each route, while a taxi regulating entity currently located in the provincial sphere of government was to issue the permits.

Within the taxi industry various operator associations had developed to protect routes and manage their members. The NTTT saw the formalisation of these as critical to stabilization of the industry. It recommended that membership of these associations now be mandatory and operating licences only be issued if supported by the association. It also recommended various formal procedures be introduced for the governance of taxi associations.

The NTTT recommended a taxi recapitalization scheme, whereby the cost of a new minibus-taxi vehicle was subsidised by approximately 20-25% by government when old vehicles not compliant with new safety standards were scrapped.

The third important policy initiative was the Public Transport Strategy and Action Plan (PTSAP) adopted in 2007 by the national government. The PTSAP emphasized the need to establish comprehensive public transport networks actively controlled and managed by a strong public network entity linked to the city authority. These networks were to be comprised mainly of rail and bus rapid transit. While the PTSAP was not inconsistent with the White Paper it assumed a more active role for the public sector in the management of city-wide networks, articulating a vision 'to shift public transport service delivery away from operator controlled, commuter based, uni-modal routes to user oriented, publicly controlled, fully integrated, mass rapid public transport networks'.

The PTSAP envisaged a phased approach, with the first phase consisting of 'Modal Upgrading' (especially the rail network), while moving in the direction of more integrated networks. The PTSAP was backed by the introduction of a new grant for road based public transport, which has been referred to by various names since it was instituted and is now called the Public Transport Network Grant (PTNG). Significantly, this grant was directed at local government, and especially the larger city governments, in line with the intention to decentralise responsibility for public transport to city level.

### 4.1.3 Legislation

The National Land Transport Transition Act (2000) codified the policies of the White Paper and the National Taxi Task Team in respect of road-based public transport. Although very detailed, it was referred to as 'transition' legislation because crucial systems were still not fully in place when the legislation was devised. Most significantly, the final dispensation for local government – including the establishment of metropolitan governments – was only agreed and implemented in late 2000. Although the NLTTA was promulgated in 2000, it was debated and passed by parliament while the local government system was still in flux.

It was superseded by the NLTA, which is the legislation currently governing the sector. The key difference between the 2000 and 2009 legislation is the latter's emphasis on the need to decentralise authority over public transport to the local level.

### 4.1.4 Key implementation challenges

However, implementation of policy and legislation has been patchy.

Firstly, attempts to formally retender and contract subsidised bus services (or renegotiate them as permitted under certain limited circumstances) in line with the NLTTA (2000) proved difficult to implement for reasons discussed further below.

Secondly, very significant resources have been directed at reviving commuter rail; however, poor management and corruption in the national passenger rail agency (PRASA) have undermined this program, along with criminality and vandalism – arguably sabotage – which has incurred severe damage. Some new trains are now being rolled out, but there remain major shortcomings in the service. A recently adopted Rail White Paper concludes that part of the solution for commuter rail lies in devolution to make it more accountable to urban governments, but the details are yet to be clarified.

Thirdly, while there have been some successes, the BRT initiatives funded by the PTNG grant have proven very expensive in relation to their impact. Cities are now searching for better solutions, including incorporation of the minibus-taxi sector as part of their networks rather than attempting to replace them with BRT. Unfortunately, overly rigid conditions placed by the national department on the grant that force cities in the direction of BRT have been proving a constraint. City level capacity has been built, which is an important step forward, but poor value for money makes the grant vulnerable under the current tight fiscal circumstances.

Fourthly, the decentralisation agenda remains contested and there has been no actual decentralisation of the PTOG funded bus contracts currently managed by the provinces.

There are three key factors that militate against the decentralisation agenda.

The first is the nature of urban development in the Gauteng province, which is the heart of the national economy and includes the three metropolitan governments of Ekurhuleni, Johannesburg and Tshwane. Over recent decades these three areas have grown together to represent an extended, single city region. Logically, a range of responsibilities relating to public transport should therefore be exercised collectively rather than at the sub-regional level. This is most obvious in relation to rail; the Gautrain has origins and destinations in all three metros, and the commuter rail network also operates as a single integrated system over the whole area.

The material factors that raise doubt in Gauteng about the logic of the decentralisation of public transport responsibilities to the three metros in the province tend to then undermine decentralisation initiatives elsewhere even where they are appropriate.

The second factor that tends to undermine decentralisation is a lack of management capacity within some local governments combined with anxiety about becoming responsible for subsidised bus contracts where the future of the subsidy is uncertain.

The third factor undermining decentralisation is administrative inertia. This is partly underpinned by vested interests relating to the current flow of the PTOG grant through provincial coffers.

## 4.2 Uncertainty in the bus industry

### 4.2.1 Uncertainty around the PTOG contracts

As indicated, the tendering or negotiating of bus contracts has proven difficult to implement. After initial efforts to do so following the promulgation of the NLTTA (2000), by 2004, out of 110 contracts, only approximately 60 contracts had been retendered and 5 negotiated. Those that had been neither retendered nor negotiated represented approximately 60% of the total value. Since 2004 there has been very limited further retendering or negotiation of these contracts.

Key reasons at the time for halting the tendering process included:

- Insufficient subsidies to cover high tendered prices arising from:
- Short contracts (initially 5 years although subsequently increased to seven years)
- Expensive specifications (including average fleet age; specific vehicle specifications)
- Services needed by an expanding population;
- Integrated Transport Plans (ITPs) required by the NLTTA were not in place resulting in bus companies successfully litigating against the new tendering process;
- Labour union objections
- In some instances existing workers employed by new operators experienced substantial reduction in remuneration and lost all accumulated benefits
- In some cases new negotiated contracts were agreed based on negotiations between the operator, the labour union and the relevant contracting authority.

After the promulgation of the NLTA in 2009, a further challenge emerged. A key thrust of the NLTA was devolution to local government. It therefore made no provision for provinces to put bus contracts out to tender; instead requiring them to be devolved to local governments, which would restructure the contracts and put them out to tender themselves. Yet after nearly 15 years the function has still not been devolved with the result that no tendering has taken place.

In the interim, most contracts have been rolled over on a short-term basis. While this allows bus companies to continue operations it makes recapitalisation of the fleet very risky, since even the medium-term future is unpredictable.

Recently, the Gautrain Management Agency facilitated a process whereby bus contracts in Gauteng were renegotiated, ostensibly providing for a seven-year contract commitment. The legal basis for this negotiated approach could be questioned; however, it is a practical way forward which seems to be giving bus companies in the area grounds for considering recapitalisation of their fleets.

Despite this uncertainty, bus companies have responded differently to these circumstances. For example, GABS in Cape Town has continued to recapitalise its fleet of 1100 vehicles to the tune of approximately 60 buses per year, and as is discussed further below, is now committing to do so with e-buses. PUTCO in Gauteng, on the other hand, with a current fleet of 1400 buses has generally not been purchasing new buses. The differential response is likely related to differences in the relationship between the bus companies and the relevant provincial and local authorities, access of the companies to capital, their relative established dominance within the local urban fabric, and other factors.

There have been attempts to resolve the absence of provisions in the NLTA to provide for contracting by provinces by amending the NLTA through a National Land Transport Amendment Act. The legislation was passed by parliament, but it rolled back the commitment to decentralise to local government to such an extent that it was unconstitutional. The South African Local Government Association (SALGA) petitioned the President who agreed that the Act as passed was unconstitutional and returned it to parliament for reconsideration. However, this process is proving slow to conclude.

#### 4.2.2 The minibus-taxi challenge

The administrative challenges in contracting and subsidising conventional bus services are compounded by two challenges relating to the minibus-taxi sector.

Firstly, the minibus-taxi sector competes on conventional bus routes. While minibus-taxis are disadvantaged by not receiving any operating subsidies, they are advantaged by not having to meet many of the obligations required of formal bus operators.

Secondly, there are political challenges, especially in some provinces. While a number of the bus companies now have significant black ownership, their origins lie in the apartheid period; and while the formal services are subsidised through PTOG, the informal minibus-taxi sector, which carries considerably more passengers per day, and is constituted out of small black businesses, receives negligible subsidies. Thus, there is a perception of unfair competition between the commuter bus and minibus-taxi sectors, with the political instincts of many ruling politicians tending to align with minibus-taxi operators rather than the legacy bus companies. This translates into a tendency amongst local administrations to seek ways of managing new contracting and subsidisation in ways that benefit minibus-taxi operators at the expense of legacy bus operators.

#### 4.2.3 Uncertainty around subsidies

The uncertainty around who is to be responsible for the formal bus contracts is further compounded by uncertainty over the future of bus subsidies.

The national department has been drafting a new subsidy policy that could have very significant implications for the subsidised bus industry. The policy is currently in draft form, with the intention being to circulate the policy for official public comment. The latest version that is publicly available is designated a 'second draft' dated October 2021.

Amongst its various observations and recommendations are the following (which have been paraphrased for brevity, and selected and ordered to highlight issues relevant to this study):

- Welfare is one of the many goals but should not be the sole reason for subsidisation
    - Subsidies should address social, economic and environmental objectives, and in doing so will result in some shift of subsidies away from the metropolitan areas
- A base allocation of 60% of subsidies to the metropolitan areas and 40% to the rest of the country is envisaged at this stage
    - The rationale for this is that while 60% of the population resides in non-metropolitan areas, the metropolitan municipalities generate about 50% more travel than other areas.
- Subsidies will be managed by municipalities
    - It is envisaged that through this mechanism the current fragmentation of subsidisation can be addressed and the link between transport and land-use better managed
    - Existing PTOG subsidies will be devolved to municipalities
    - Where the subsidised public transport network transcends municipal boundaries, relevant municipalities may jointly assign the management of the subsidy to a juristic entity in order to ensure that the public transport service is efficiently managed
    - Where municipalities have declared that they have no capacity to administer public transport subsidies in terms of plans, the relevant provincial government must provide support to the affected municipality to help develop such capacity
- Subsidisation of public transport will be based on transport plans approved by municipal councils
    - There will be no differentiation of public transport modes. Rather, subsidy will be paid on the basis of a transport plan that incrementally achieves specific goals.
- Subsidies will include both operational and capital support
    - Operational subsidies will take the form of a direct user-targeted operational component that will be limited to households considered poor i.e. below the upper bound poverty line that is determined by the state (R1183 per person per month in the household in 2018)
    - Persons from such households should not spend more than 10% of their income on transport for work, education and basic health services, but the subsidy will be limited to a maximum number of trips per month
- All the infrastructure, including non-motorised transport infrastructure, and vehicles operating on the subsidised network, will be financed and owned by the state, and managed through an appropriate contract. Operators will be required to compete for the right to operate in line with a service contract and an approved transport plan

- The operating subsidy will increasingly be administered through information technology
    - Direct user-targeted subsidies will require a fare collection system allowing for a means-tested form of digital identification.

While these recommendations are still subject to public engagement and can be changed, if implemented some of the implications could be substantial. The process for agreeing on a new subsidy policy is proving very slow which further adds to the uncertainty.

# 5 Fiscal and financial context

The fiscal and financial context is important for understanding the extent of budgetary support for public transport in South Africa and the extent to which the fiscal room to support the shift to e-buses is constrained.

### 5.1.1 Stable macro-economic management but significant challenges

South Africa has maintained a generally sound fiscal policy in the period since 1994. Nevertheless, the country faces significant macro-economic challenges that constrain the ability to invest in new public initiatives.

In the initial years after democratic elections, economic growth increased, and the country's public finances were reasonably buoyant. However, South Africa now faces a difficult combination of continued slow growth, combined with high levels of poverty, inequality, and unemployment. This has been exacerbated in recent years by relatively weak public sector capacity combined with the additional pressures of the COVID-19 pandemic and the country's electricity crisis. There are significant challenges in a number of cities; service delivery has deteriorated in recent years, including in areas such as electricity and water distribution as well as road maintenance. Meanwhile local revenue collection has come under pressure. Unstable coalition governments have exacerbated challenges in already weakened local administrations. The country's National Treasury reports on key high-level indicators of financial stress show pressure to a greater or milder degree across all five C40 cities.

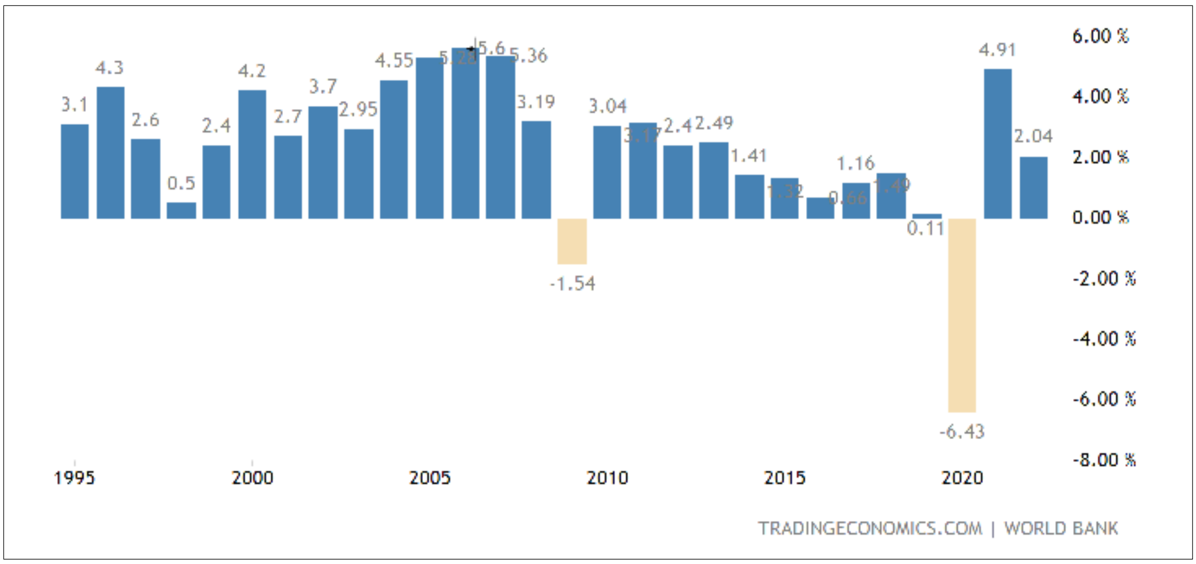



*Figure 17: Annual economic growth rates since 1995*

*Source: Tradingeconomics.com (sourced 2023/08/04)*

Figure 17 shows the annual economic growth rates since 1995. The most recent years have been disrupted by COVID-19; however, the overall trend is weak. South Africa cannot easily address its social challenges with growth levels below 3% annually.

### 5.1.2 Budget deficits

Low growth puts pressure on the fiscus, leading to increased budget deficits. As shown in Figure 18, budget deficits as a percentage of Gross Domestic Product (GDP) were well contained when growth was increasing – even running a surplus in 2006 and 2007 – but deficits have mostly been between 4% and 5% since then.

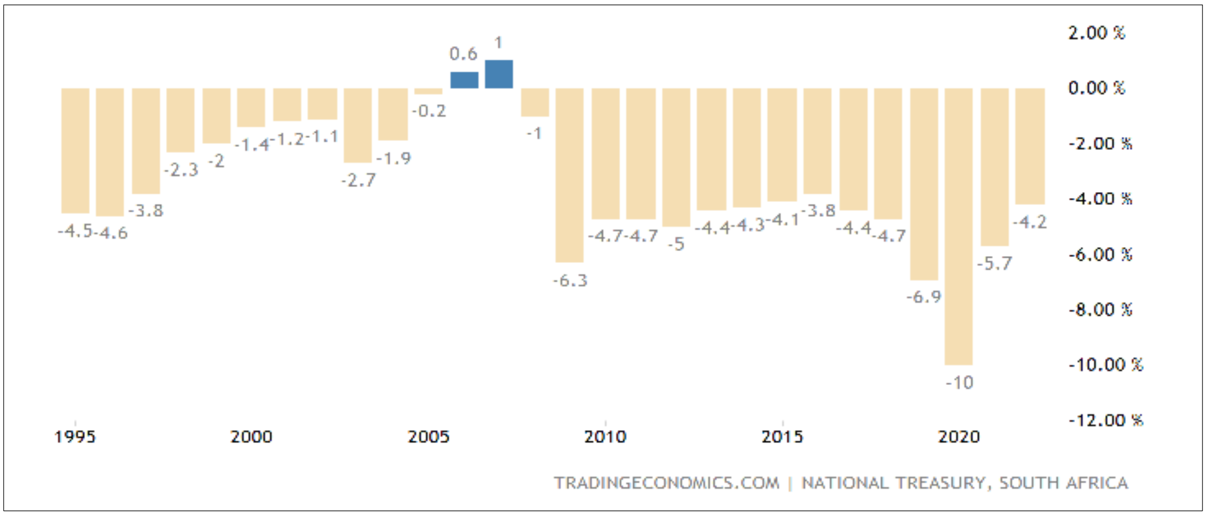



*Figure 18: Annual budget deficit as a percentage of GDP since 1995*

*Source: Tradingeconomics.com (sourced 2023/08/04)*

### 5.1.3 Government debt levels

The sustained budget deficits in excess of 4% combined with poor growth have seen government debt levels rise as a proportion of GDP, peaking at 70.7% in 2020 before falling back somewhat. As a result national government is being forced to implement significant reductions in government spending reducing the scope for supporting initiatives through the fiscus to switch to e-buses.

Figure 19 shows total government debt as a percentage of GDP from 2000 to the present.

In February 2023 National Treasury indicated that the government planned to take on ZAR254 billion of the state-owned electricity utility, Eskom's ZAR423 billion debt over the next three years, to restore its financial viability. As a result, gross debt to GDP is now anticipated to stabilise at 73.6% of GDP in 2025/26.

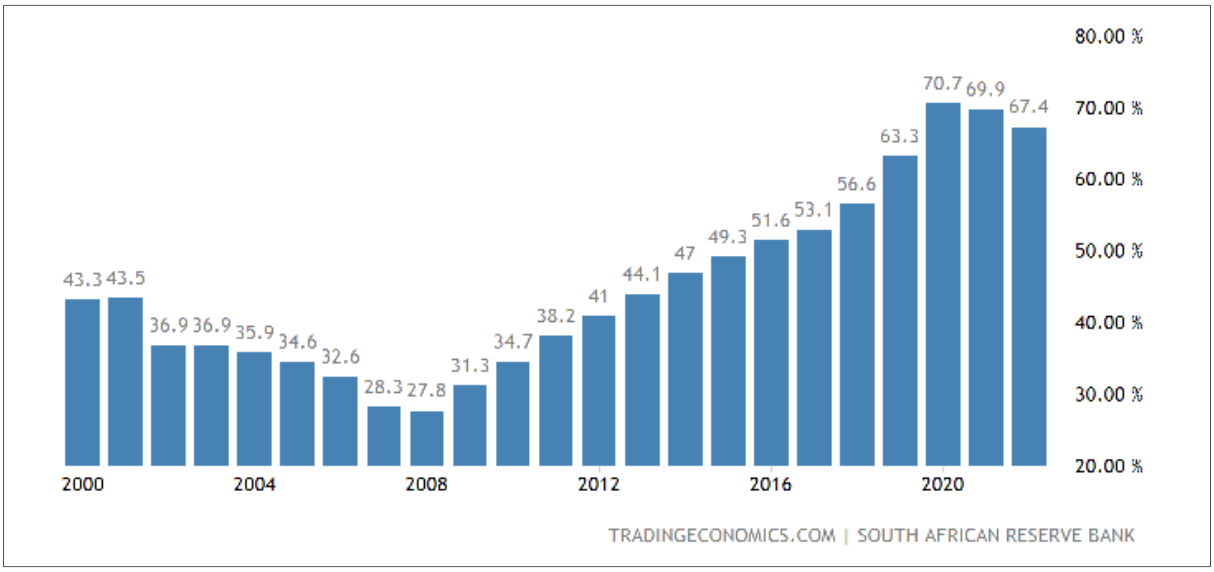



*Figure 19: Total government debt as a percentage of GDP (2000 to 2022)*

*Source: Tradingeconomics.com (sourced 2023/08/04)*

### 5.1.4 Credit ratings

The international credit ratings on South Africa's sovereign debt reflect the risks inherent in the graphs shown above. These ratings impact on relative interest rates and the country's overall ability to borrow, and therefore on the scope for investment in new initiatives.

From around 2000 the three major international credit ratings agencies rated South Africa as investment grade, but ratings have now fallen back to speculative grade, albeit the higher bands within the set of speculative grades.

Figure 20 show the credit ratings given to South Africa by S&P, one of the three main agencies. In S&P's ratings, investment grade begins from BBB-.

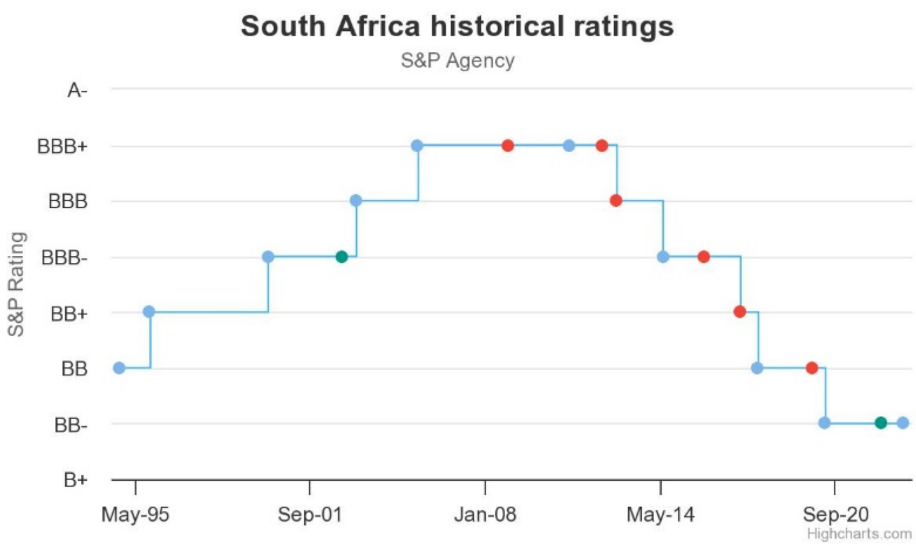



*Figure 20: S&P's credit ratings for South Africa's sovereign debt*

*Note: In the chart, a green dot denotes a positive outlook, while a red dot denotes a negative outlook.*

## 5.2 National budget

### 5.2.1 Consolidated national expenditure and revenue

Total consolidated national expenditure for the 2023/24 financial years was projected in the annual budget in February 2023 at ZAR2242.6 billion (approximately US$121.2 billion[8]) of which ZAR340.5 billion – or 15.2% is anticipated to be absorbed by interest payments on government debt.

Table 6 shows the national budget, with revised estimates for the most recent year and budgeted figures for the current and following two years. In appropriating the budget three years are presented, referred to as the Medium-Term Expenditure Framework (MTEF); however, the outer two years are projections to indicate intention, and are not binding in the way the first year is.

South Africa's decentralised structure of government means that in the current year ZAR859.1 billion – or 38.3% - of the national consolidated budget total is to be paid in transfers to provincial and local government. Provincial government collects almost no revenues of its own. Most of its budget is spent on the social services, health and education, although it also spends a significant amount on provincial roads.

Local governments on the other hand – especially the bigger cities – raise significant own funding through property taxes and fees for services such as electricity and water distribution, refuse and sewerage removal. On average, local government own revenues represent approximately two-thirds of their total expenditure, rising to around 85% in the major metros. Local government spending is mostly on built environment related services, including roads and transport. The finances of the C40 cities are discussed further below.

*Table 6: National budget (ZAR billion)*

| **R billion/percentage of GDP** | **2022/23** | **2023/24** | **2024/25** | **2025/26** |
|---|---|---|---|---|
| | **Revised estimate (R billion)** | **Current budget (R billion)** | **Medium-term estimates (R billion)** | |
| **Revenue** | **1 893** | **1 959** | **2 078** | **2 225** |
| | *28.5%* | *28.0%* | *27.9%* | *28.0%* |
| **Expenditure** | **2 169** | **2 243** | **2 360** | **2 477** |
| | *32.6%* | *32.0%* | *31.7%* | *31.2%* |
| *Non-interest expenditure* | *1 853* | *1 893* | *1 987* | *2 070* |
| | *27.9%* | *27.0%* | *26.7%* | *26.1%* |
| **Budget balance** | **-276** | **-284** | **-282** | **-252** |
| | *-4.2%* | *-4.0%* | *-3.8%* | *-3.2%* |

*Source: National Treasury Budget Review 2023*

### 5.2.2 National transport expenditure

Total transport expenditure for 2023/24 was budgeted in February 2023 at ZAR79 565.0 million, or 3.54% of the total national consolidated budget. The summary of the national Transport budget (Vote 40) is shown in Table 7.

[8] This is based on an exchange rate of ZAR18.50 to US$1.00. See the comments in 1.4 regarding the ZAR / US$ exchange rate.

Road-based Public Transport accounts for ZAR15 048.9 million in the current budget year. Much the bulk of this is paid in transfers and subsidies to provinces and municipalities. The transfers to PRASA are shown under the Rail Transport item. Most of this amount is transferred to the Passenger Rail Agency of South Africa (PRASA).

*Table 7: Summary of national Transport budget*

| | 2023/24 | | | 2023/24 | 2024/25 | 2025/26 |
|---|---|---|---|---|---|---|
| ***R million*** | **Current payments** | **Transfers and subsidies** | **Payments for capital assets** | **Total** | **Total** | **Total** |
| **MTEF allocation** | | | | | | |
| Administration | 498.4 | 14.7 | 3.4 | 516.4 | 534.8 | 564.5 |
| Integrated Transport Planning | 89.2 | – | 0.3 | 89.4 | 96.6 | 101.0 |
| Rail Transport | 64.9 | 20 527.9 | 0.1 | 20 592.9 | 21 508.5 | 22 470.9 |
| Road Transport | 130.9 | 42 479.3 | 0.9 | 42 611.1 | 47 456.2 | 52 864.5 |
| Civil Aviation | 202.8 | 111.1 | 0.6 | 314.5 | 328.8 | 343.8 |
| Maritime Transport | 333.6 | 45.1 | 0.4 | 379.2 | 396.6 | 414.8 |
| Public Transport | 344.3 | 14 704.3 | 0.3 | 15 048.9 | 16 383.8 | 17 378.9 |
| **Subtotal** | **1 664.1** | **77 882.3** | **6.0** | **79 552.4** | **86 705.4** | **94 138.3** |
| International Oil Pollution Compensation Funds | – | 12.6 | – | 12.6 | 13.1 | 13.7 |
| **Total expenditure estimates** | **1 664.1** | **77 894.9** | **6.0** | **79 565.0** | **86 718.5** | **94 152.0** |

*Source: National Treasury Estimates of National Expenditure 2023*

### 5.2.3 Road-based public transport

Table 8 shows a breakdown of the national Transport Department's spending on the program called 'Public Transport'. This program represents all road-based public transport.

Almost all the expenditure is for the two bus subsidisation programs. As indicated in the previous subsection, the Public Transport Network Grant (PTNG) is transferred to selected municipalities for the implementation of 'integrated public transport networks' (IPTN's), which are mostly accounted for by the BRT initiatives. The Public Transport Operating Grant is transferred to provinces to subsidize the conventional commuter bus services, which represent the bulk of the formal bus services in South Africa. These programs are described further in the next subsections.

The figures also show national government subsidies for the informal minibus-taxi industry. The 'taxi recapitalisation' item represents the capital subsidy scheme amounting to ZAR151,000 per taxi – or about 25% of a new 16-seater vehicle – when old vehicles are scrapped and new vehicles purchased which comply with current safety standards.

The South African National Taxi Council is the body that represents the national taxi industry, which was established in the late 1990s as a result of the reforms introduced by the National Taxi Task Team. The one-off gratuity paid in the 2020/21 financial year was to compensate taxi operators for loss of income during the COVID-19 pandemic.

*Table 8: Expenditure on (road-based) public transport*

| **Subprogramme 7** | **Audited outcome** | | | **Adjusted budget** | **Medium-term expenditure estimate** | | |
|---|---|---|---|---|---|---|---|
| ***R million*** | **2019/20** | **2020/21** | **2021/22** | **2022/23** | **2023/24** | **2024/25** | **2025/26** |
| Taxi recapitalisation | 240.9 | 234.0 | 308.4 | 476.8 | 478.7 | 500.2 | 522.6 |
| One-off taxi gratuity | – | 1 135.00 | – | – | – | – | – |
| South African National Taxi Council | 23.8 | 25.1 | 26.5 | 27.5 | 28.7 | 30 | 31.3 |
| Public transport network grant | 6 370.1 | 4 389.1 | 5 174.5 | 6 012.9 | 6 794.0 | 7 752.2 | 8 369.0 |
| Public transport operations grant | 6 325.8 | 6 749.6 | 7 120.8 | 7 090.4 | 7 402.9 | 7 735.4 | 8 081.9 |
| Other | 217.5 | 276.8 | 215.3 | 366.0 | 344.6 | 366.0 | 374.1 |
| TOTAL | **13 178.1** | **12 809.6** | **12 845.5** | **13 973.6** | **15 048.9** | **16 383.8** | **17 378.9** |

*Source: National Treasury Estimates of National Expenditure 2023*

### 5.2.4 New expenditure reductions

At the end of October each year the South African national Minister of Finance issues a Medium Term Budget Policy Statement (MTBPS). While not making any changes to appropriations on the revenue side, the MTBPS is important in setting out any changes to envisaged spending over the medium-term three-year period, arising especially as a result of changes in revenue estimates based on the first half of the financial year but also based on any new policy thinking.

On 1 November 2023, as this report was being finalised, the Minister announced various expenditure reductions across a range of services. On the whole, however, spending on road based public transport was not reduced significantly.

## 5.3 Finances of the C40 cities

The PTNG grants for creating integrated public transport networks, which thus far has been focussed on the BRT program are transferred to municipalities who then take responsibility for the programs. If expenditure proves higher than envisaged the deficit must be made up by the municipality. As indicated, it is envisaged that the PTOG grant will also, in future, be transferred to municipalities rather than provinces to support subsidised bus services.

While capital grants are available in terms of the PTNG program for, inter alia, the purchase of new buses, where money is borrowed to purchase buses to be owned by the municipality the lender does not have recourse to national government, but to the municipality itself.

The financing of local government in South Africa is relatively well developed for a country of its overall level of development. The metropolitan governments collect a large proportion of their revenue themselves, rather than relying on grants from national government. The key general tax revenue source is residential and commercial property taxes (known in South Africa as ‘property rates’) which are based on property values, while the bulk of revenue collected are fees for services including electricity (which the larger municipalities distribute), water, refuse and sewerage services. Metropolitan governments also receive an origin-based share of fuel levies collected nationally.

Table 9 summarises total operating and capital revenue for the five C40 cities. The figures are in millions.

*Table 9: Unaudited actual capital and operating revenue for C40 cities for 2023 FY*

| | **Unaudited actual figures for year ending 30 June 2023** | | | |
|---|---|---|---|---|
| **R millions** | **Operating Revenue** | **Capital Revenue** | **Total** | **Total Revenue as % of adj budget** |
| Cape Town | 53 275 | 7 447 | 60 722 | 98.1% |
| City of Ekurhuleni | 47 943 | 2 076 | 50 019 | 93.2% |
| eThekwini | 47 639 | 3 738 | 51 377 | 96.6% |
| City of Johannesburg | 70 514 | 5 085 | 75 599 | 102.6% |
| City of Tshwane | 29 561 | 1 529 | 31 090 | 69.1% |
| **Total C40 Metros** | **248 931** | **19 876** | **268 807** | |
| **Total all Metros** | **281 985** | **24 226** | **306 211** | |

The figures are derived from data published by South Africa's National Treasury and are based on quarterly returns provided by the municipalities. They are 'actual' figures, in that they are submitted on the basis of actual rather than budgeted revenue and expenditure. However, they are preliminary results and are unaudited. There appear to be some errors in the figures; for example, no figure is provided for the share of the national Fuel Levy received by Tshwane. However, they represent the best current figures available giving details of each of the five C40 cities.

While city finances appear from the figures to be reasonably healthy, there are some significant indicators of fiscal stress. National Treasury reports on key high-level indicators of financial stress show pressure across all five C40 cities, with the least pressure evident in Cape Town. This assessment is consistent with the extent to which Cape Town is still able to finance capital from internally generated funds.

The more detailed figures in Table 10 show a number of important features. Firstly, transfers – evident in both the operating and capital accounts - represent a relatively small proportion of total revenue. Secondly, revenue is dominated by earnings from the trading services, denoted as 'exchange revenue'. Of this, service charges for electricity are much the biggest component. The different between the cost of bulk electricity purchases and the electricity revenues earned are accounted for by the cost of running the cities' electricity distribution networks, although all cities generate some profit on the electricity service which is used to cross subsidise other services. The instability in this sector combined with increasing bulk costs is having a negative effect on the cities' finances. The main source of non-exchange revenue is property rates, followed by transfers and subsidies and the share of the fuel levy.

The capital account shows the breakdown of revenue sources for capital. Grants from national government usually represent the largest share followed by borrowing. Most cities generate revenue internally for capital spending. This is typically done through there being a difference between the interest rate charged to each of the services and the average interest rate paid by the city to its lenders, combined with the proceeds of accumulated capital.

The main sources of borrowing by the metros are the Development Bank of Southern Africa (DBSA) followed by commercial banks. These are usually specific purpose loans. Cities also issue bonds which are bought by pension funds and other investors. A relatively small portion of loans are provided by international development finance institutions.

The capital expenditure figures are provided by function and show the spending on road transport in context. The road transport figure includes capital expenditure on the PTNG

*Table 10. Capital and operating expenditure 2022-2023 (Preliminary actual results)*

| ***R million*** | **Cape Town** | **Ekurhuleni** | **Joburg** | **Tshwane** | **eThekwini** |
|---|---|---|---|---|---|
| **Operating Revenue and Expenditure** | | | | | |
| **Operating Revenue** | **53 275** | **47 943** | **70 514** | **29 561** | **47 639** |
| **Exchange Revenue** | | | | | |
| Service charges - Electricity | 16 425 | 18 229 | 16 754 | 10 337 | 15 597 |
| Service charges - Water | 3 971 | 5 785 | 8 929 | 3 950 | 5 890 |
| Service charges - Waste Water | 2 030 | 3 258 | 6 181 | 1 196 | 1 380 |
| Service charges - Waste Management | 1 309 | 1 723 | 2 455 | 1 327 | 966 |
| Sale of Goods and Rendering of Services | 597 | 1 553 | 1 451 | 879 | 272 |
| Interest and dividends | 1 614 | 1 268 | 2 263 | 816 | 1 557 |
| Other | 1 404 | 267 | 1 451 | 578 | 1 082 |
| **Non-Exchange Revenue** | | | | | |
| Property rates | 11 570 | 7 897 | 14 535 | 6 680 | 12 088 |
| Fines, penalties and forfeits | 2 018 | 110 | 366 | 116 | (59) |
| Licences and permits | 46 | 325 | 12 | 33 | 49 |
| Transfer and subsidies - Operational | 5 575 | 5 407 | 13 693 | 3 377 | 4 604 |
| Interest | 124 | 279 | 165 | 271 | 433 |
| Fuel Levy | 2 667 | 1 831 | 1 984 | - | 3 380 |
| Other | 3 925 | 11 | 277 | 2 | 400 |
| **Operating Expenditure** | **50 101** | **45 665** | **71 234** | **33 411** | **42 112** |
| Employee related costs | 16 028 | 10 083 | 18 037 | 9 676 | 11 540 |
| Remuneration of councillors | 170 | 146 | 179 | 111 | 136 |
| Bulk purchases - electricity | 10 382 | 14 048 | 14 109 | 8 959 | 12 642 |
| Inventory consumed | 5 307 | 5 729 | 6 158 | 2 923 | 3 231 |
| Debt impairment | - | 5 694 | 2 174 | 1 729 | 1 114 |
| Depreciation and amortisation | 3 259 | 1 942 | 3 920 | 2 016 | 2 719 |
| Interest | 718 | 1 085 | 4 055 | 2 988 | 879 |
| Contracted services | 8 282 | 4 928 | 4 902 | 3 357 | 5 265 |
| Transfers and subsidies | 324 | 494 | 5 058 | 2 | 463 |
| Irrecoverable debts written off | 2 477 | 44 | 3 467 | 0 | 0 |
| Operational costs | 2 729 | 1 437 | 6 768 | 1 654 | 2 221 |
| Losses on disposal of Assets etc | 425 | 34 | 2 408 | (4) | 1 902 |
| | | | | | |
| **Surplus/(Deficit)** | **3 174** | **2 278** | **(720)** | **(3 850)** | **5 526** |
| Transfers and subsidies - capital | 1 543 | 1 444 | 1 546 | 1 025 | 2 347 |
| Other transactions | 5 | 4 | 1 379 | - | 142 |
| **Surplus/(Deficit) for the year** | **4 716** | **3 718** | **2 205** | **(2 825)** | **8 022** |

| *R million* | Cape Town | Ekurhuleni | Joburg | Tshwane | eThekwini |
|---|---|---|---|---|---|
| **Capital Revenue and Expenditure** | | | | | |
| **Sources of Finance** | **7 447** | **2 076** | **5 085** | **1 529** | **3 738** |
| National Government | 2 272 | 1 366 | 1 669 | 1 193 | 2 260 |
| Provincial Government | 10 | 14 | - | - | 66 |
| Other Transfers and subsidies | 100 | - | 562 | 91 | 0 |
| **Transfers recognised - capital** | **2 381** | **1 380** | **2 231** | **1 284** | **2 326** |
| Borrowing | 1 915 | 481 | 1 365 | (52) | 989 |
| Internally generated funds | 3 151 | 215 | 1 489 | 297 | 423 |
| | | | | | |
| **Capital Expenditure Functional** | **7 446** | **2 076** | **5 085** | **1 529** | **3 738** |
| **Municipal governance & administration** | **1 301** | **308** | **215** | **176** | **272** |
| **Community and Public Safety** | **1 291** | **520** | **1 530** | **277** | **567** |
| Community and Social Services | 52 | 20 | 121 | 56 | 68 |
| Sport And Recreation | 72 | 46 | 17 | 26 | 72 |
| Public Safety | 194 | 22 | 145 | 9 | (4) |
| Housing | 949 | 432 | 1 222 | 172 | 420 |
| Health | 24 | - | 25 | 14 | 12 |
| **Economic and Environmental Services** | **1 303** | **347** | **1 068** | **218** | **1 094** |
| Planning and Development | 146 | 11 | 300 | 13 | 216 |
| Road Transport | 1 029 | 323 | 764 | 205 | 878 |
| Environmental Protection | 128 | 13 | 5 | - | 1 |
| **Trading Services** | **3 542** | **901** | **2 168** | **851** | **1 787** |
| Energy sources | 1 242 | 572 | 1 252 | 485 | 602 |
| Water Management | 775 | 168 | 451 | 200 | 534 |
| Wastewater Management | 1 102 | 94 | 338 | 162 | 457 |
| Waste Management | 424 | 67 | 126 | 4 | 194 |
| **Other** | **9** | **-** | **104** | **8** | **19** |

financed BRT projects as well as new roads, although the latter usually tends to be quite limited. Much of the expenditure on roads is for maintenance, which is included in the operating account.

The actual spending by cities on their BRT projects has tended to be significantly lower than their allocation from national government. This is attributable to the complexity of the BRT projects and capacity challenges at local level combined with onerous administrative processes required for local expenditure.

# 6 The electricity crisis and the Just Energy Transition Implementation Plan

## 6.1 Electricity crisis

### 6.1.1 Nature and roots of the crisis

South Africa is currently experiencing a severe electricity supply crisis. Unless resolved, this will clearly impact the potential for introducing e-buses in the country.

South Africa first experienced what it terms 'load shedding' in 2007. Although there have been long periods since then without loadshedding, it has intensified from 2018 and reached critical levels in the last two years, especially during 2023.

'Load shedding' is the term given when total electricity demand exceeds total supply, and the national grid operator reduces power to some parts of the grid in order to avoid the grid becoming unstable. High levels of instability can lead to grid collapse which can then require a number of days – if not weeks – to restore power, during which time most of the country will be without electricity. Load shedding is thus a necessary crisis management tool to address insufficient power supply.

In South Africa most electricity is generated by a national state-owned company, ESKOM. Currently ESKOM has approximately 50 Gigawatts of installed capacity, but poor management of this capacity over an extended period has led to much lower availability of energy. In 2023 the Energy Availability Factor (EAF), which is the percentage of electricity that is actually available as a proportion of installed capacity, has ranged between about 50% and 60%. Given the composition of Eskom's generating capacity, a well-functioning system should have an EAF of around 80%, allowing 20% of generation capacity to be off-line for maintenance or other reasons.

There have been various factors underlying Eskom's current failure. After a major build of new coal fired power stations in the early 1980s based on a higher anticipated growth in energy demand than transpired, South Africa had a significant energy surplus into the 1990s. However, when demand began to catch up with supply it was slow in procuring new power. When it did embark on building new power stations it did so through two very large coal fired plants, Medupi and Kusile, each designed to generate 4.8 GW of power. These, however, are taking almost a decade longer than planned to come on-stream, with anticipated final completion only in 2023 and 2026 respectively.

### 6.1.2 Measures to address the crisis

Various measures are now being taken to address the crisis. The single most important decision was taken in July 2022, when the President overruled opposition within the ruling party to open up generation to the private sector. Not only is this leading to substantial private sector investment in the sector, but it is also driving a shift from fossil fuel generation to renewables, since the cost of new renewable energy, particular solar and wind, is now significantly lower than coal or other fossil fuel power. Reports indicate that as of February 2023 there were 13.4 GW of private renewable energy projects at 'budget quote' phase (a key step before financial close) and approximately another 3.8GW in private power under construction procured by the Ministry of Minerals and Energy.

The second key measure is to separate ESKOM into three independent companies – one each for generation, transmission, and distribution, and bolster transmission capacity. The priority is the creation of an independent transmission company, to be known as the National Transmission Company (NTC) South Africa. This will enable competition amongst generators who will be able to feed their power into an independent grid operator not conflicted by its own generation interests. It will also better facilitate investment in the grid. The National Transmission Company is anticipated to start trading by the end of 2023 and the new system is being supported by a new Electricity Act also anticipated to be promulgated in 2023.

Along with these two major structural changes, a wide range of additional measures are being implemented to manage the crisis more effectively in the short term. Amongst these are subsidies to encourage households to invest in roof-top solar to reduce the demand on the national grid and its distributors, and feed-in technologies and tariffs to enable small generators, including households, to feed into the distribution network and receive some returns.

## 6.2 Just Energy Transition Investment and Implementation Plans

### 6.2.1 Origins and nature of the plan

Part of the response to the electricity crisis has been to develop strategies that use addressing the crisis to leverage a major shift from coal fired generation to renewables. South Africa's Just Energy Transition Investment Plan (JET-IP) (2022) and the subsequent Just Energy Transition Implementation Plan (JET-ImpP) (2023) lie at the core of this.

The JET-Partnership and associated plans have been conceived by the South African government, ESKOM, and a collection of international partners that have pledged support to South Africa's energy transition. A broad plan was agreed at COP 26 in November 2021 in Glasgow, with US$8.5 billion pledged jointly by US, UK, Germany, France, and the EU in the form mostly of lower interest loans to support what is termed the 'Just Energy Transition'. Since then, other countries have joined the initiative, including Italy, Canada, Denmark, Netherlands, Spain, and Norway, while the donor pool has been further expanded to include multilateral development banks, national development banks, and development finance agencies. As of late September 2023, the pledged amount had risen to US$11.8 billion.[9]

South Africa's Just Energy Transition (JET) Partnership concluded with the above countries in November 2021 represents a new global scale initiative, which is now being replicated elsewhere, including Indonesia, Vietnam, and Senegal.

JET Partnerships rest on country-led transformation, with international public partners providing the concessional funding necessary to de-risk investment in the transition and crowd in private capital. In South Africa's case, most of the committed resources are in the form of concessional loans, mostly loan guarantees.

South Africa published its high-level JET Investment Plan (JET IP) for 2023-2027 at the November 2022 COP 27 in Sharm el-Sheikh, a year after the agreement was signed. The Investment Plan seeks to provide a framework whereby the pledged finance leverages a much greater level

[9] News24.com 29 September 2023

of resources from both private and public sources, with the JET-IP estimating the requirement at about ZAR1.5 trillion, or, using the exchange rate at that time, about US$98.7 billion.

The JET-IP identified three key priority investment areas for the transition, namely:

- electricity;
- new energy vehicles;
- green hydrogen.

As is evident in Table 11, the majority of the identified need and proposed funding is intended to be for the electricity sector. The table shows an identified need of ZAR1 030 billion in the electricity sector (or US$68.7 billion), with electricity infrastructure allocated US$6.9 billion of the initial US$8.5 billion pledged.

*Table 11: JET-IP Financing needs per sector and priorities to be supported by IPG funding*

| **ZAR (US$) billion** | **Electricity** | **NEV** | **$GH_2$** |
|---|---|---|---|
| **JET-IP Financing needs Total: ZAR1 480 (US$ 98.7)** | 1 030 (68.7) | 128 (8.5) | 319 (21.3) |
| IPG Total: US$ 8.5 billion indicative allocation to the JET-IP | | | |
| Infrastructure | 6.9 | 0.2 | 0.5 |
| Planning and implementation capacity | 0.7 | | 0.2 |
| Skills development | 0.012 | | |
| Economic diversification and innovation | 0.022 | | |
| Social investment and inclusion | 0.016 | | |

### 6.2.2 Key sectoral objectives

In the electricity sector, the infrastructure investment priorities are:

- to manage the decommissioning of the retiring coal generation fleet, in line with a revised Integrated Resource Plan (IRP), and in tandem with the development of renewable energy generation at scale and pace;
- to timeously strengthen the transmission grid infrastructure to accommodate the shift to renewable energy; and
- to modernise the electricity distribution system.

The focus on the New Energy Vehicle sector arises, in particular, because of the importance of the motor manufacturing sector to South Africa's industrial economy, representing 5.7% of SA GDP in 2020, 17.3% of manufacturing output, and employing 508 957 people. This must transition to emission-free vehicles if the sector is to remain viable and competitive.

Regarding the New Energy Vehicle (NEV) sector, the focus in the JET-IP is thus on:

- transitioning the automotive sector value chains as the global shift to electric vehicle production gains momentum,
- building NEV supply chain localisation and setting the base for NEV manufacturing and component manufacturing, to protect sector employment and promote new growth in sustainable manufacturing.

In the Green Hydrogen sector, investment is focused on:

- key interventions to set South Africa up to become a world-leading exporter of $GH_2$ by incubating local $GH_2$ ecosystems
- undertaking critical planning, feasibility, and proofs of concept
- developing the necessary skills.

Within the New Energy Vehicle component, public transport is specifically identified as an area where the national government and local (city) governments could advance procurement and incentives. The plan includes funding the charging infrastructure and energy storage and supply chain investments in the local assembly, as well as supporting investments in public transport such as buses, taxis, and fleets.

Implementation will take a variety of forms. For example, opportunities will be encouraged for institution-specific funding agreements to be concluded directly between the providers of finance (for example, an MDB or international DFI) and the implementing institution of a programme or project (for example, Eskom, a province, or a municipality), subject to the respective parties' policies and due diligence, within parameters set by the National Treasury and relevant legal mandates.

In other instances, national intermediary institutions (for example, DBSA or IDC) would manage the disbursement of funds by agreement with international providers of finance (for example MDBs or international DFIs) and thus oversee project execution by implementing institutions.

The lead institution for public transport related initiatives is the DBSA.

More details contained in the Implementation Plan published in November 2023 are provided in 17.6.

# 7 National and local government commitments to a green transition

## 7.1 Introduction

This subsection covers the most important and relevant existing official transport policies and roadmaps towards e-bus deployment. These are categorised by:

- National government;
- The five C40 cities.

The purpose is to note the documents and convey the key highlights related to e-buses. For further details the documents can be accessed directly.

## 7.2 National government

### 7.2.1 Green Transport Strategy for South Africa (2018-2050)

Until the adoption of the Electric Vehicle White Paper in late November 2023 (see 7.2.5), the most significant national policy step towards recognising the importance of reducing emissions in the transport sector had been the Green Transport Strategy. This is a wide-ranging strategy embracing all parts of the sector. Here we concentrate on the high-level objective and key aspects that are relevant to the implementation of e-buses.

The objectives of the Green Transport Strategy include:

1. Enabling the transport sector to contribute its fair share to the national effort to combat climate change in a balanced fashion, considering the NDoT and the sector's primary responsibility of promoting the development of efficient integrated transport systems to enable sustainable socio-economic development;

2. Promoting behavioural changes towards sustainable mobility alternatives through information, education and awareness raising;

3. Engaging the low carbon transition of the sector, to assist with the aligning and developing of policies which promote energy efficiency and emission control measures in all transport modes;

4. Minimizing the adverse effects of transport activities on the environment;

5. Facilitating the sector's just transition to a climate resilient transport system and infrastructure.

A specific set of actions is specified in relation to EVs. The document states that in order to grow the uptake of EVs in South Africa DoT, in conjunction with DTI and National Treasury, will:

1. offer producers of EV vehicle manufacturing incentives to both produce and sell affordable EVs in South Africa, for both the local and export markets;

2. work with local research institutions to conduct research on EV batteries;

3. work with national, provincial, and local government departments and authorities and the automobile industry to set annual targets for the uptake of EVs and hybrid EVs in the Government vehicle fleet, as well as monitoring the local content of the manufacturing of cars locally, in line with the Industrial Policy Action Plan (IPAP);

4. introduce the conversion of old technology vehicles with higher emission factors to be retrofitted with EV technology;

5. consider providing incentives related to the beneficiation of using local resources in the manufacturing of key machineries and or components (e.g. fuel cell);

6. assist in establishing and developing local EV OEMs.

The strategy includes a set of short-, medium- and long-term actions. Those most relevant to the implementation of e-buses are summarised in Table 12.

### 7.2.2 Green Paper: Advancement of New Energy Vehicles in South Africa

In May 2021 the Department of Trade and Industry published a Green Paper entitled *Advancement of New Energy Vehicles in South Africa*. The intention was to finalise the document based on feedback and comment received.

*Table 12. Key Green Transport Strategy actions*

| Activity | Measures | Lead Department | Supporting Department/Institution | Time Frame |
|---|---|---|---|---|
| Government/ Fleet Procurement Guidelines | Develop guidelines for the procurement of vehicles throughout government to procure efficient vehicles, using clean technologies. | DoT | NT, DTI, DEA | Medium term |
| Electric/ Fuel Cell Vehicle Batteries | Finalise the feasibility of a local manufacturer of EV batteries / fuel cell batteries at a reduced cost. | DTI, DoT | DOT, DST | Short term |
| Electric Charging Stations | Expand electric charging stations powered by photo-voltaic panels by 40 per annum: accessible to general public. | DTI | IDC | Short-medium term |
| Metro-bus fleets | Draft regulations requiring 10% of Municipal bus fleets converted to cleaner technologies or cleaner fuel | DoT | metros | Long term |

*Source: Green Transport Strategy for South Africa (2018 – 2050)*

The key focus of this document is on the vehicle manufacturing industry. South Africa has a sizeable motor vehicle manufacturing industry that represents a significant portion of the national manufacturing sector, accounts for 4.9% of GDP in 2020 (2.8% manufacturing & 2.1% retail) and exports approximately 64% of its output. However, a majority of its key markets will introduce major constraints – if not outright bans – on the sale of internal combustion powered vehicles in their countries starting from around 2030. There is thus an urgent need to transition the industry to new energy vehicles.

The sector is driven by the private sector, but government has a critical role to play in facilitating a transition.

The draft Green Paper seeks to develop a framework upon which a comprehensive and long-term automotive industry transformation plan on new energy vehicles can emerge, with specific focus on:

- creation of a high-yielding business environment, including an appropriate fiscal and regulatory framework, that makes South Africa a leading and a highly competitive location, not only within the African continent but globally, for electric vehicle production;
- support and investment in the expansion and development of new and existing manufacturing plants to support the production of new energy vehicles and components within South Africa and to grow the level of employment in the sector;
- development and investment in new energy vehicle component technology and expansion of the fledgling electric supply chain, by increasing support and investment in a set of unique NEV components;
- reinvestment and support towards reskilling and upskilling of the workforce to ensure the right skills are available for the design, engineering and manufacturing of EVs and related components and systems;

- the transition of South Africa towards cleaner fuel technologies available globally;
- adoption of new and sustainable manufacturing processes to significantly reduce greenhouse gas emissions and improve our environmental wealth;
- ensuring that that Research and Development (R&D) investment is strategically targeted at activities that are likely to give South Africa a competitive advantage.

#### 7.2.3 Electric Vehicles Regulations Framework

In mid-2023 the national Department of Transport embarked on a set of 'roadshows' to the nine provinces to highlight the Green Transport Strategy and initiatives flowing from it, and to obtain comment.

Noting that one of the GTS strategic short-term targets is 'to convert 5% of the public and national sector fleet in the first seven years of the implementation of this strategy and an annual increase of 2% thereafter, to cleaner alternative fuel and efficient technology vehicles', the presentation emphasized the need for a co-ordinated inclusive approach between policy-making departments, research institutions, the Uyilo e-mobility program, and original equipment manufacturers (OEM's).

One of the initiatives arising out of the Green Transport Strategy is the development of an 'Electric Vehicles Regulations Framework'. Informed by policy documents such as the *Green Paper on the Advancement of New Energy Vehicles (NEV) in South Africa,* the Framework has five key pillars, with associated objectives as summarised in Table 13

*Table 13. Key pillars of the EV Regulations Framework*

| | |
|---|---|
| Standards and Safety | • Enable EV's produced in SA to be compliant in export markets and to be globally competitive |
| Incentives and affordability – EV's | • Create a domestic EV market to underpin and support the manufacturing OEM's and exports |
| Incentives and affordability – Charging | • Create a domestic market that supports various business models and innovation to enable a vibrant charging sector<br>• EV charging infrastructure to enable EV uptake and provide standards that enable business models for charging |
| Performance | • Ensure better comparison between EV models and from different manufacturers.<br>• Help to define this market, accelerate development of more cost-effective fast charging systems, enhance user convenience, and extend EV driving range |
| Environmental impact | • Reduce CO2 emissions and incentivize the purchase of EV's |

#### 7.2.4 NDoT Green Procurement Guidelines for Government Vehicle Fleet

The National Department of Transport is also currently developing green procurement guidelines for procuring government vehicles. The objective of these guidelines is to:

- Provide options that are available on how to procure Energy Efficient Vehicles;

- Provide guidelines on how to set up/develop a green vehicle procurement tender;
- Provide/suggest the environmental criteria to be included in green vehicle procurement tenders/contracts;
- Suggest information regarding further aspects/criteria to be considered; and
- Provide examples checklists, concepts, and terminology that one needs to know when pursuing green vehicle procurement.

### 7.2.5 Electric Vehicles White Paper (November 2023)

While this C40 report was it its final draft, the national government adopted its *Electric Vehicles White Paper*, which builds on the various policy documents already mentioned.

The White Paper identifies ten actions in support of the development of South African EV productive capacity, and six actions in support of the development of a South African market for EVs.

The ten actions in support of the development of South African EV productive capacity are:

1. An increase in levels of investment and funding, including the development of improved cost-effective incentive support to be announced through the publication of new Automotive Investment Scheme (AIS) guidelines. The higher levels of investment funding are intended to catalyse EV investment in automotive assembly and component manufacturing.
2. Facilitation and development of an electric battery regional value chain, including raw material refining; battery active materials and component production; and cell manufacturing. This is to deepen the SADC region's participation in the automotive value chain.
3. The introduction of a temporary reduction on import duties for batteries in vehicles produced and sold in the domestic market, to improve cost competitiveness.
4. Securing or maintaining duty-free export market access for vehicles and components produced in South Africa to support the resilience of the industry.
5. Leveraging R&D tax incentives to deepen domestic value addition.
6. Commercialising green hydrogen production in South Africa as a source of sustainable fuels.
7. Implementing energy reforms, including executing interim solutions for energy in partnership with industry.
8. Implementing reforms to network industries, including freight rail and ports.
9. Refurbishing the rail line between Gauteng and Ngqura to improve overall cost competitiveness.
10. Developing an EV certification programme in collaboration with industry for skills development.

The six actions in support of the development of a South African market for EVs are:

1. Developing and implementing a framework for fleets to transition to SA-produced new energy vehicles, including government-owned, public transport, corporate fleets, and mining equipment.

2. Scale up investment in charging infrastructure.

3. Developing opportunities for localisation of charging components and infrastructure.

4. Supporting increased grid capacity to facilitate uptake of EVs.

5. Consider consumer incentives for adoption of EVs.

6. Evaluating the need for economic regulation on EV charging.

## 7.3 C40 cities' climate and green transport plans

This subsection covers policies and other relevant documentation from the five C40 cities that specifically address city commitments related to the roll out of e-buses or green transport.

### 7.3.1 Cape Town

#### (a) Overview

In 2017 the City of Cape Town (CCT) signed the C40 'Fossil Free Streets' Declaration in the run-up to the launch event in Paris, France. The declaration was later changed to the 'Green and Healthy Streets' (GHS) Declaration to better align with associated C40 programs and networks. This means the city has committed itself to procure, with its public transport partners, only zero-emission buses from 2025.

In 2020 Cape Town also committed to carbon neutrality by 2050. This was set out in a document entitled 'City of Cape Town's Carbon Neutral 2050 Commitment' as well as the "Climate Change Action Plan" (CCAP) regarding carbon reduction and the adoption of green energy.

Three specific actions listed under Goal 20 of Strategic Focus Area 9 of the CCAP, which relate to the preparation for a complete transition to electric or alternative fuel-powered freight, bus, taxi, and passenger vehicles by 2050, include:

- Action 20.1: Develop a procurement strategy for low-carbon emission vehicles and fuel technologies towards carbon neutrality.
- Action 20.2: Develop the necessary policy and regulatory environment to promote the uptake of electro-mobility freight and electric passenger transport (including public and private vehicles and minibus-taxis) and manage risks to the electricity grid.
- Action 20.3: Show city leadership and gather real-world data from EV pilot programs such as the installation of publicly accessible charging infrastructure.

The city's climate change vision includes Cape Town becoming a city where electric-powered public transport (including minibus-taxis) is preferred over private vehicles. To ensure such a sustainable mobility system in Cape Town, one that is not only carbon-neutral but also enhances the quality of life and livelihoods, this plan must guarantee the feasibility of powering all vehicles with clean fuels.

### (b) Green Cape report on Golden Arrow Bus Services (GABS) project to introduce e-buses, and EV Market Intelligence report

Apart from its own initiatives, the City of Cape Town seeks to promote independent initiatives aligned with its objectives. Green Cape is a non-profit organisation that works at the interface of business, government, and academia to identify and remove barriers to economically viable green economy infrastructure solutions independent. The Green Cape report on the GABS project to introduce e-buses is an example of the promotion of such initiatives.

A further relevant report for this project is the Green Cape Report entitled '2022 Electric Vehicles: Market Intelligence Report', which highlights current investment opportunities in the EVs market in South Africa and the Western Cape. One of the key opportunities identified in the latter report is local manufacturing and electrification of public transport.

The report, which was produced in partnership with the Western Cape Government but has a national perspective, also identifies the following key drivers for EV take-up in public transport:

The need to meet climate obligations and greenhouse gas reduction targets (i.e. City of Cape Town Climate Action Plan goals).

- Public transport demonstrates the best business case for alternative fuel applications.
- Reduced fleet operational costs, including reduced fuel and maintenance costs.
- Decreasing battery prices.
- Increase in renewable energy usage and the clean energy transition.
- Local content requirements for manufacturing include the designation of 80% local content requirements for bus manufacturing in SA.

Key barriers are identified as:

- Slow local uptake due to high upfront cost.
- Rigid public procurement system.
- The poor precedent created by the City of Cape Town's (CCT) unsuccessful 2017/18 e-bus pilot.
- Lack of innovative and cost-effective financing mechanisms and access to capital.
- Insufficient skills throughout the value chain

### 7.3.2 Ekurhuleni

Ekurhuleni's Green City Action Plan (GCAP) was adopted in 2022. It is consistent with the City's Growth and Development Strategy 2055 (GDS 2055), where it envisions becoming a "delivering, capable, sustainable" city by 2055.

The GCAP discusses several transportation-related measures that focus on shifting travel from private cars to public transit, as well as electrifying cars and buses. The 2030 targets for this outcome are as follows:

- 25% market share of EVs in 2030;
- 25% reduction in fossil fuel energy use; and
- 20% reduction in private fossil fuel vehicle kilometres travelled.

These targets are supported by a set of selected measures within the transport sector. Note that improvement for minibus-taxis is included along with 'encourage electric vehicles', and 'new buses and priority bus lanes.

*Table 14: Ekurhuleni – Measures to reduce greenhouse gases (compared to BAU) by 2030*

| Measures | | Sector indicator | GHG Reduction compared to BAU (%) | GHG Reduction compared to BAU (MtCO2e) |
|---|---|---|---|---|
| **TRANSPORT** | 1. Encourage EVs<br>2. Parking restrictions<br>3. New buses and priority bus lanes<br>4. Integrated payment system and improvement for minibus-taxis | 20% reduction in private fossil fuel vehicle-kilometres travelled | 3.7% | 0.5 |

Estimated costs and potential sources of revenue for the Transport initiatives are shown in Table 15.

The document notes that the City 'will integrate the Green City Action Plan measures and targets into its development plan and budget, to support detailed design and ultimately implementation. In addition, the City will look to mobilise and work with key partners and other stakeholders, including private sector players.

### 7.3.3 eThekwini (including Durban)

In 2019 eThekwini adopted a Climate Action Plan (CAP), addressing all sectors including transport, with a Vision that 'by 2050 eThekwini is a sustainable, climate resilient city, where people's needs are prioritised.'

The aim is to transform the city's fleet into low-emission vehicles, with a focus on EVs and hybrids. While the long-term goal is to shift all vehicles across the city to zero-emission vehicles, given the current context and the extent of change needed, this move is planned to be incrementally achieved. The actions to achieve this target include:

- Facilitating the transition of 100% of vehicle-based feeder trips to low-carbon options by 2050.
- Converting all municipal vehicles (owned & procured) to low-carbon options by 2050.
- Enabling the supply of low-carbon energy through the implementation of appropriate infrastructure (e.g., battery storage, electric vehicle charging stations).
- Providing training programs for small, medium, and micro-enterprise businesses (SMMEs) in the motor service industry to enable them to provide services to zero and low-emission vehicles.
- Developing and implementing innovative financial instruments (financed through international climate finance) that help consumers transition to low-carbon transport options.

*Table 15: Ekurhuleni – estimated costs and revenue sources for intended measures*

| Measures | | Total Cost (ZAR million) | Direct Cost (ZAR million | Payback Period (Years) | Potential funding sources | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | National | Municipal/ Utilities | Fis (DFIs Banks) | PPP | Other private sector |
| TRANSPORT | Encourage EVs | 4 400 | 200 | n/a | x | x | x | x | x |
| | Parking restrictions | - | - | n/a | | x | | | x |
| | New buses and priority bus lanes | 980 | 980 | n/a | | x | x | | x |
| | Integrated payment system and improvement for minibus-taxis | 1 445 | 5 | n/a | | x | | | x |

- Lobbying the national government to enforce the switch of all vehicles to zero-emission vehicles by 2050.

In March 2022 eThekwini (Durban) released a report summarising the draft contents of its revised 'Durban Climate Change Strategy', with the aim of defining a city-wide approach to adapting to climate change and mitigating Durban's contribution to climate change.

In terms of transportation, the DCCS goal is for Durban to provide integrated, climate-smart, low-carbon transport systems for passengers and freight. More specifically, Objective H.3 stipulates that greenhouse gases from transport in Durban are minimized, and the energy efficiency of transport is improved, which encompasses:

- H.3.2 aims to explore the adoption of a range of alternative fuels and fuel-efficient technologies that are less carbon intensive.
- H.3.3 explores the local potential for the adoption of energy-efficient transport technologies.
- H.3.4 prioritises the use of and promotes the purchase of low-carbon and energy-efficient vehicles

### 7.3.4 Johannesburg

#### (a) Overview

The City of Johannesburg is a signatory of the 'Green and Healthy Streets' (GHS) Declaration to better align with associated C40 programs and networks. This means the city has committed itself to procure, with its public transport partners, only zero-emission buses from 2025.

The CoJ has also published a Climate Action Plan (CAP) in March 2021. The document notes that, CoJ has committed to pursuing an 'ambitious but achievable' action scenario and has adopted the following emission reduction targets: 25% by 2030, 75% by 2040 and 100% (net-zero emissions) by 2050, as compared to the 2016 baseline.

Amongst the various sectors forming part of the plan, transport emissions are to be reduced through;

- modal shift from private to public transport,
- the use of cleaner fuels (e.g. electric and hybrid vehicles) and
- higher vehicle efficiency (e.g. vehicle emissions standards).

The following targets form the basis of the ambitious scenario in respect of transport.

| | 2025 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Transportation** | • Private car use reduced to 27% of journeys;<br>• 4% of journeys by BRT, 25% by minibus, 5% by commuter rail;<br>• 5% of vehicles electric. | • Private car use reduced to 26% of journeys;<br>• 5% of journeys by BRT, 24% by minibus, 6% by commuter rail;<br>• 7.5% of vehicles electric. | • Private car use reduced to 18% of journeys;<br>• 10% of journeys by BRT, 21% by minibus, 11% by commuter rail;<br>• 40% of vehicles electric. | • Private car use reduced to 12% of journeys;<br>• 14% of journeys by BRT, 16% by minibus, 18% by commuter rail;<br>• 60% of vehicles electric. |

Furthermore, as part of the Johannesburg Growth and Development Strategy – 2040, The city aims for all city fleets to use green and renewable energy and fuel sources.

**(b) Green mobility analysis, 2020**

Before Johannesburg released its comprehensive Climate Action Plan it had already, in August 2020, produced a document aimed at identifying the least-cost technology pathways to improving air quality and reducing carbon dioxide emissions from the City of Johannesburg's municipal bus services, Metrobus and making various recommendations (City of Johannesburg, 2020).

The study found that although the CoJ Integrated Development Plan (IDP) and the National Green Transport Strategy have endorsed deployment of diesel dual-fuel (DDF) engines as a key technology solution, DDF technology is insufficient to meet stated climate goals.

The report identifies various alternative technologies which may better reduce emissions, including Euro VI gas engines accompanied by a transition from fossil gas to biomethane; or Euro VI diesel engines in the near term, operated without coal-to-liquids fuel and followed within 10 years by the exclusive procurement of zero-emission engines.

Significantly, it finds that the relatively low average number of kilometres travelled per year by buses in the Metrobus system limits the financial benefit of capital-intensive technologies such as battery e-buses (BEBs). BEBs offer 'greater operational cost savings, public health benefits, and environmental benefits', but because 'of the relatively high capital expenses for these technologies, greater utilisation rates are necessary to make them more financially competitive with conventional technologies on a total cost of ownership (TCO) basis'.

It goes on to state, that 'in the base assessment, where annual activity was assumed to be 36,000 km/yr, the BEB was estimated to have the highest TCO. However, as annual activity increases, the BEB reaches TCO parity with hybrid engines at 45,000 km/yr, diesel engines at

58,000 km/yr, and CNG engines at 72,000 km/yr. Utilisation can be increased through extended ownership periods or greater annual activity that serve to make better use of the capital investment.'

### 7.3.5 Tshwane

In 2021 the City of Tshwane adopted a Climate Action Plan. The Vision of the CAP is "to ensure that Tshwane is a net-zero carbon and climate-resilient city by 2050". It builds on three pillars of net-zero carbon, climate resilience and co-benefits.

The CAP plans ten outcomes (with 36 programmes and 52 actions) that together are intended to deliver a net-zero carbon and climate-resilient city by 2050. Interventions in the transport sector are envisaged to deliver 13.5% of emissions reductions. These are aligned with Outcome 3 for which the targets in the short- medium- and long-term are shown in Table 16.

*Table 16. Tshwane: Targets for transport sector outcomes*

| 2025 | 2030 | 2050 |
|---|---|---|
| 100% of transport plans, frameworks and strategies consider current and future climate risks (to the entire network and all users) | 30% of City-owned buses and the entire fleet are electric 50% of trips are made by public transport or NMT | 100% of City-owned buses and the entire fleet are electric 70% of trips are made by public transport or NMT |

Programme 4 within Outcome 3 is to '"Green" the City's fleet and drive a Citywide shift towards net-zero carbon transport'. Specific actions are to:

- Upgrade the City's fleet to net-zero carbon vehicles;
- Improve vehicle fuel efficiency;
- Prepare for and implement a Citywide roll-out of EVs;
- Develop financing mechanisms that will promote/enable a city-wide roll out of EVs

The CoT 'Climate Change Response Strategy' also identifies multiple priority programs and interventions aimed at combating climate change. Of particular interest is Intervention 5, which promotes cleaner mobility. This intervention aims to:

- Expand the electric vehicle infrastructure throughout the city to support the adoption of EVs.
- Commit the city to expanding its fleet of EVs, with a special focus on adding e-buses.
- Produce compressed natural gas (CNG) from landfill sites to supply CNG-propelled buses, thereby significantly reducing the operating costs of these buses.
- Ensure that vehicles exceeding tolerable emissions levels are either repaired or deemed unroadworthy.

# Part C The bus industry in C40 cities

## 8 Current business models

### 8.1 Business models in South African C40 cities.

There are many ways of grouping bus operations in South Africa. They could be grouped according to whether operations are privately or publicly run; which sphere of government they are contracted to; whether they are subsidised or not; how ownership of buses is structured; or a number of other factors.

In this section, the bus contracts are mostly grouped according to their institutional origins, and we then show key variations in models within each of these groups. The institutional approach is useful because, firstly, many of the characteristics of the various operations have been defined by their institutional origins; and secondly, in introducing e-buses the institutional context is important. The key groups in South Africa are:

**A. Formal private operators contracted mainly by provincial government** and subsidised from the Public Transport Operating Grant (PTOG).

**B. Legacy conventional municipal bus services:** Within this group are two models:

- B1: Municipally owned and operated;
- B2: Municipally owned but privately operated.

**C. Bus rapid transit systems and related:** These are also municipally contracted but have different institutional origins and arrangements from the legacy conventional municipal bus services. While most of them have characteristics of BRT, some are a form of conventional bus services or variations (such as the dial-a-ride service in Cape Town). There are various models within this group, but we identify two key variations:

- C1: BRT with private operators using their own vehicles;
- C2: BRT with private operators using municipally owned vehicles.

**D. Scholar transport:** These are the services contracted by various public education departments to transport school children to and from school in some areas.

**E. Informal, private small operators** (informal minibus-taxi sector).

**F. Other, private, unsubsidised bus operators:** This consists of a large number of vehicles operating under many different circumstances but not forming the core of public transport. They include, for example, the tourist coach industry.

**G. Feeder bus services** to another mode of public transport, contracted by the authority running such other mode. The Gautrain feeder service is the main example, and forms part of a provincial concession to the contacted rail concessionaire.

**H. Buses for internal use** operated not by a dedicated bus operator but by the public or private sector for their own internal use, such as for transporting their own employees.

*Table 17: Overview of current bus operator business models in South African C40 cities*

| **Model Groups** | | **Who is responsible?** | | **Funding arrangement** | | **Contractual arrangement** | |
|---|---|---|---|---|---|---|---|
| **Model** | **Examples** | **Bus ownership and operations** | **Oversight and control** | **Subsidy** | **Subsidy mechanism** | **Contract type** | **Procurement** |
| Group A | PUTCO & GABS | Mostly operated by private operators, who also own their own fleet | These services falling within Metros should ideally be managed by the relevant Cities, although the assignment of the services to Cities has generally not been implement since the NLTA was adopted. | PTOG | Subsidies are paid, ostensibly, on a vehicle km basis, although in many cases in reality, the subsidy amount is based on historical allocations and the amount paid per kilometre derived on the basis of regular negotiations between the service provider and the provincial govt. | Net contract | Constitution requires that such services must be procured through competitive tendering for contracts. The NLTA provides that such tenders are limited to a maximum period of seven years, with provision (s41 of NLTA) for a once-off 12-year contract to be negotiated under certain circumstances to facilitate system restructuring. |
| Group B1 | Johannesburg Metrobus, Tshwane bus services & Ekurhuleni Bus Service | Bus services are fully operated by the cities, who also owns the buses | Some operated by municipal companies (known as 'municipal entities'), others as a city department, both governed by the Municipal Systems Act (2000) and the Municipal Finance Management Act (2003) | Municipal taxes; Durban municipal bus service also gets PTOG | Where owned by municipal entity, they have their own financial statements, but these form part of the consolidated financial statements of the parent municipality. In effect, their finances are guaranteed by their parent municipality.<br><br>Otherwise operated as a City department.<br><br>In Durban the provincial government pays PTOG to municipality to part cover deficit | | While the objective is to cover costs, deficits are common and ultimately paid for by the parent municipality, with the exception that in the case of the Durban municipal bus service there is a contribution from PTOG. But effectively, new bus purchase is financed by the municipality. |
| Group B2 | Durban municipal bus service | Buses are city owned and maintained. Operations contracted to private company | | | | | |
| Group C1 | Rea Vaya (Johannesburg) | City contracts operations to private operator, who owns the buses. | Private operators running the bus service. Fares are collected through an independent fare system operator outsourced to a private company on contract to the City. | PTNG, and Municipal taxes | PTNG is intended to be primarily for capital expenditure, however, a significant subsidisation of operating spending has been permitted. The PTNG may also be used to fund a portion of | Gross contract | Contracted in terms of the NLTA as follows:<br><br>• Either for a once-off maximum 12-year contract negotiated under certain |
| Group C2 | MyCiTi (Cape Town), A Re | The city owns the buses, which the | | | | | |

| Model Groups | | Who is responsible? | | Funding arrangement | | Contractual arrangement | |
|---|---|---|---|---|---|---|---|
| **Model** | **Examples** | **Bus ownership and operations** | **Oversight and control** | **Subsidy** | **Subsidy mechanism** | **Contract type** | **Procurement** |
| | Yeng (Tshwane) | private operator operates | Station management services are mostly out-sourced to private companies | | the per kilometre rate to subsidise up to 100 per cent of the capital cost (including interest and related fees) of vehicles purchased by the VOC. | | circumstances to facilitate system restructuring (s41);<br>• Or awarded by tender for a maximum of 7 years (s42 or s43).<br>Alternatively issued in exceptional circumstances in terms of city supply chain management policy. |
| Group E | Minibus-taxis | Most operators own between one and five vehicles, with a very small number owning bigger fleets of around 30 to 40 vehicles. | The individualistic nature of the business makes it difficult to organise and ensure compliance with key service requirements. The MBT model is flexible, with low level of regulation, limited taxation, and low barriers to entry. | No opera-ting subsi-dies; capital subsidy equivalent to +/- 20% cost of new vehicle when old scrapped | Minibus-taxis do not receive operating subsidies and will only provide services which they perceive to be profitable. | Drivers are not employed by vehicle owners, but 'rent' the vehicle for the day in return for a 'target' that they must pay the owner, having covered fuel and oil costs | |
| Group F | There is a range of further operators that provide various forms of transport of people, but which do not fall within the core of the public transport system. These include, for example, tourist services. These operators are all private and unsubsidised. | | | | | | |
| Group G | Gautrain | Some buses owned by Province, some by the sub-contractors to concessionaire | Governed by concession agreement | Province, with national support | Ridership guarantee | Concession | Public Private Partnership, in compliance with National Treasury rules |
| Group H | Buses owned by public or private sector entity / company for their own internal use | | | | | | |

## 8.2 Procurement of vehicles

A critical distinction between the different models is whether the private operator or the public sector owns the buses. Where the private operator owns the buses, the private operator generally will also procure the buses; although there are exceptions to this, when, for example, the public authority procures the buses which then become the property of the operator over time as the contract progresses.

Where private operators procure buses, they will logically take steps to ensure they get the best value for money. If they fail to do so they bear the financial risk. It is likely that if they are to provide contracted services to the public sector then the public sector will demand certain specifications, and these will have to be adhered to. However, apart from this there should be limited public sector involvement in the process.

Where, however, the public sector procures the vehicles it must adhere to the laws governing public procurement. The country's Constitution spells out the principles for this, stating:

> *217.* ***Procurement****. (1) When an organ of state in the national, provincial, or local sphere of government, or any other institution identified in national legislation, contracts for goods or services, it must do so in accordance with a system which is fair, equitable, transparent, competitive and cost-effective.*
>
> *(2) Subsection (1) does not prevent the organs of state or institutions referred to in that subsection from implementing a procurement policy providing for-*
>
> *a) categories of preference in the allocation of contracts; and*
>
> *b) the protection or advancement of persons, or categories of persons, disadvantaged by unfair discrimination.*
>
> *(3) National legislation must prescribe a framework within which the policy referred to in subsection (3) must be implemented.*

Procurement legislation differs somewhat between national, provincial, and local government. However, all legislation governing the procurement of vehicles – and indeed the procurement of public transport services must comply with the constitutional provisions.

## 8.3 City-based analysis

Having discussed the groups and models in broad terms, the following subsection examines each of the cities, explaining the models within the city context. The information here and in the tables in the text box was obtained from various sources, including PTOG and PTNG data obtained from the National Department of Transport, as well as interviews and correspondence with various relevant city departments.

### Key tables

The following tables give more information regarding many services described in this section, as at 2023:

- Operational statistics are given in Table 19 (p.82), including revenue kilometres, passenger journeys, fare income and bus numbers.
- Financial information, including the cost-recovery ratio, cost and subsidies, is given in Table 44 (p.155).

### 8.3.1 Cape Town

The key road-based services in Cape Town (excluding scholar services) are:

- Golden Arrow Bus Services (Group A);
- MyCiTi (Group C);
- Informal minibus-taxi operators (Group E).

**(a) Golden Arrow Bus Services (PTOG)**

Golden Arrow Bus Services (GABS) is the major public transport bus service operator in Cape Town, providing commuter bus services throughout a large part of the City of Cape Town metropolitan area. Contracted mainly to the provincial government, the company operates a fleet of over 1,100 buses on 1,300 routes, with a daily ridership of around 220,000 people.

Since 2013, a GABS subsidiary (Table Bay Rapid Transit) has also been contracted by the City of Cape Town to run part of the metro's MyCiTi system. GABS also operates MyCiTi's N2 Express service on behalf of a company it has formed with two minibus-taxi companies.

Of critical relevance to this report is that GABS has been piloting the use of e-buses. Based on what it has learned, GABS has expressed an intention to convert its fleet to BEBs over time (Neethling, 2023). This process is described in more detail in section 13.

**(b) MyCiTi BRT**

MyCiTi is Cape Town's BRT project implemented in line with national government's Public Transport Strategy and Action Plan. Initial elements of the service began operating in May 2010 mainly as a shuttle service for the 2010 FIFA World Cup held in South Africa.

During Phase 1, which was launched in 2013, the City outsourced MyCiTi's vehicle operations to three different vehicle operating companies, two of which were comprised of former minibus-taxi operators and the third a subsidiary of GABS incorporating an empowerment partner. In 2014 MyCiTi service extended its coverage with the N2 Express service encompassing areas to the south-east of Cape Town. 2022/23 operational statistics show that MyCiTi has a fleet of approximately 355 vehicles, with 26 million passenger trips per annum.

Fare collection, an automated public transport management system and station services were also outsourced to different private companies and are funded partially though PTNG and partially by the City from its own funds.

By March 2023 monthly passenger journeys on MyCiTi was about 1.7 million. Figure 21 shows an interesting picture regarding the impact on passenger numbers by a range of factors, such as strikes, destruction of key stations through vandalism, suspension of services due to contract disputes and the COVID-19 pandemic.

The first stage VOC contract for Phase 1 is coming to an end in 2025. The City has approved a business plan for stage 2 of Phase 1, starting in late 2022 (City of Cape Town, 2022). The first part of the business plan focuses on enhancing and reducing the costs of system-wide elements of the MyCiTi service, such as the fare and vehicle monitoring systems and station management. The second part updates the city's approach to the MyCiTi Phase 1 service and is focused on preparing for the competitively tendered stage 2 contracts that will come into effect in 2025 as well as other measures to reduce the projected Phase 1 operating deficit, thus to release funds to the next phase of MyCiTi roll-out. The concern was that a disproportionate part of the operating deficit was driven by projected Phase 1 operating costs.

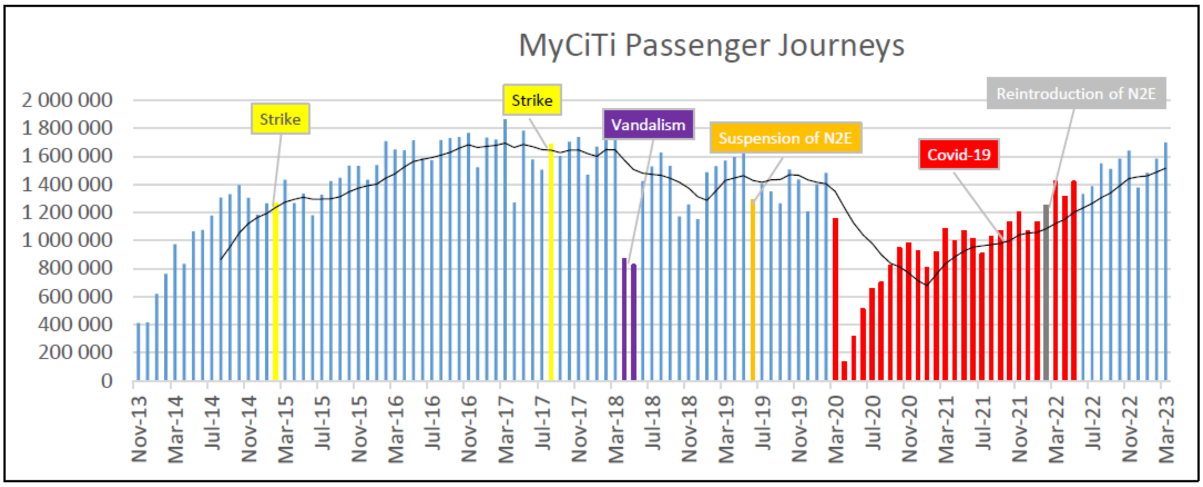



*Figure 21: MyCiTi passenger journeys 2013-2023*

*Source: (City of Cape Town, 2023)*

A key strategy underpinning this MyCiTi Business Plan is to focus the MyCiTi service on its areas of competitive strength, namely longer routes with relatively high levels of demand where a dedicated right of way, the most direct route and quick boarding stations can be leveraged cost-effectively. The approach seeks to replace scheduled feeders on feeder routes where demand has been compromised by unlawful MBT encroachment or where demand is low, by harnessing VOC flexibility, ingenuity and operational experience to deliver more competitive and demand-responsive services using appropriate vehicles and technology that will minimise the opportunity for unlawful competition and optimise service provision meeting the diverse needs of a broad potential passenger base.

A closer alignment of cost and revenue, on a per passenger/kilometre basis, and as similar a user experience as far as reasonably possible, is required between the two phases.

The Phase 2A is the next major phase of the MyCiTi service, will focus on the provision of BRT type services between the Metro Southeast (Khayelitsha and Mitchell's Plain) and Wynberg and Claremont (City of Cape Town, 2020). MyCiTi services will provide the primary public transport offering on designated routes, with MBT services planned to be acting as feeders. Arising from the experience of implementing and operating Phase 1 of MyCiTi, and of the N2 Express, several lessons have been learnt and challenges identified. The design of Phase 2A reflects cognisance of these lessons, including those in Table 18.

*Table 18: MyCiTi Phase 2A – design changes due to lessons learned*

| **System aspect** | **Response to lessons learnt** |
|---|---|
| Organisational Structure | • Focused and comprehensive MyCiTi management structure required<br>• Should include appropriate integration tools and KPIs to deliver required outcomes<br>• Contract management skills and competencies required |
| Competitive advantage | • Ensure MyCiTi is more attractive than other modes<br>• Use an "impact compensation" model – only compensate if there is sustained negative impact on MBTs |

| | |
|---|---|
| | • The feeder model to be reassessed due to low R/C ratios (MBTs to complement the network by providing feeder and community services) |
| Infrastructure | • Develop more resilient station and bus stop structures to prevent vandalism<br>• Build stations only where demand is high, and left-aligned median stops at other stopping locations<br>• Consider loadshedding mitigating design measures as part of station designs |
| Operations Management | • Interrogate systems and infrastructure plans early to optimise operations |
| Fleet | • Use low floor buses to enable more flexible use of vehicles<br>• Improve contractual arrangements in respect of maintenance and repair<br>• More accurately assess refurbishment and replacement needs<br>• Adequate provision for the replacement of damaged fleet due to vandalism and accidents (financially with an appropriate procurement mechanism) |
| Vehicle operating contracts | • Revise to provide better operational control<br>• Negotiate reduced rates based on experience to date<br>• Pursue tender if no reasonable agreement in reasonable period |

**(c) Informal minibus-taxis**

There are approximately 10 000 minibus-taxis with operating licences in Cape Town. Estimates have been made that there are as many as 6 000 illegal operators (those operating without licences). While there are numerous informal operators operating short routes within townships without licences, the figure of 6 000 is probably unlikely, especially given the City of Cape Town's strict policy of impounding vehicles operating without licences.

### 8.3.2 Ekurhuleni

The key road-based public transport services in Ekurhuleni, excluding scholar services are:

- PUTCO (Group A);
- Ekurhuleni Bus Service (Group B1);
- Harambee BRT (Group C);
- Informal minibus-taxis (Group E).

Although Ekurhuleni is designated a metropolitan area, it has no obvious single centre as found in the other five C40 cities, consisting rather of nine towns and 17 townships. It was thus constituted from a number of smaller legacy administrations. The relatively fragmented urban form distributed over a substantial area creates significant challenges for public transport.

(a) **PTOG s**ubsidised services

The PTOG data received from NDoT indicates that there are currently no PTOG-funded bus operations in Ekurhuleni. This could be due to PUTCO's withdrawal from the GT1187/1 tender, which could be the reason why no buses are shown as operational in the database.[10]

**(b) City of Ekurhuleni Bus Service**

The City of Ekurhuleni Bus Service is a municipal bus service, wholly owned by the metropolitan government. It was formed by amalgamating two legacy municipal bus services from two of the municipalities – Germiston and Boksburg – that were amongst those brought together to form the metropolitan City of Ekurhuleni. It continues to operate from the original 2 depots in these two areas.

The City of Ekurhuleni Bus Service operations have enjoyed limited but consistent support from commuters, with services recording increases in passenger numbers throughout the 2022/23 financial year. The Ekurhuleni Bus Service operations gradually increased from previous years rising to more than 900 000 passengers for the year.

**(c) Harambee**

Since 2008 the City has been working on the Integrated Rapid Transport Network (IRPTN) to connect the City through public transport.

Its BRT service, implemented in terms of the national PTSAP and funded through the PTNG, is called the Harambee Bus Service. Harambee consists of a 56km trunk route from Tembisa in the north to Vosloorus in the south. It was built in phases with the aim of connecting the nine Ekurhuleni towns of Benoni, Germiston, Springs, Kempton Park, Edenvale, Nigel, Brakpan, Boksburg, and Alberton

#### 8.3.3 Johannesburg

The key road-based public transport services in Johannesburg, excluding scholar services are:

- PUTCO (Group A)
- Metrobus (Group B1)
- Rea Vaya (Group C)
- Informal minibus-taxis (Group E).

**(a) PUTCO (Group A)**

The largest PTOG funded operator in Johannesburg, the Public Utility Transport Corporation (PUTCO), is a provider of commuter bus services in the provinces of Gauteng, Limpopo, and the western parts of Mpumalanga. Today the company is one of the biggest commuter bus operators in the country, with a fleet of 1,400 buses, employing just over 3,300 people, and transporting more than 210,000 passengers on a daily basis.

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[10] Source: Mamelodi and the key taxi industry issues – News – Sibusiso Buthelezi (thesbu.com)

PUTCO is a fully private operation, purchasing and owning its own buses. It is contracted by the Gauteng Province.

**(b) Metrobus (Group B1)**

Metrobus is the municipal bus service of the City of Johannesburg. It is structured as a municipal owned company (defined as a 'municipal entity' under the Municipal Systems Act) wholly owned by the City of Johannesburg.

With a fleet of 532 buses, it has more vehicles than Johannesburg's Rea Vaya services, and is the second largest municipal bus service in the country. While initially confined mainly to white areas under apartheid, it now operates a wider network of routes, although PUTCO is responsible for the bulk of conventional services into the township areas. Additionally, it holds the position of the second-largest municipal bus operator in South Africa, with 532 buses that serve 80 scheduled routes and 130 school routes, with a daily ridership of approximately 90,000 passengers.

**(c) Rea Vaya (Group C)**

Rea Vaya is the BRT system operating in the City of Johannesburg. The Rea Vaya project was implemented in phases, with both Phase 1A and 1B currently operational. Preparations are being concluded to operationalize Phase 1C(a), which is the third phase of the Rea Vaya system.

The municipality views a core purpose of the Rea Vaya system, in addition to ensuring the convenience and safety of transport users, to be the inclusion in the formal system of previously excluded public transport operators, including minibus-taxi operators on affected routes, who primarily become owners of the Bus Operating Companies (BOCs) that operate the Rea Vaya BRT system.

### 8.3.4 Tshwane

The key road-based public transport services in Tshwane, excluding scholar services are:

- PTOG-related services (Group A);
- Tshwane Bus Services (Group B1);
- Tshwane Rapid Transit (Group C);
- Informal minibus-taxis (Group E).

**(a) PTOG-related services, including PUTCO (Group A)**

We have already described PUTCO in the discussion on Johannesburg.

PUTCO, which is contracted by the Gauteng Province, in which Johannesburg, Tshwane and Ekurhuleni are all located, also operates within the Tshwane area.

**(b) Northwest Star**

Northwest Star (NWS) Bus Company is a subsidiary of Northwest Transport Investments (Soc) Ltd, a parastatal company owned by the North West Provincial Government. NWS has been the primary transportation provider in the North West Province since its establishment. The company operates a network of public transportation services connecting the North West Province and Mpumalanga to the City of Tshwane, Ekurhuleni, and Midrand, with a fleet of approximately 640 buses. These services are primarily conducted through contracts with the Department of Transport (DoT), with a significant portion of passenger fares subsidised by the government.

**(c) Tshwane Bus Services (Group B1)**

Tshwane Bus Services (TBS) is a municipal bus service. It is a division of the City of Tshwane's Department of Roads and Transport.

It provides conventional commuter services to commuters traveling in and around Tshwane, focussing mainly on the more closely located areas, unlike PUTCO, which serves more distant areas. TBS operates from three fully operational depots: the C. de Wet depot, Jan Niemand Park depot, and Pretoria North depot, all also owned by the municipality. TBS has a total fleet size of 254 buses and operates across 278 routes radiating from the city centre, with an average route length of 14 km.

**(d) Tshwane Rapid Transit: A Re Yeng (Group C2)**

The Tshwane Bus Rapid Transit (TRT) service forms a key part of the City's Integrated Rapid Public Transport Network (IRPTN) and seeks to integrate with other transportation modes across the City including minibus-taxis, Tshwane Bus Service, and Gautrain.

TRT was formed in response to a government initiative to transform public transport and dramatically improve commuters' experience of mobility in Tshwane through BRT. The shareholders of TRT are affected minibus-taxi and bus operators, which provided services where A Re Yeng was planned to operate. TRT's shareholding is equivalent to their estimated market share. In an effort to contain emissions TRT uses Compressed Natural Gas (CNG) buses and Euro IV diesel engines.

TRT operates under a concession agreement with the CoT and follows standard operating procedures designed by the City. The CoT is responsible for fee collection, monitoring services, tracking TRT's performance, and owning/ managing the buses.

**(d) Informal minibus-taxi operators**

The minibus-taxi industry, in the City of Tshwane (CoT), is loosely organised by the Tshwane Taxi Industry and includes the two main national minibus-taxi industry structures namely: South African National Taxi Council (SANTACO) and National Taxi Alliance (NTA). There are approximately 40 minibus-taxi associations of which 33 are fully registered and seven provisionally registered.

Approximately 93% of the minibus-taxi association membership actively provide services while the rest are considered 'dormant'. Out of 19 684 active members, almost three quarters (73%) do not have permits or operating licences, whereas 4% of inactive members (1 495) have permits and operating licences. The records also show that there are 23 980 registered minibus-taxi vehicles. Out of these, 38% have operating licenses and 62% are without an operating license.[11]

[11] Information supplied by City of Tshwane.

### 8.3.5 eThekwini (Metro, which includes Durban)

The City of eThekwini's structure of services differs somewhat from the other C40 cities in South Africa. It has no large private operator equivalent to PUTCO or GABS in the other metros. There are a number of small legacy bus operators contracted to the provincial government and which receive PTOG subsidies.

The structure can be summarised as follows:

- a collection of small, provincially contracted private legacy services, (Group A);
- Legacy municipal services with three brands, all owned by the municipality but with private contracted operators, with somewhat different services (Group B2)
    - Tansnat, which operates the services called Durban Transport (the main municipal service) and Mynah on a net contract basis
    - Copper Sunset that operates the People Mover service on a gross contract basis;
- Go! Durban BRT (Group C) – not yet operational;
- Informal minibus-taxis (Group E).

The main services in eThekwini are Durban Transport, People Mover, and Mynah. The Go! Durban IRPTN project is underway with the first corridor slated to commence operations in 2024, while the commencement dates for the other two remain unconfirmed.

(a) **Small legacy private operators**

There are a number of legacy operators each with small fleets which are contracted to the provincial government and receive PTOG funding – thus falling into what we have categorized as Group A. These include Combined Transport, K. Chetty Transport, Metro Bys, and Twoline.

(b) **Durban Transport**

The municipality is responsible for the Durban Transport service for commuters both in traditional white areas and African and other townships. The City owns and maintains the vehicles, but has contracted operations out to a company set up by minibus-taxi operators, Transnat Durban (Pty) Ltd. The service is sometimes referred to by the brand name 'Aqualine' – originating from an amalgamation of the old, segregated Blue and Green Lines.

The service uses high floor 12m diesel buses and charges lower fares than the other services in the area. The buses are spacious and capable of accommodating a large number of passengers. Some of the buses are wheelchair friendly.

Durban Transport was privatised, which resulted in, the municipality selling only the buses to the private operators. The fixed infrastructure (such as depots and workshops) was excluded and was to be rented from municipality by the successful bidder. The buses were then sold to individual operators, who were allocated routes, collected the fares on the allocated routes and serviced the buses in the garages, which it managed. But this led to significant deterioration of the fleet.

Following this financial distress, the municipality bought the buses back and agreed to renegotiate the arrangements and a reconstituted company (Transnat) was contracted to provide operations.

(c) **Durban People Mover**

The Durban People Mover is a tourist-oriented bus service, also servicing commuters, which runs every 15 minutes from 06:30 to 23:00 and consists of two routes within the central business district and along the beachfront, servicing Durban's entertainment and business areas using low floor 12m diesel buses. This bus system formed part of a transport redesign process that the City implemented for the 2010 FIFA World Cup.

Durban People Mover has a fleet of 24 buses which on average travel 53 500 kms per month. Between July 2022 and June 2023, the buses travelled approximately 640 000 kms, carrying 1.4 million passengers with a revenue of R8.6 million.

**(d) Mynah**

Mynah buses were introduced at the end of the 1980s as an additional mode of transportation on popular Durban routes. Today, the Mynah bus service operates old generation high floor 9m diesel buses serving routes just outside of the Durban central business district. These routes include areas such as Musgrave Road, Florida Road, and Ridge Road. Additionally, there are several buses that serve outlying areas and provide inter-city travel options.

(e) **Go! Durban BRT services**

The eThekwini Municipality embarked on an ambitious Bus Rapid Transit (BRT) implementation plan known as Go! Durban in 2010. The complete network was designed to consist of nine universally accessible routes, including one rail and eight rapid bus trunk routes with dedicated right of ways , feeders and complementary services. The service was planned to use 300 buses, using 12m low floor diesel buses for trunk services and 9m low floor diesel buses for feeder routes.

Implementation of the Go! Durban system has been delayed, with the first corridor now scheduled to commence operations in 2024.

The project has faced a series of challenges, from sabotage attempts by local communities seeking job and economic opportunities, to interference from construction 'mafias,' and prolonged disputes with taxi associations demanding compensation for lost routes. They have threatened to halt the project if their demands are not met.

(f) **Bus maintenance and depo**ts

The City owns the depots for all the services and maintains them. Renovations are needed at depots to cater for the City's plan to standardise on low floor buses in the future.

As indicated above, bus maintenance is the responsibility of the City. Currently, in all services other than the limited number of small legacy operators described under (a) above, the operators do not have maintenance responsibilities. The maintenance requirements are set by the City and are outlined in detail within the Service Level Agreement (SLA) between the City and the relevant operator. Other than the usual three-year servicing and maintenance plan included when new buses are procured, the City performs most of the maintenance using its own staff, while sometimes using the OEM. The City charges the operators for the use of the depot, for maintenance of the buses, and for security.

(g) **Financing responsibilities**

The operation of the buses is primarily funded by the City and PTOG with charges levied on Transnat for the use of buses, maintenance, security and use of the depot facilities.

The City bears the financial responsibility for the People Mover service, which generates revenue directly for the City without any funding from PTOG.

The collection of fares and other system income varies somewhat, depending on the specific contractual arrangements:

- Under net contracts, the operator receives these revenues, and uses it as a source of income to operate the service.
- Under gross contracts, fare revenue accrues to the City, and the City pays the operator to operate the service.

# 9 Numbers and characteristics of bus services in C40 cities

## 9.1 Overview of characteristics

Table 19 (p. 82) sets out key operational data regarding bus operations in the C40 cities in the financial year ending in 2023, per category of services, including the operator(s), revenue kilometres, passenger numbers, staffed bus stations, drivers, and numbers of buses (per capacity / type). This table is based on PTOG and PTNG reports from provinces and cities to the national government, engagements with the cities directly, and analysis of the NaTIS bus registration figures.[12]

This accounts for all buses that NaTIS record as being registered in the C40 cities.

Figure 22 shows passenger journeys per annum in the five C40 cities in services for which information could be sourced. These cover PTOG and PTNG subsidized services, as well as other municipal bus services (where they exit). Johannesburg, Tshwane, and Cape Town move significant passenger numbers; on the other hand passenger numbers in eThekwini and Ekurhuleni are low in comparison.

[12] The sources of this information are explained in more detail in the note following the table.

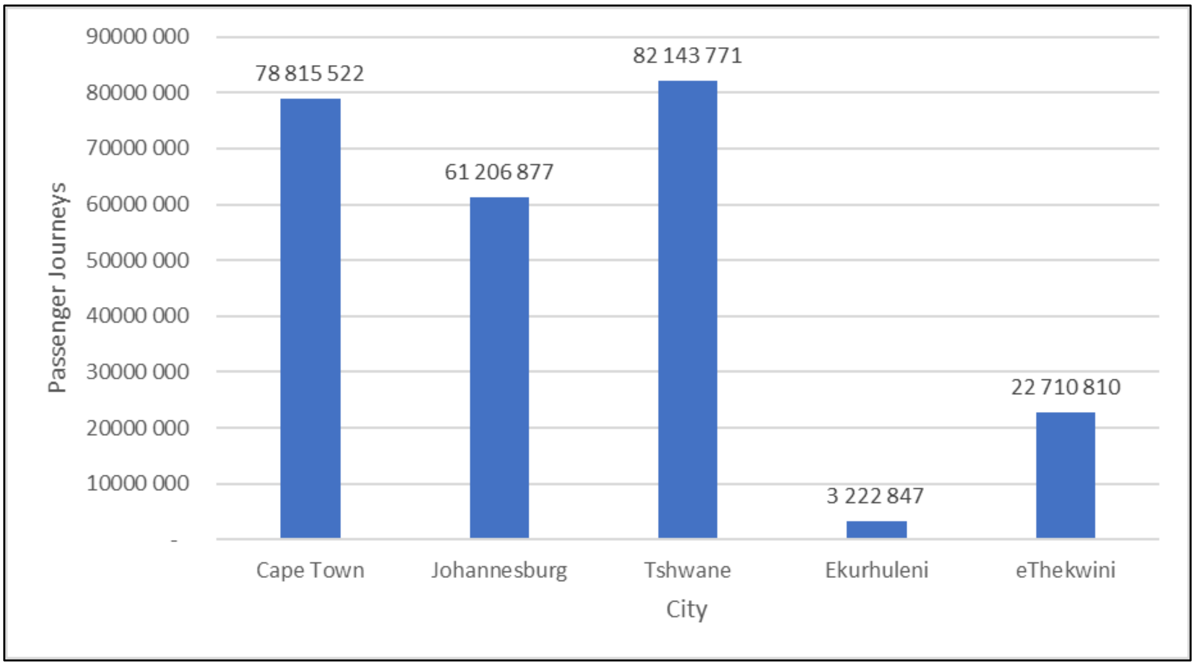



*Figure 22: Passenger journeys p/a in bus services in C40 cities (2023)*

*Source and scope: See Table 19*

Figure 23 shows revenue kilometres per annum for bus services in C40 cities for which information could be sourced. Cape Town has the highest revenue kilometres, followed by Johannesburg and Tshwane.

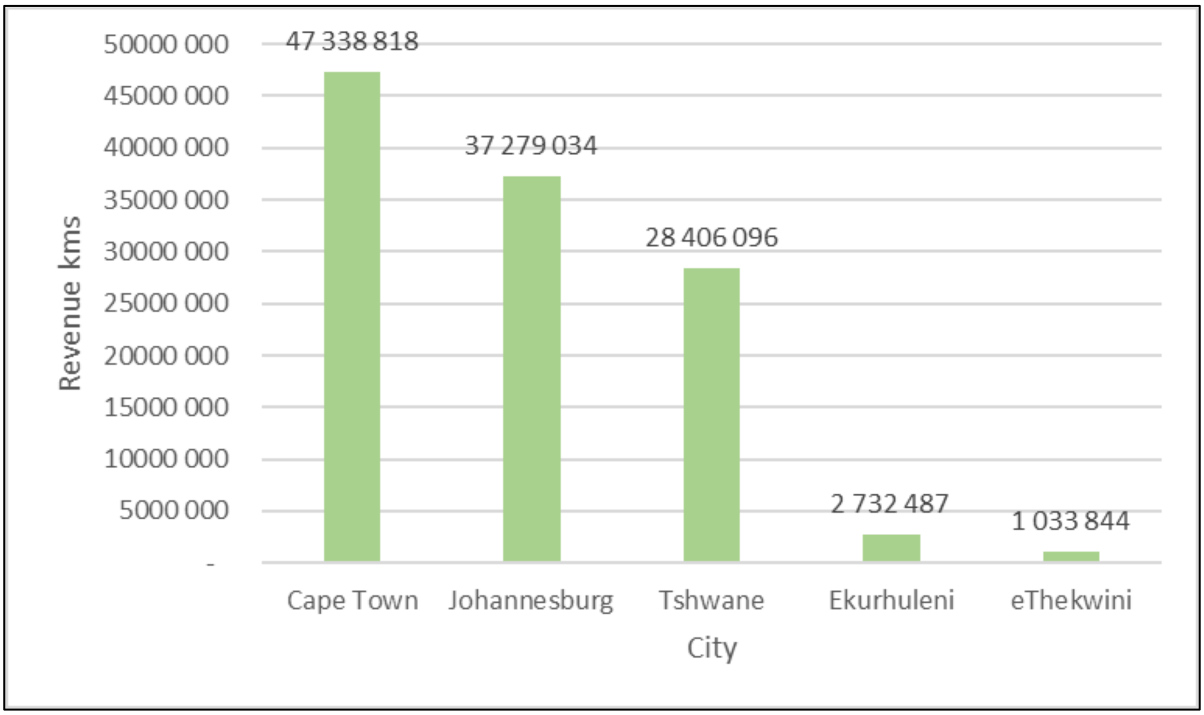



*Figure 23: Revenue kms in bus services in C40 cities (2023)*

*Source and scope: See Table 19*

Figure 24 provides a summary of bus numbers in each city. PTOG and PTNG subsidised bus services, and other municipal services constitute a significant portion of the total fleet in most cities, ranging from 10% of the total fleet in Ekurhuleni to 50% of the total fleet in Cape Town. The number of "additional buses" per city was calculated by subtracting the PTNG, PTOG and other municipal bus services totals from the overall number of buses obtained from the 2023 NaTIS data set. The graph below includes all registered buses, and therefore the scope (and thus extent of bus services covered) is significantly wider than the previous two graphs.

Tshwane has the highest number of buses, followed by Johannesburg and Cape Town.

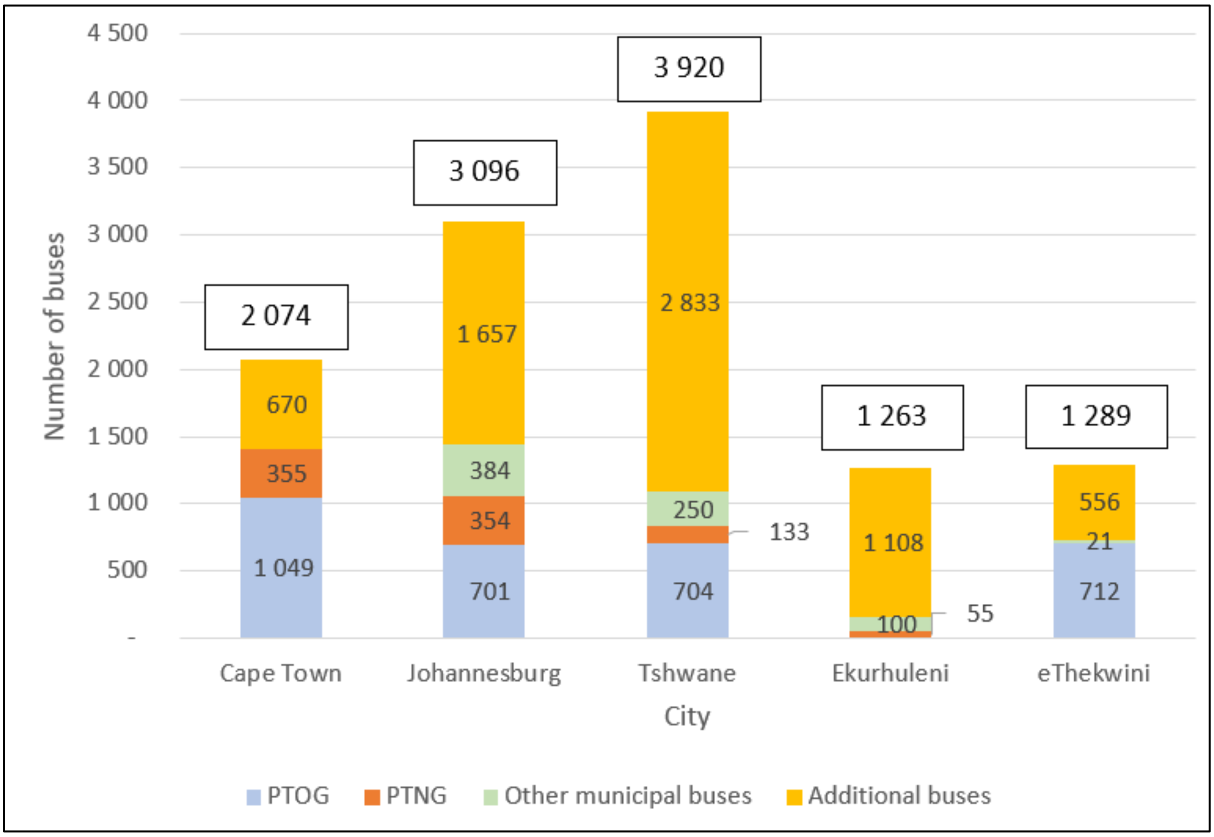



*Figure 24: Number of buses in C40 cities (2023)*

*Source and scope: See Table 19*

Figure 25 provides a summary of the total system income and funding per annum for PTOG, PTNG and other municipal services in each city. For a detailed assessment of these figures, refer to Table 44 (p. 155). In considering this information, note that Ekurhuleni had no reported PTOG-operated services, while eThekwini had no PTNG services in operation.

System income comprises mainly fare revenue but could include income from sources such as advertising. Note this regard:

- the highest system income by far was collected regarding Cape Town-based bus services, amounting to R1.27 billion;
- Johannesburg-based bus services collected system income of R0.71 billion.

Funding for bus services (including national grants and city's own spending) is shown in Table 44 and covers operating and capital expenditure in the financial year ending in 2023. In this regard, note that "PTNG services funding" includes all PTNG grant funding and city contributions regarding such services, including capital funding for the construction towards new phases of BRT projects; it is therefore not limited to operations.

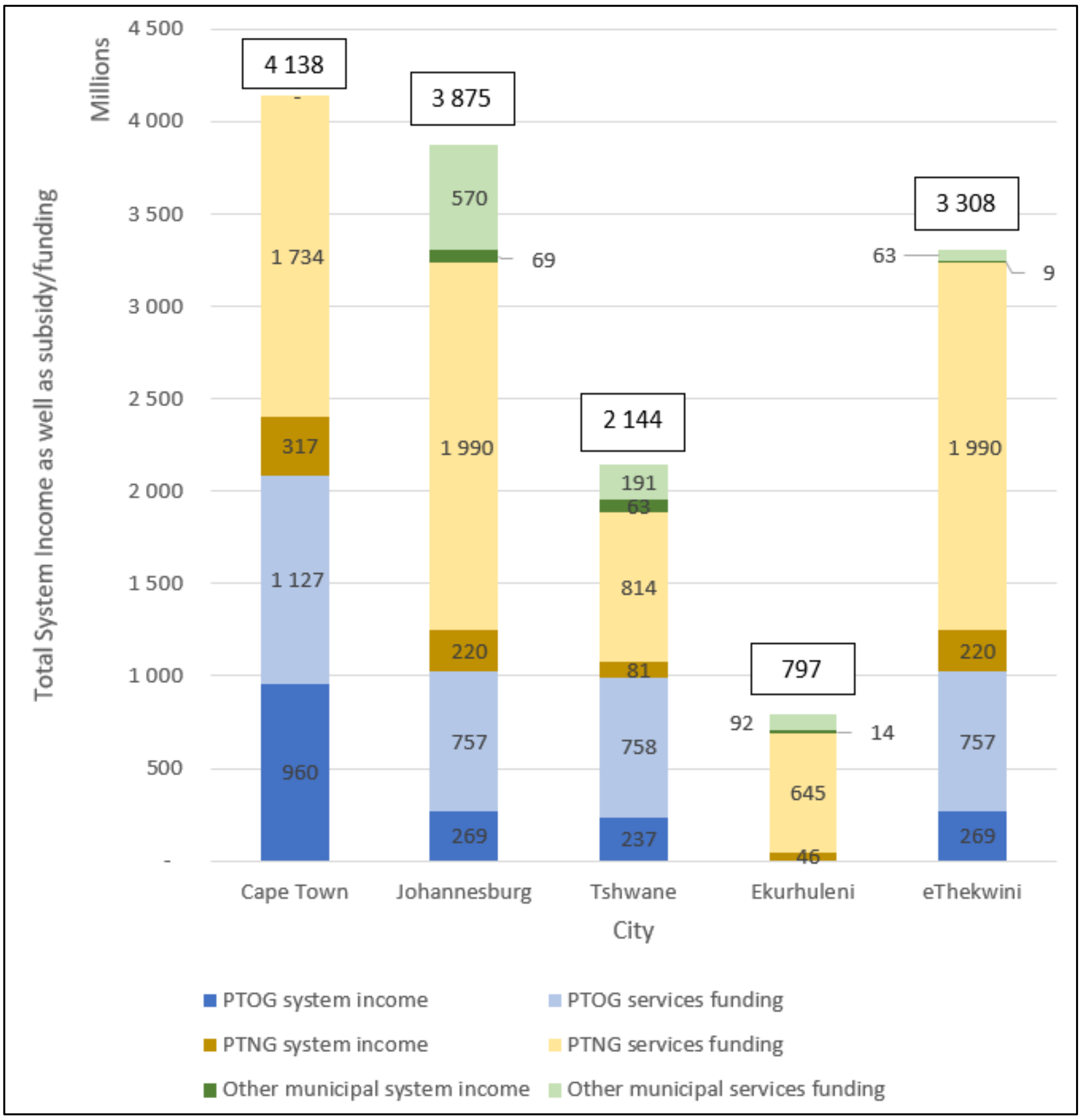



*Figure 25: Total system income and funding for bus services in C40 cities (millions)*[13]

*Source: Based on the information set out in Table 44*

The discussions in 9.2 to 9.4 is a more extensive analysis focusing on the NaTIS data.

Table 44 (p. 155) further provides an analysis regarding the cost recovery ratio of bus services (i.e. fare revenue as a proportion of the cost of the service) in the C40 cities. In this regard the overall cost recovery in C40 cities of the following services in 2023 was as follows:[14]

[13] Note that "PTOG services funding" and "PTNG services funding" refer to all funding towards these services, not only the PTOG and PTNG grants respectively, and includes other funding provided by the cities. "Funding" excludes system income, such as fare revenue and advertising.

[14] Note the following differences regarding these ratios: The PTOG ratio constitutes fare revenue as a proportion of total assumed costs, based on the assumptions set out after Table 44; while the ratios regarding the other two services are the fare revenue numbers as a proportion only of direct operating costs (since capital spend often relates to infrastructure for future phases, and are thus not relevant as a proportion of costs of current services.)

- PTOG services: 34%
- PTNG services: 30%;
- Other municipal services: 29%.

Cost recovery within these categories vary significantly.

Examples of cost recovery of PTOG services (subject to the above notes):

- Cape Town PTOG services: 46%;
- Operators in Johannesburg: between 26%;
- Operators in Tshwane: between 24%;
- Operators in eThekwini: between 26%.

Examples of cost recovery of PTNG services:

- City of Cape Town BRT services: 36%;
- Johannesburg BRT services: 25%.

The cost recovery of other municipal services:

- Johannesburg: 28%;
- Tshwane: 31%;
- Ekurhuleni: 18%;
- An eThekwini service: 12%.

*Table 19: Summary of bus operations data per C4O city*

| City | Model | Operator | Revenue km | Passenger trips[4] (overlaps with "Journeys") | | | Passenger journeys[5] (overlaps with "Trips") | Staffed bus stations | No. of drivers | Passenger capacity[6] (Overlaps with "Type") | | | | | Type of bus / length (overlaps with "Capacity") | | | | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cash | MJT | Sub-total | | | | 95+ | 71-94 | 51-70 | 35-50 | <35 | Articulated | 12m | 9m | 6m (eg MBT size) | |
| Cape Town | PTOG | Contracted | 31 041 864 | 21 539 539 | 30 646 562 | 52 186 101 | 52 186 101 | - | n/a | - | 1 049 | - | - | - | n/a | n/a | n/a | - | 1 049 |
| | PTNG | Multiple operators | 16 296 954 | | 26 629 421 | 26 629 421 | 18 235 677 | 39 | 488 | 43 | 101 | | 211 | | 43 | 101 | 211 | | 355 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 166 | 72 | 432 | -0[7] | - | | | | | 670 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 209 | 1 222 | 432 | 113 | - | n/a | n/a | n/a | | 2 074 |
| Johannesburg | PTOG | Various | 14 143 347 | | 2 744 109 | 12 402 433 | 12 402 433 | n/a | n/a | - | 701 | - | - | - | n/a | n/a | n/a | - | 701 |
| | PTNG | Multiple | 15 285 257 | | 45 005 832 | 45 005 832 | 24 728 479 | 59 | 632 | 160 | 194 | | - | | 160 | 194 | - | | 354 |
| | Other municipal | Metrobus | 7 850 430 | | 3 798 612 | 3 798 612 | 4 893 146 | - | 355 | | 384 | | | | | 384 | | | 384 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 144 | 389 | 918 | 206 | - | | | | | 1 657 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 304 | 1 668 | 918 | 206 | - | n/a | n/a | n/a | | 3 096 |
| Tshwane | PTOG[1] | Various | 19 349 680 | | 2 785 714 | 11 656 683 | 11 656 683 | n/a | n/a | - | 704 | - | - | - | n/a | n/a | n/a | - | 704 |
| | PTNG[2] | Multiple | 3 324 863 | | 7 440 000 | 7 440 000 | 8 039 313 | 13 | 167 | 7 | 126 | | - | | 7 | 126 | - | | 133 |
| | Other municipal | Tshwane bus | 5 731 553 | | 63 047 088 | 63 047 088 | 5 729 101 | n/a | 198 | 34 | 216 | | | | | 250 | | | 250 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 672 | 942 | 1 055 | 164 | - | | | | | 2 833 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 713 | 1 988 | 1 055 | 164 | - | n/a | n/a | n/a | | 3 920 |
| Ekurhuleni | PTOG+ | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | | n/a | | n/a | n/a | n/a | | - |
| | PTNG | Multiple | 1 676 133 | | 3 222 847 | 3 222 847 | 3 064 432 | 31 | 114 | | 46 | | 9 | | | 46 | 9 | | 55 |
| | Other municipal | Ekurhuleni bus | 1 056 354 | 55 414 | 837 303 | 892 717 | 892 717 | n/a | 87 | | 100 | | | | | 100 | | | 100 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 105 | 501 | 350 | 152 | - | | | | | 1 108 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 105 | 647 | 350 | 161 | - | n/a | n/a | n/a | | 1 263 |
| eThekwini | PTOG | Various | 391 395 | | 13 593 238 | 22 710 810 | 22 710 810 | n/a | n/a | - | 694 | 18 | - | - | n/a | n/a | n/a | - | 712 |
| | PTNG | n/a | n/a | n/a | | n/a | n/a | n/a | n/a | 43 | 101 | | 211 | | 43 | 101 | 211 | | 355 |
| | Other municipal | People Mover: Copper Sunset | 642 449 | n/a | | 1 395 712 | 1 395 712 | n/a | n/a | | 21 | | | | | | 21 | | 21 |
| | **Subtotal** | | 1 033 844 | n/a | n/a | 24 106 522 | 24 106 522 | - | - | 43 | 816 | 18 | - | 211 | 43 | 101 | 232 | - | 1 088 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 294 | 201 | 197 | 57 | - | | | | | 749 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 337 | 1 017 | 215 | 57 | - | n/a | n/a | n/a | | 2 925 |
| Totals | PTOG | | 64 926 286 | 40 662 600 | 58 293 427 | 98 956 027 | 98 956 027 | n/a | n/a | - | 3 148 | 18 | - | - | n/a | n/a | n/a | - | 3 166 |
| | PTNG | | 36 583 207 | | 137 905 188 | 82 298 100 | 54 067 901 | 142 | 1 401 | 253 | 568 | - | 431 | - | 253 | 568 | 431 | - | 1 252 |
| | Other municipal | | 15 280 786 | n/a | n/a | 69 134 129 | 12 910 676 | n/a | n/a | 34 | 721 | - | - | - | - | 734 | 21 | - | 755 |
| | Additional buses | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 1 668 | 3 821 | 2 970 | 481 | - | | | | | 8 940 |
| | **NaTIS bus total** | | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 1 668 | 6 542 | 2 970 | 701 | - | n/a | n/a | n/a | | 11 881 |

**Notes:**

1. PTOG data as reported by contracting authority to NDoT 2022/23.
2. PTNG data as reported by city to NDoT, 2022/23.
3. In same cases year was assumed to be 2022/23.
4. "Trips" are counted whenever a passenger boards a vehicle.
5. "Journey" is counted from origin to destination, even if multiple vehicles are used. In case of PTOG numbers, journeys are assumed to be the same as trips.
6. Bus capacity: assumptions made in this table, where bus length was available, but bus capacity was not. These are the assumptions:
   (a) Assumed all PTOG buses are standard sizes, with pax capacity of 51-95, although it is known that some of these buses fall in one of the other categories.
   (b) Assumed 9m buses have pax capacity of 35-50
   (c) Assumed 12m / Standard buses have capacity of 51-95
   (d) Assumed 18m / articulated buses have capacity of 95+

## 9.2 Bus types

According to the latest available NaTIS data, the current bus fleet in South African C40 cities comprises 11 881 buses registered to both government and private owners. Figure 26 illustrates the distribution of buses among the five cities. Gauteng could be viewed a consisting of one extended city-region, and includes the cities of Johannesburg, Tshwane, and Ekurhuleni, all of which heavily rely on public transport, including buses. It also includes two district municipalities, which have areas of high density. This explains why Gauteng has the highest number of registered buses with 10% of the total C40 cities bus fleet operating in Ekurhuleni, 26% in Johannesburg, and 33% in Tshwane. The City of Cape Town has a significant fleet, accounting for 17% of the total, while eThekwini has 14% of the total.

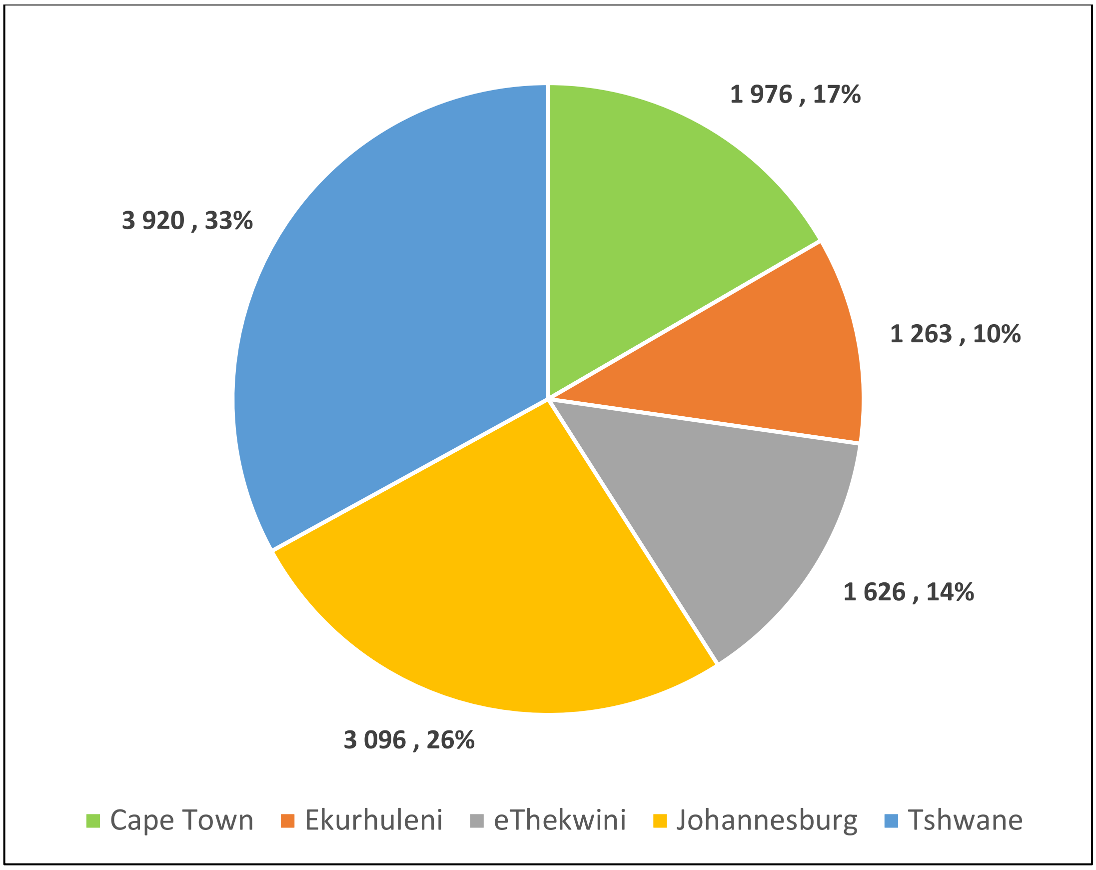



*Figure 26: The number of registered buses in each C40 city*

*Extrapolated from NaTIS vehicle registration data, 2023*

The number of green technology buses is extremely low in each of the three provinces, with only 11 buses in total having been registered. The e-buses are located in the Western Cape comprising eleven BYD buses in Cape Town.[15] Unfortunately, the acquisition of the e-buses in Cape Town was cancelled by the City due to reasons related to the procurement process. However, GABS recently completed a pilot study using two of these buses.

[15] Although there are 11 BYD electric buses in Cape Town, only 2 are registered in the NaTIS system. Additionally, there are two e-buses operating on routes for the University of Johannesburg. The fact that they are not included in the NaTIS database is presumably a mistake.

In Gauteng, NaTIS indicates that there are eight registered Compressed Natural Gas (CNG) buses operating on the A Re Yeng Bus system in Tshwane. However, the City of Tshwane has reported that there are actually 40 CNG buses in operation. This discrepancy could be explained if 32 of these buses have been incorrectly registered in the NaTIS system.

The most commonly used fuel type in South African C40 cities is diesel fuel, accounting for 99% of the total, as shown in Table 20. Only a small fraction of buses in the Western Cape run on electricity, while a few buses run on CNG in Gauteng.

*Table 20: Buses by energy source in C40 cities*

| | Cape Town | Ekurhuleni | eThekwini | Johannesburg | Tshwane |
|---|---|---|---|---|---|
| Diesel | 1 973 | 1 261 | 1 624 | 3 085 | 3 909 |
| Articulated | 62 | 17 | | 45 | 8 |
| Bus (double deck) | 59 | 15 | 5 | 145 | 91 |
| Bus (single deck) | 1 855 | 1 229 | 1 619 | 2 895 | 3 810 |
| Battery electric | 2 | | | | |
| Bus (single deck) | 2 | | | | |
| Gas | | | | 8 | 1 |
| Bus (single deck) | | | | 8 | 1 |
| Petrol | 1 | 2 | 2 | 3 | 10 |
| Bus (single deck) | 1 | 2 | 2 | 3 | 10 |
| Grand Total | 1 976 | 1 263 | 1 626 | 3 096 | 3 920 |

*Extrapolated from NaTIS vehicle registration data, 2023*

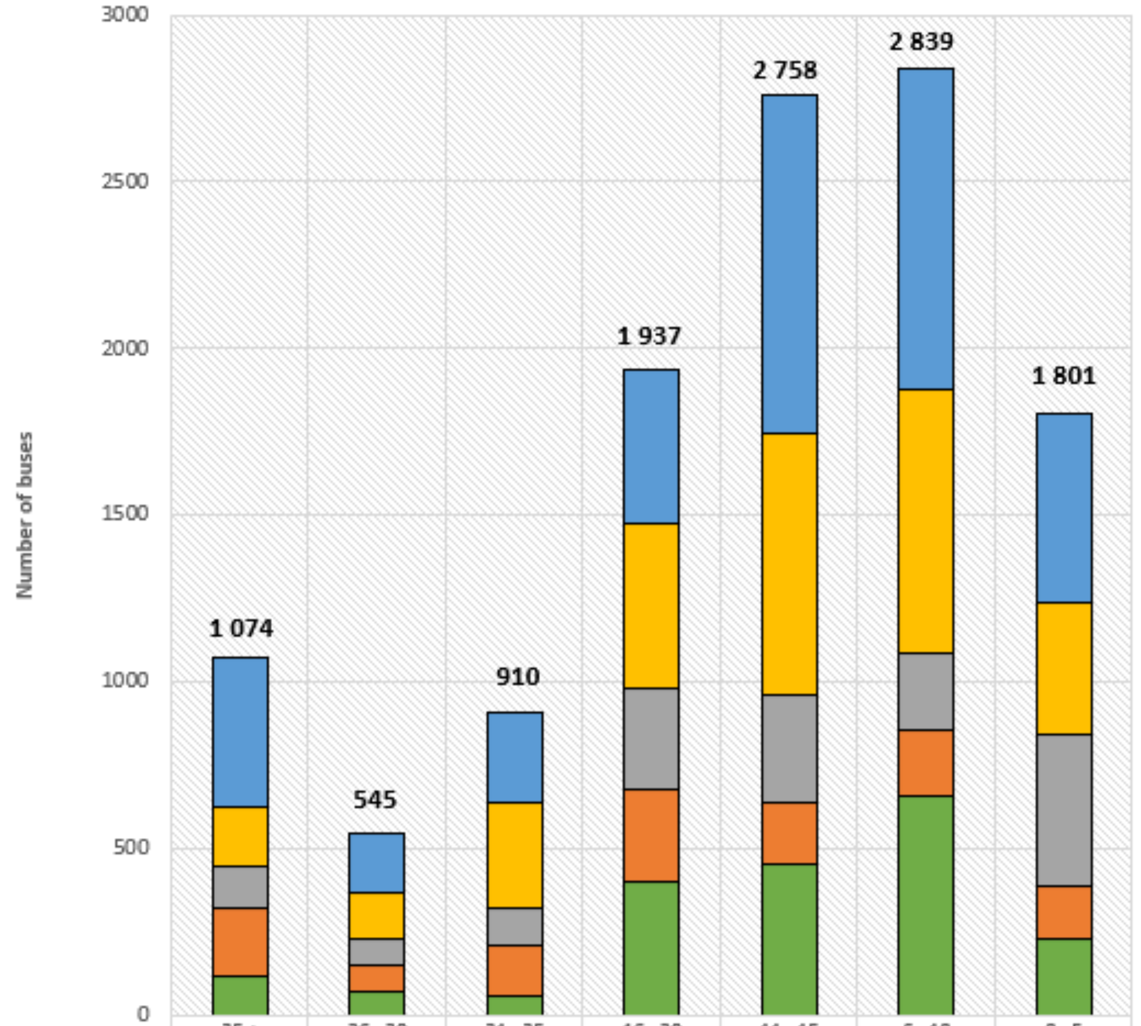
Cape Town accounts for 17% of the total registered buses in the C40 cities, ranking it third in terms of bus numbers. The majority of buses are single-deck, with double-deck and articulated buses occurring in very low numbers. This correlates with the statistics of the national C40 cities bus fleet, which also indicate single-deck buses as the most common bus type. A similar trend is seen in all C40 cities.

Tshwane has the highest number of total registered buses (33%) out of all the C40 cities, while Johannesburg accounts for 26% of the total registered buses in the province, ranking it second in terms of bus numbers.

eThekwini accounts for 14% of the total registered buses in the province, ranking it fourth in terms of bus numbers while Ekurhuleni has the lowest number of total registered buses (10%) out of all the C40 cities.

## 9.3 Age distribution

Figure 27 shows the number of buses in the South African C40 cities. Most vehicles are 6 to 10 years old, followed by vehicles 11 to 15 years old. The average bus age in the C40 cities is 17 years.




| | 35 + | 26 - 30 | 21 - 25 | 16 - 20 | 11 - 15 | 6 - 10 | 0 - 5 |
|---|---|---|---|---|---|---|---|
| Tshwane | 453 | 178 | 274 | 461 | 1015 | 964 | 567 |
| Johannesburg | 173 | 139 | 317 | 494 | 784 | 793 | 396 |
| Ethekwini | 128 | 80 | 110 | 307 | 322 | 225 | 454 |
| Ekurhuleni | 205 | 79 | 151 | 277 | 187 | 200 | 156 |
| Cape Town | 115 | 69 | 58 | 398 | 450 | 657 | 228 |

Age

*Figure 27: Age of buses in South African C40 cities*

*Extrapolated from NaTIS vehicle registration data, 2023*

In Cape Town the largest proportion of buses (33.26%) are between 6 to 10 years old, followed by the 11-to-15-year age category (22.78 %). The average age of buses in Cape Town is slightly lower than the national C40 cities average, at 16 years.

In Johannesburg the 6 to 10 years (25.61 %) and the 11-to-14-year age category have a similar number of vehicles (25.32 %). The average age of buses in the Johannesburg is slightly lower than the national C40 cities average, at 15 years.

In Tshwane the range of 11 to 16 years has the largest number of vehicles, followed by the 6-to-10-year age category. The average age of buses in Tshwane is closely aligned with the national C40 cities average, at 17 years.

In Ekurhuleni, the range of 16 to 20 years has the largest number of vehicles, with the highest count, totalling 277 buses. Notably, this is followed by the 30 and above year age category. Ekurhuleni has the oldest bus fleet out of all 5 cities, with an average age of 20 years.

eThekwini also have a unique age distribution when compared to other C40 cities with the largest number of vehicles in the 0-to-5-year age category, totalling 454 buses. This is followed by the 11-to-15-year age category. eThekwini has the second oldest bus fleet out of all 5 cities, with an average age of 19 years.

Bus ages can be further grouped as indicated in Table 21, which shows that 39% of buses are less than 10 years old, 62% less than 15 years old, and 79% less than 20 years old. This indicates that, generally, bus fleets in these cities are relatively regularly renewed.

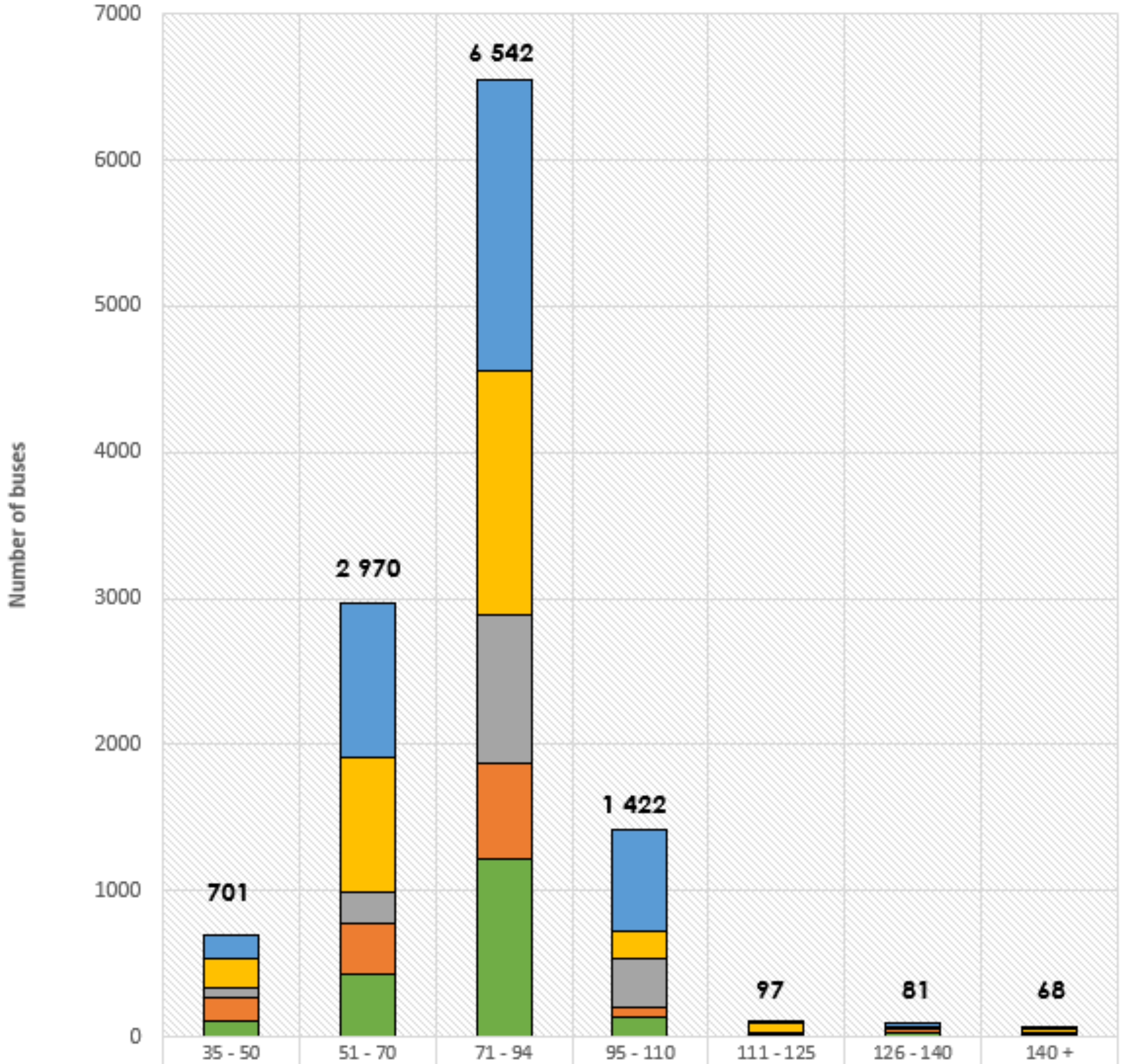
*Table 21: Bus age brackets in South African C40 cities*

| **Bus age (from first registration)** | | | | | |
|---|---|---|---|---|---|
| **1st set** | **%** | **2nd set** | **%** | **3rd set** | **%** |
| 35 + | 9% | >16 | 38% | >23 | 21% |
| 29 - 34 | 5% | | | | |
| 23 - 28 | 8% | | | | |
| 17 - 22 | 16% | | | 0-23 | 79% |
| 10 - 16 | 23% | 0-16 | 62% | | |
| 6 - 10 | 24% | | | | |
| 0 - 5 | 15% | | | | |

*Extrapolated from NaTIS vehicle registration data, 2023*

## 9.4 Bus capacity

Figure 28 shows the total bus passenger carrying capacity in South African C40 cities. It indicates that over 50% of the buses have a capacity ranging from 71 to 94 passengers, while 25% of the buses accommodate between 51 to 70 passengers. A small number of buses have a capacity exceeding 110 passengers.




| | 35 - 50 | 51 - 70 | 71 - 94 | 95 - 110 | 111 - 125 | 126 - 140 | 140 + |
|---|---|---|---|---|---|---|---|
| Tshwane | 164 | 1055 | 1988 | 695 | 4 | 6 | 8 |
| Johannesburg | 206 | 918 | 1668 | 190 | 64 | 24 | 26 |
| Ethekwini | 57 | 215 | 1017 | 332 | 5 | | |
| Ekurhuleni | 161 | 350 | 647 | 65 | 10 | 19 | 11 |
| Cape Town | 113 | 432 | 1222 | 140 | 14 | 32 | 23 |

Total capacity (sitting and standing)

*Figure 28: Bus capacity in South African C40 cities*

*Extrapolated from NaTIS vehicle registration data, 2023*

Based on NaTIS data, in Cape Town over 60% of the buses have a capacity ranging from 71 to 94 passengers, while 22% of the buses accommodate between 51 and 70 passengers. Cape Town follows the national C40 cities trend, with only a small number of buses having a capacity exceeding 110 passengers.

In Ekurhuleni the data indicates that over 50% of the buses have a capacity ranging from 71 to 94 passengers, while 28% of the buses accommodate between 51 and 70 passengers. Ekurhuleni also follows the national C40 cities trend, with only a small number of buses having a capacity exceeding 110 passengers.

In Johannesburg, over 50% of the buses have a capacity ranging from 71 to 94 passengers, while 30% of the buses accommodate between 51 and 70 passengers. Johannesburg also follows the national C40 cities trend, with only a small number of buses having a capacity exceeding 110 passengers.

In eThekwini, over 60% of the buses have a capacity ranging from 71 to 94 passengers, while 20% of the buses accommodate between 95 and 110 passengers. This differs significantly from bus capacities in other C40 cities. Additionally, the data reveals that eThekwini has the lowest number of buses in the 111-125 passenger category, with no buses having a capacity of more than 125 passengers.

In Tshwane, over 50% of the buses have a capacity ranging from 71 to 94 passengers, while 27% of the buses accommodate between 51 and 70 passengers. Tshwane also follows the national C40 cities trend, with only a small number of buses having a capacity exceeding 110 passengers.

# 10 Bus suppliers and manufacturers

This section provides a summary of the bus manufacturing landscape in South Africa, focusing on manufacturers capable of supplying both diesel and e-buses.[16] The information in this section was obtained from online publications and sources related to the specific companies.

## 10.1 Bus body builders

Table 22 lists the major bus body builders in South Africa.

*Table 22: Major bus body builders in South Africa*

| Bus body builders | Overview |
|---|---|
| Busmark | Busmark has supplied buses to the South African market for nearly 50 years. The company designs, develops, manufactures, services, and maintains buses on behalf of local and international OEMs, using local labour and materials out of their production facilities in Johannesburg and the Western Cape (Gray, 2021). |
| Marcopolo SA | Marcopolo South Africa has operated in the South African market since 1996. In 2009 it became the first bus body builder within South Africa to secure a BRT project (Marcopolo SA,2023). Subsequently, it participated in other BRT initiatives such as Johannesburg's Rea Vaya, Cape Town's MyCiTi, and Tshwane's A Re Yeng. |
| MCV SA | MCV is an Egyptian company that has been manufacturing buses since 1998. MCV South Africa was established in 2007. The company has been manufacturing customised models for the South African market as well as developing a city vehicle range (MCV, 2023). |
| Busco | Busco is a South African sales and marketing company for BusAfrica, which is a supplier and bus bodywork manufacturer for several OEM bus products, including Scania, Mercedes-Benz, Volkswagen, M.A.N., Volvo, and Iveco (Busco, 2023). |

[16] A more detailed discussion of the competitive landscape, which covers different types of buses manufactured, battery options, pricing, and service offerings, is provided in Paper 2.

## 10.2 Bus suppliers

Figure 29 shows the market share of buses in South Africa by manufacturer, this data was obtained from the 2023 NaTIS vehicle registration data. The results show that Mercedes Benz holds the largest share, followed by MAN, and Volkswagen. Note that this analysis is of all registered buses with passenger capacity of more than 35, not only those vehicles that were registered in recent years.

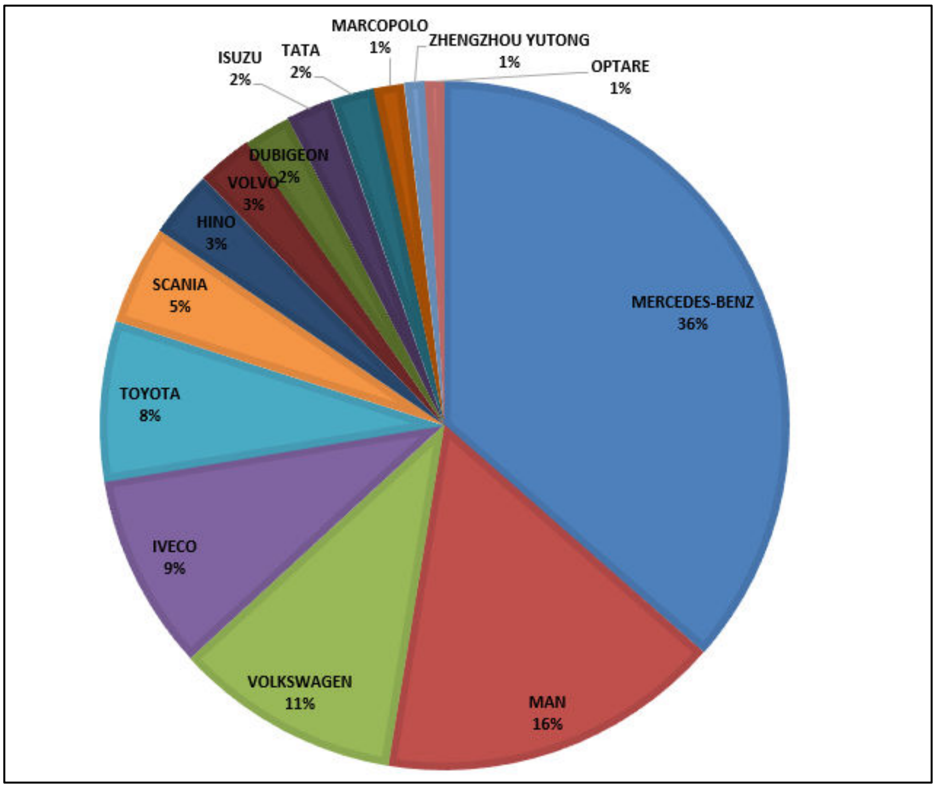



*Figure 29: South African bus market share by manufacturer*

*Extrapolated from NaTIS vehicle registration data, 2023*

Table 23 lists the major current bus suppliers in South Africa.

*Table 23: Major bus suppliers in South Africa, with a focus on e-buses*

| Bus suppliers | Overview |
|---|---|
| MAN SA | MAN Automotive South Africa headquarters are in Isando, with an assembly plant in Pinetown, a bus and coach manufacturing facility in Olifantsfontein, a central parts depot in Isando, and a widespread national sales, service, and parts dealer network. According to MAN, its Lion's Explorer bus is the only OE-manufactured bus body in South Africa, designed for African conditions to European standards. It is the first bus supplier to have received a large order of e-buses in South Africa (MAN, 2023). |
| MB Truck City | MB Truck City is the South African agent for Sinotruk, which has a bus division known as Zhongtong Bus. Zhongtong bus considers themselves pioneers in China's bus manufacturing industry (TruckCity, 2023). The company's manufacturing facility in China can produce 30,000 new e-buses per year. |

| | |
|---|---|
| Mercedes Benz | Mercedes Benz currently does not have an e-bus product offering in South Africa. |
| MiPower | According to MiPower the company are experts in plant equipment and fleet supply, as well as operating, maintenance, bodywork, and fuel management of buses. Their website indicates that their buses can be configured to meet specific specifications and can be manufactured in either 12m or 18mn length. The company is also able to develop fixed and mobile charging infrastructure, and all e-buses are under warranty, but with certain conditions. The e-buses are assembled in factory locations across South Africa and the main services and parts warehouse is in Johannesburg (MiPower, 2023). |
| Real African Works | RAW specializes in city buses with a focus on BRT systems in various municipalities. The company focuses on the design, development, manufacturing, marketing, and selling of automotive drivetrain, specializing in commercial vehicles with a payload of three tons and above. RAW indicated that it is working on developing and manufacturing electric and hydrogen fuel cell buses for municipalities in South Africa (Real African Works, 2023). |
| Scania | Scania South Africa primarily specialises in trucks but has a global presence that allows for the acquisition of buses from branches worldwide. Scania product offering includes hybrid electric, biogas natural gas, biodiesel, and diesel buses. (Scania, 2023) |
| Volvo SA | According to the company, it has become one of the leading bus manufacturers in the industry. Over the past decade, Volvo buses has expanded its product range. Volvo's current product offering includes fully assembled e-buses for the European market and a competitive chassis option for developing markets. This includes a 12m e-bus which is expected to be ready for market by 2024/2025 as well as a 18m articulated e-bus which is expectant to be ready by 2026/2027, but production will be determined by demand (Volvo, 2023). |

In an interview with GABS regarding their electric bus operations, GABS indicated that, based on its information, the four main manufacturers involved in/interested in EVs manufacture in South Africa are MAN, Volvo, BYD and Yutong. There are also further programmes aimed at encouraging the manufacture of electric engines in South Africa, which may be relevant to the manufacture of e-buses in the country. This includes the Atlantis Special Economic Zone: Electric Vehicle Manufacturing Investment Strategy.

Public Transport vehicles such as buses and taxis are designated by the Department of Trade, Industry and Competition (DTI) meaning that these vehicle types require 80% locally manufactured components such as vehicle body (see 10.3.4). This represents a strategic market opportunity which can be used to establish an electric vehicle manufacturing industry at the Atlantis special economic zone with a potential market size of 350 000 minibus-taxis and 65 000 buses (GreenCape, 2021).

## 10.3 Capital cost of buses

### 10.3.1 Estimated comparative costs

The capital costs of buses are often the primary purchase criterion for cities. Therefore, it is crucial to understand that the cost figures are highly context-specific and often vary between countries or regions due to different circumstances, such as taxation, fees, buying incentives, or subsidies. Table 24 provides an estimate of the purchase cost for diesel and e-buses in South Africa

*Table 24: Estimated cost of buses in South Africa*

| Bus technology | Bus size | Estimated cost (Rands) |
|---|---|---|
| Diesel Euro V[17] | 12m | R 4 500 000 |
| | 18m | R 6 375 000 |
| Diesel Euro VI | 12m | R 5 000 000 |
| | 18m | R 7 945 000 |
| CNG | 12m | R 5 380 000 |
| | 18m | R 8 340 000 |
| E-bus | 12m | R 9 000 000 |
| | 18m | R 13 500 000 |

*Source: GABS interview and DBSA (2022)*

Diesel buses have the lowest capital costs compared to other bus technologies and are an established and well-researched technology that has reached market maturity, with availability from numerous suppliers and significant local expertise. E-buses have a much higher purchase price (approximately 40 - 45% more) compared to comparable Euro VI diesel buses.

The batteries are the most expensive component of the e-bus, although battery prices have already fallen by 79% since 2010 and are expected to continue declining (Draexler and Jain, 2021).

Because the core capital cost of e-buses is higher a number of additional factors drive the TCO up even more, such as those discussed in this subsection below, as well as insurance (see 15.4.6(d)).

### 10.3.2 Ad Valorum duty

There is a set tariff regime on vehicles and automotive components imported into South Africa. Ad valorem tax, essentially a luxury excise tax that increases exponentially with the price of the vehicle, is calculated according to a formula. It is set at a maximum of 30%, and the ad valorem excise duty is calculated on a sliding scale, with the rate of the duty increasing with the value of the vehicle (Naamsa, 2023).

Ad valorem tax duties only apply when the vehicle is imported fully assembled. Assembly operations of trucks and buses receive the benefit of duty-free importation for all driveline components, including engines, transmissions, drive-axles, and gearboxes. This means that the chassis can still be imported without paying ad valorem tax.

[17] The cost of diesel Euro V buses is given here based on historic information. However, it may be difficult to source such buses since many manufacturers consider this technology obsolete. If it can be sourced, it is likely to be at a cost premium against the prices given here.

The purpose of ad valorem tax duties on commercial vehicles, in some cases, is to provide protection for domestic industries by making imported commercial vehicles less competitive in terms of cost and is to generate revenue for the government

In South Africa, the import duty on medium and heavy commercial vehicles is set at 20% ad valorem (based on the value). A preferential agreement results in imported vehicles from the EU paying only 12% duty (NAAMSA, 2023). This is one of the identified contributors to the high cost of EVs in South Africa.

This should not significantly impact the procurement of BEBs because the current method in South Africa involves importing the chassis and locally building the bus body. Given this, the argument could be made that ad valorem tax should not be removed because it protects the local manufacturing industry.

However, there is a good argument to be made for temporary exception from ad valorem taxes on electric buses used in pilot projects, thus to allow the importation of fully assembled buses for such tests. The quantum of ad valorem taxes is very large, rendering pilot projects extremely expensive, which could disincentivise such tests. Pilots are important to test use of these buses under local conditions. Once this technology is further proven, the possibility of an exemption can be removed, stimulating local manufacture.

### 10.3.3 Value added tax (VAT)

This financial challenge of e-buses being more costly to purchase than diesel buses is exacerbated by the South African VAT system's treatment of public transport. VAT on goods and services related to public transport is not recoverable as input tax. This significantly inflates the capital cost of electric buses. Entities like municipalities and bus operators, unable to reclaim this VAT, face an increased financial burden. This unique VAT dispensation for public transport not only heightens the upfront cost but also acts as an economic disincentive against adopting environmentally friendly electric buses. The non-recoverability of VAT in this sector thus deepens the cost disparity between electric and diesel buses, presenting an increased barrier to transitioning to greener transport solutions.

### 10.3.4 Procurement rules

Procurement by government departments is regulated by the 2022 Preferential Procurement Policy Framework Regulations (PPR 2022) which prescribes a framework within which preferential procurement must be implemented. These regulations refer to specific goals that must be included in all procurement of good and services, which may include contracting with persons, or categories of persons, historically disadvantaged by unfair discrimination on the basis of race, gender or disability.

The previous 2017 Preferential Procurement Policy Framework Regulations included a stipulation that 80% of bus bodies must be manufactured locally and chassis, engine and transmissions must be assembled from completely knocked down kits in South Africa. This promoted the establishment of a local bus manufacturing industry.

However, following a successful court challenge to the regulations, the PPR 2017 was repealed and replaced with the PPR 2022, which contains no local production and content requirement for buses. The National Treasury has, however, stated that the 2022 Regulations would act as a "placeholder" for organs of state pending the enactment of the Public Procurement Bill, which would make local content requirements once again obligatory.

The Public Procurement Bill is being finalised in 2023 and is meant to repeal the PPPFA. Yt must still go through the complete legislative process, which includes a public participation process. This is likely to be robust given the number of stakeholders involved in public procurement.

# 11 Projected numbers of buses to be purchased (2023-2050)

## 11.1 Introduction

The total number of buses likely to be purchased in future is an important factor that will inform strategies of bus suppliers regarding local manufacture, since it gives an indication of possible economies of scale.

Projected numbers of buses to be purchased in the period 2023 to 2050 have been collected using two different methodologies:

- Through interviews and engagements with the cities themselves; and
- Through analysing the national data on vehicle registrations, recorded through the NaTIS system, a product of the Road Traffic Management Corporation (RTMC).

The former collection of data was undertaken in collaboration with each of the C40 cities, and also used reports from provinces to NDOT regarding Group A buses. The results of this process are reported in Appendix A.2 (p.157). Table 45 to Table 50 provide the information validated by the cities regarding the total number of buses they expect to purchase between 2023 and 2040, as well as information on PTOG subsidised services and municipal bus services.

On the other hand, the NaTIS data enables a more complete analysis, including all buses registered in the C40 cities, even if not managed by cities or by provinces. In the analysis below we have chosen to focus on the NaTIS data, using different growth scenarios.

## 11.2 Analysis using NaTIS data

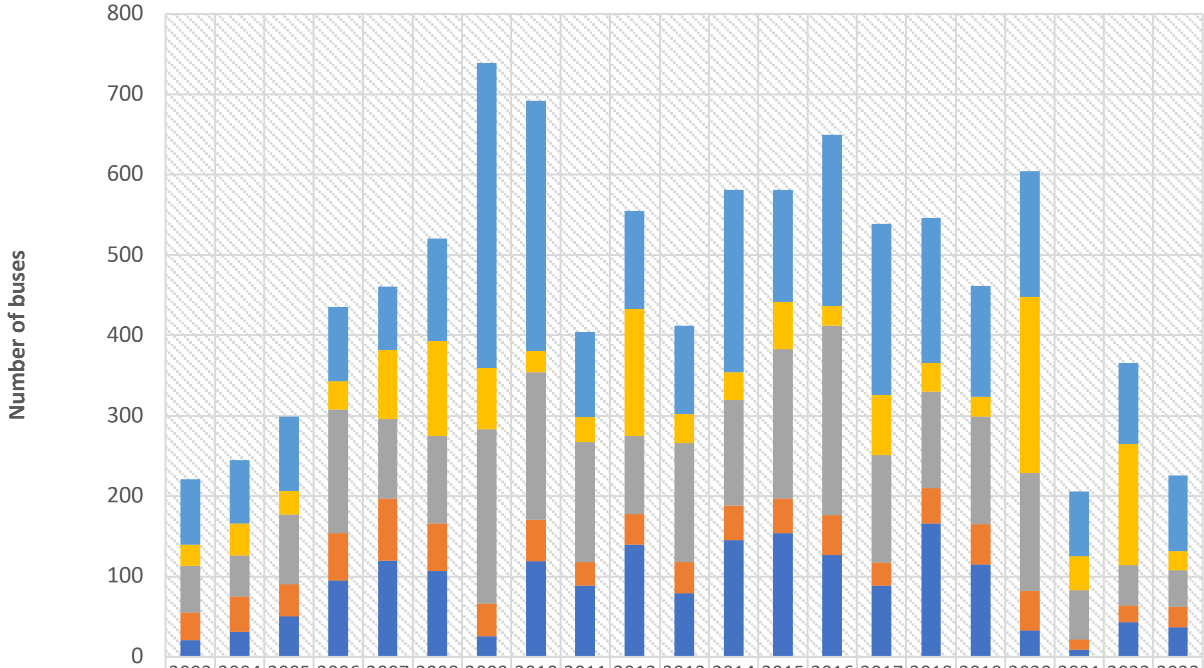
The 2022/23 vehicle registration data from NaTIS was used to develop a projection of the number of buses procured in each of the C40 cities from 2023 to 2050. The projection is based on historical vehicle registration data dating back to 2003. This period was chosen because it aligns with the longest bus replacement strategy considered, which is 20 years (assuming that a bus may have a useful life of 20 years before being replaced).

### 11.2.1 Historical bus registrations

Figure 30 shows the number of buses registered in all C40 cities between 2003 and 2023. On average, there were 464 buses registered each year, with an average annual growth rate of 2.7% between 2003 and 2020.[18] There is a marked drop in 2021 and 2022, probably from the

[18] In the context of bus purchases, the years 2021 and 2022 saw a significant deviation from historical trends. During these two years, bus purchases were exceptionally low, which disrupted the otherwise stable pattern of annual acquisitions. This anomaly had the effect of skewing the calculated average, rendering it unrepresentative of the typical growth rate observed over the previous two decades. These years were recognized as outliers, primarily due

impact of COVID, but possibly also due to other factors. The 2023 number is only for eight months, and in the end the number of buses for the full year is likely to be similar to 2022, or higher. From 2024, it is likely that the earlier trend will recover, depending on general economic recovery in South Africa.




| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tshwane | 81 | 79 | 92 | 92 | 79 | 128 | 379 | 312 | 106 | 122 | 110 | 227 | 139 | 213 | 213 | 180 | 138 | 156 | 81 | 101 | 94 |
| eThekwini | 27 | 40 | 30 | 35 | 86 | 118 | 77 | 26 | 31 | 158 | 36 | 34 | 59 | 25 | 75 | 36 | 25 | 219 | 42 | 151 | 24 |
| Johannesburg | 58 | 51 | 87 | 154 | 99 | 109 | 217 | 183 | 149 | 97 | 148 | 132 | 186 | 236 | 134 | 120 | 134 | 147 | 61 | 50 | 46 |
| Ekurhuleni | 34 | 44 | 40 | 59 | 77 | 59 | 40 | 52 | 29 | 38 | 39 | 43 | 43 | 49 | 28 | 44 | 50 | 49 | 13 | 21 | 25 |
| Cape Town | 21 | 31 | 50 | 95 | 120 | 107 | 26 | 119 | 89 | 140 | 79 | 145 | 154 | 127 | 89 | 166 | 115 | 33 | 9 | 43 | 37 |

Procurement year

*Figure 30: Buses registered in C40 cities between 2003 and 2023*

*Extrapolated from NaTIS vehicle registration data, 2023.*

Between 2003 and 2020, eThekwini has the highest average annual growth rate of 0.8% with an average of 64 buses registered each year. This is followed by Cape Town with an average annual growth rate of 0.3%; although Cape Town has had more bus registrations each year at an average of 94 buses.

In Tshwane there were on average 158 buses registered each year, with an average annual growth rate of 0.16%. This is followed by Johannesburg with a slightly lower average annual growth rate of 0.13% and 136 buses registered each year.

Ekurhuleni shows the lowest numbers with 46 buses registered each year, at an average annual growth rate of 0.06% between 2003 and 2020.

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to the extraordinary circumstances created by the COVID-19 pandemic. Therefore, the 2021 and 2022 data were removed when projecting the average annual growth rate in bus purchases.

### 11.2.2 Bus replacement model, assuming business-as-usual

In this Business-as-Usual (BAU) scenario, the projection assumes a growth rate in bus purchases of 2.7% per annum, reflecting the average annual growth rate observed between 2003 and 2020 in NaTIS registrations of buses. Bus replacement projections at different growth rates are discussed in 11.2.3.

Figure 31 shows the number of buses expected to be procured between 2024 and 2050, under three possible replacement scenarios: buses replacement every 10, 15, or 20 years.

The thick black line is the trend line, assuming a third of buses are replaced every 10 years, another third every 15 years and the remaining third every 20 years. Based on this information, C40 cities are projected to purchase on average of about 721 buses per year in the first two-year period, and 1 202 buses per year in the last 5-year period (see Table 25). When considering the entire country, the projected bus purchases are estimated to be approximately 40% higher, at 1 682 per year in the last 5-year period.[19]

*Table 25: Projected minimum annual bus purchases in C40 cities and nationally*

| Period | Years in period | Likely annual bus replacements: C40 cities | Likely annual bus replacements: national |
|---|---|---|---|
| 2024-2025 | 2 | 721 (1 441) | 1 009 (2 018) |
| 2026-2030 | 5 | 767 (3 834) | 1 074 (5 368) |
| 2031-2035 | 5 | 715 (3 575) | 1 001 (5 005) |
| 2036-2040 | 5 | 852 (4 259) | 1 193 (5 963) |
| 2041-2045 | 5 | 746 (3 729) | 1 044 (5 221) |
| 2046 - 2050 | 5 | 1 202 (6 008) | 1 682 (8 411) |

*(Period totals shown in brackets)*

*Extrapolated from NaTIS vehicle registration data, 2023.*

Note that 2041-2045 has a lower projection as fewer buses would require replacement due to lower bus purchases in the historical reference years. The 2041-2045 period corresponds to the lower bus purchases that occurred during the 2019-2023 period.

### 11.2.3 Bus replacement projects using alternative growth scenarios

This subsection examines how the bus replacement model would be impacted by alternative growth rates to the Business-as-Usual scenario discussed above. Determining a "realistic" growth rate for the number of buses to be procured by South African C40 cities depends on several factors and can vary greatly from one city to another. Key considerations, per city, include population growth (for all reasons, including the rate of urbanisation), the city's effectiveness in supporting public transport, such as initiatives to reduce private vehicle use, improved public transport services and the city's budget for public transport, as well as the city’s and bus operator’s vehicle replacement policy.

[19] This ratio was obtained from 2018 NaTIS data which was used to compare the number of buses in 5 C40 cities compared to the rest of the country.

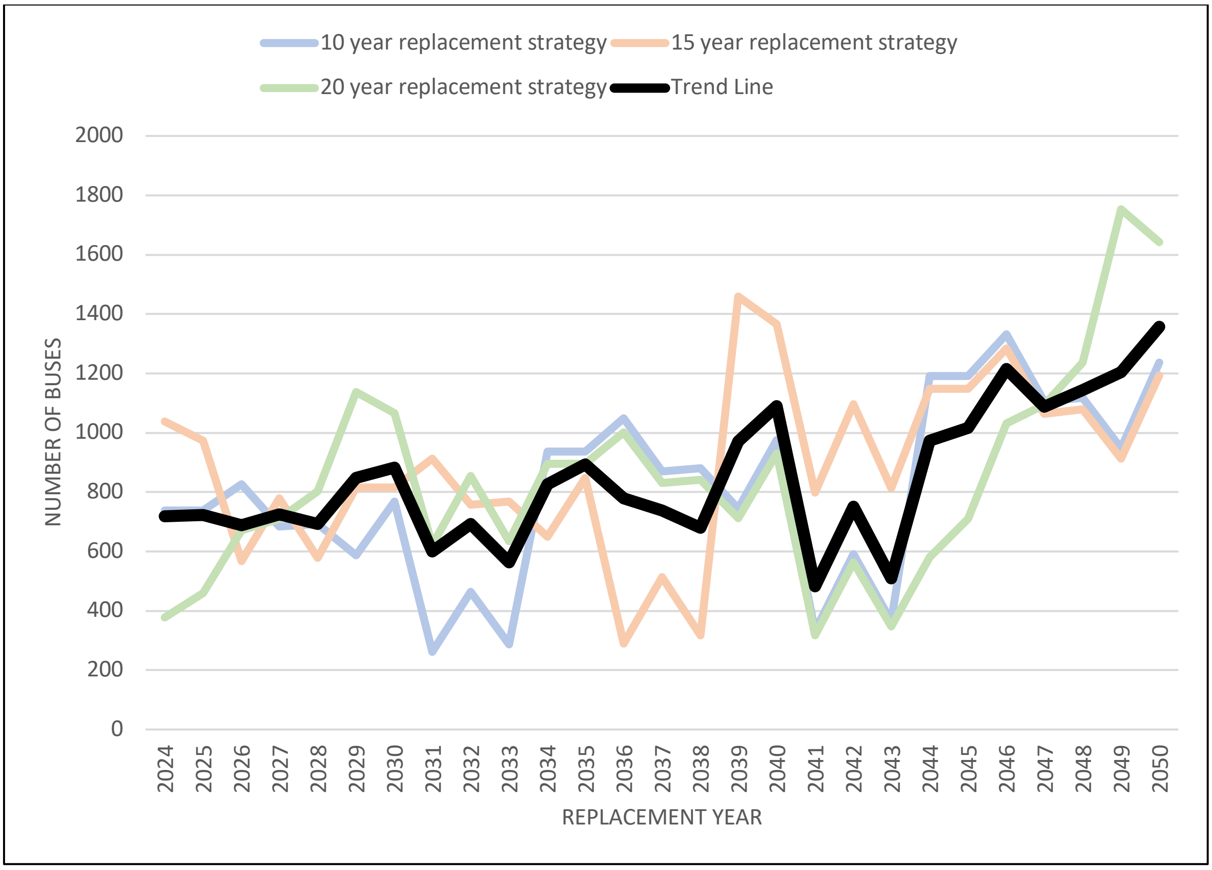



*Figure 31: Estimated minimum bus purchases in C40 cities, 2024-2050*

*Extrapolated from NaTIS vehicle registration data, 2023.*

A realistic growth rate could range from a slight annual increase in well-served, stable urban areas to a more substantial percentage in rapidly developing or policy-shifting contexts. This study modelled two additional growth scenarios to accommodate these variations:

a) **Minimum growth projection**, being the business-as-usual (BAU) scenario (see 11.2.2).

b) **Realistic growth projection**, using the projected population growth factor of 3.1% for the five C40 cities between 2024 and 2050.[20]

c) **Aspirational growth projection** using a growth factor of 8.1%. This growth factor is three times the BAU / historical growth rate and could occur if the following strategies are successful: (a) if there is effective implementation of the MBT operating licence regime; (b) if security and uncertainty regarding NLTA contract length and subsidies are addressed (see Part F ) and (c) if cities are able to grow the public transport modal share, and thus achieve a significant modal shift from private vehicles to public transport, as is envisaged in the integrated transport plans of C40 cities.

In the five C40 cities, the number of new buses to be purchased per year is projected to grow as follows, with numbers shown in Table 26:

[20] The population growth data was sourced from CSIR (2023). The growth factor was calculated by applying the population growth rate to the latest NHTS public transport data to obtain the estimated number of daily public transport trips in 2050. The bus mode share targets for 2050 were obtained from the C40 cities' Climate Action Plans and applied to the estimated trip projections to calculate the growth between 2023 and 2050.

- Scenario 1 (business as usual), 721 new buses per year in 2030 to 1 202 in 2050;
- Scenario 2 (realistic growth), 747 new buses per year in 2030 to 1 306 in 2050;
- Scenario 3 (aspirational growth), 1 116 new buses per year in 2030 to 3 328 in 2050.

*Table 26: Projected annual bus purchases in C40 cities – growth scenarios*

| Period | Years in period | Minimum / BAU: 2.7% Annual (period totals) | Realistic growth: 3.1% Annual (period totals) | Aspirational growth: 8.1% Annual (period totals) |
|---|---|---|---|---|
| 2024-2025[21] | 2 | 721 (1 441) | 747 (1 494) | 1 116 (2 233) |
| 2026-2030 | 5 | 767 (3 834) | 796 (3 981) | 1 210 (6 048) |
| 2031-2035 | 5 | 715 (3 575) | 746 (3 730) | 1 206 (6 031) |
| 2036-2040 | 5 | 852 (4 259) | 900 (4 500) | 1 687 (8 436) |
| 2041-2045 | 5 | 746 (3 729) | 802 (4 012) | 1 851 (9 255) |
| 2046-2050 | 5 | 1 202 (6 008) | 1 306 (6 531) | 3 328 (16 639) |

*(Period totals shown in brackets)*

*Extrapolated from NaTIS vehicle registration data, 2023.*

## 11.3 Nation-wide projected bus purchases: South Africa

For the bus manufacturing industry, it is important to get an understanding of likely bus orders nationally, and not only in the C40 cities[22].

Nationally, the number of new buses to be purchased per year is projected to grow as follows:

- Scenario 1 (business as usual), 1 009 new buses per year in 2030 to 1 044 in 2050;
- Scenario 2 (realistic growth), 1046 new buses per year in 2030 to 1 123 in 2050;
- Scenario 3 (aspirational growth), 1 563 new buses per year in 2030 to 2 591 in 2050.

*Table 27: Projected national annual bus purchases – growth rate scenarios*

| Period | Years in period | Minimum (BAU): 2.7% Annual (period totals) | Realistic growth: 3.1% Annual (period totals) | Aspirational growth: 8.1% Annual (period totals) |
|---|---|---|---|---|
| 2024-2025 | 2 | 1 009 (2 018) | 1 046 (2 091) | 1 563 (3 126) |
| 2026-2030 | 5 | 1 074 (5 368) | 1 115 (5 573) | 1 693 (8 467) |
| 2031-2035 | 5 | 1 001 (5 005) | 1 044 (5 222) | 1 689 (8 444) |
| 2036-2040 | 5 | 1 193 (5 963) | 1 260 (6 299) | 2 362 (11 810) |
| 2041-2045 | 5 | 1 044 (5 221) | 1 123 (5 617) | 2 591 (12 957) |
| 2046-2050 | 5 | 1 682 (8 411) | 1 829 (9 144) | 4 659 (23 294) |

(Period totals shown in brackets)

*Extrapolated from NaTIS vehicle registration data, 2018 and 2023.*

[21]The projected number of buses to be purchased per year in 2024-2025 is not the same in the three scenarios. This discrepancy arises because these numbers are based on an average of the three replacement periods, i.e., 10, 15, and 20 years, which is then multiplied by the different growth factors in each scenario.

[22] The national projection was calculated using both the 2018 and 2023 NaTIS data. The 2018 NaTIS data included bus registration data for the whole of South Africa, while the 2023 NaTIS data only covered the C40 cities. Thus the 2018 data was used to extrapolate national figures for 2023.

# Part D Piloting and costing e-buses in South Africa

## 12 Introduction to piloting e-buses

Currently, South Africa has approximately 63 000 buses and minibuses, including those used for public transport and by private entities, that could be replaced by e-buses through a phased approach (Green Cape , 2023). However, at present, there are very few e-buses in operation, in two pilot projects, which were launched to understanding the scope and necessary conditions for further roll-out.

The first of these projects is a pilot by GABS, which was implemented over an 18-month period with two e-buses in Cape Town. This initiative is very significant for this study and is discussed in more detail in section 13.

Another pilot is underway at the University of Johannesburg (UJ) (University of Johannesburg, 2023). UJ plans to incorporate the e-buses into its existing fleet of diesel buses that transport students between different campuses. The authors were unable to source an analysis of this pilot, and for that reason it is not discussed in more detail here.

## 13 The GABS e-bus initiative

### 13.1 Piloting BEBs

GABS undertook an e-bus pilot project to address the lack of available operational field test data. GABS used e-buses along all operational bus routes in Cape Town to assess, among other things, the vehicles' ability to manage the steep local topography and to populate test-proven assumptions for its financial model aimed at comparing the performance of e-buses with that of its diesel buses.

GABS began the pilot with an electric 36-seater BYD vehicle. It was a Bus Rapid Transit (BRT) specification bus, with the bus body manufactured and assembled locally in Cape Town by Busmark, using imported e-bus chassis from BYD. Approximately 7,000 km of field testing was initially conducted without passengers using the 37-seater BYD-bus, during which the maximum potential passenger weight was modelled using sandbags. Safety and range were also evaluated for an additional 50,000 km once passengers were introduced.

In 2022 GABS procured an additional electric 65-seater BYD commuter bus, which was better suited to their operational requirements in terms of seat capacity and was imported fully assembled. A further year-long pilot trial of the new electric 65-seater BYD commuter bus was run in its ordinary operations, with passengers, to compare the energy efficiency results obtained from the initial 37-seater e-bus trial, and to learn other necessary lessons.

The second phase pilot, with the 65-seater bus, basically confirmed the efficiencies of e-buses from the first phase of the pilot.

### 13.2 Vehicle operations and performance

Vehicle performance data was obtained from the above GABS e-bus pilot tests.

GABS reports that the e-buses performed well, and that it learnt significant lessons. The pilot tests determined that:

- E-bus battery range has been confirmed at 300 km on a full charge;
- It takes 2 to 3 hours to fully charge these buses;
- Energy efficiency was found to be around 1.05 kWh per km for a 36-seater BYD bus and 1.10 kWh per km for a 65-seater BYD bus;
- Energy cost savings of 69% was achieved compared to a conventional diesel bus for the 36-seater and energy cost savings of 70% was achieved by the 65-seater bus;
- Performance along local topography has been confirmed to be good;
- Maintenance impact showed a 50% savings in spare parts, 30% savings in labour, and 80% savings in oils and lubricants for both e-bus types;
- Passengers reported a quiet and comfortable ride with improved air quality at bus stops due to the reduction in fumes.

In terms of operational cost savings, GABS determined that it could save approximately R657,000 in fuel costs per bus per year by switching from a diesel bus to an e-bus (based on May 2023 prices). Despite the higher purchase cost of an e-bus (roughly double that of a diesel bus), the bus fleet operator would still benefit from the fuel savings accrued. This would allow the e-bus to pay for itself over its lifespan of 8 to 12 years. Table 28 provides an overview of the operational costs of a diesel bus compared to an e-bus.

*Table 28: Operational cost-related analysis of a diesel bus vs e-bus*

| Operational analysis | Diesel bus | E-bus |
|---|---|---|
| Cost per bus (Rands) | R2.9 million | R6.0 million |
| Energy consumed (units per 300km) | 120 litres of diesel | 297 kWh of electricity |
| Energy cost (rands per 300km) | R2 480.00 | R683.10 |
| Cost per km (Rands) | R8.27 | R2.28 |
| Fuel savings per year per bus (Rands) | R657 000 | |
| Return on capital investment through fuel savings | 8 – 12 years | |

## 13.3 Charging strategy

GABS identified two main operational utilisation peaks: one in the morning (04:00 to 09:00) and the other in the afternoon (15:00 to 21:30). During these peak periods, the fleet utilisation rate is high, and there is limited opportunity for charging at the depots. Currently, GABS has two AC chargers and one DC charger at their depot. In future scenarios, DC fast chargers may be placed at certain bus stops to enable opportunity charging while the buses are away from the depots. The periods with the most favourable charging conditions are as follows:

- Mid-day off-peak (09:00 to 15:00): 70% of the bus fleet is available for charging for six hours.
- Night-time off-peak (21:30 to 04:00): 95% of the bus fleet is available for charging for 6.5 hours.

This charging strategy would involve utilising grid electricity charging at night, taking advantage of off-peak electricity tariffs, and solar charging during the day. To enable night-time off-peak charging with green energy, GABS would require a grid-tied battery energy storage system (BESS) or the ability to bring off-site renewable energy to the depots during this window.

### 13.4 Future plans

GABS concluded that BEBs are the way to go, and now plans to replace its existing fleet incrementally with 60 e-buses every year starting from 2024, until its full fleet of 1100 diesel buses has been replaced. This represents an estimated annual investment cost of approximately R360 million. All future charging stations will be equipped with DC fast charging capabilities as more e-buses are acquired. In addition to this, because a majority of its current fleet uses diesel, GABS also plan launch a pilot study to test whether they can economically convert diesel buses to electric buses.

## 14 City e-bus pilots with DBSA

In April 2023, the Global Environment Facility (GEF) funded project titled 'Accelerating the Shift Towards Electric Mobility in South Africa' was approved by the GEF Council. This project, referred to as the 'child project,' is part of the GEF's global program led by the United Nations Environment Programme (UNEP).

This is an important project and, if costs and conclusions are similar to the GABS pilot above, would provide a significant push in the shift to e-buses in South Africa.

The program's objective is to assist countries in designing and implementing electric mobility programs as part of a broader shift toward a sustainable, low-carbon transport sector. It is also envisaged that participating cities will gain the necessary experience to demonstrate the benefits and economic feasibility of integrating renewable energy into the transport sector. The Development Bank of Southern Africa (DBSA), accredited by the Global Environment Facility, is responsible for developing, implementing, and reporting on projects and programs funded by the GEF. The DBSA will act as the implementing agency for the project, overseeing various activities, including ensuring timely project delivery and disbursing funds in line with the approved project implementation plan.

This project will comprise four main components to be implemented including:

1. Institutional capacity building to support the large-scale transformation of the public transport sector.
2. Deployment and demonstration of electric buses.
3. Policy enhancement and pilot replication for an integrated and sustainable mass-transit transport solution for South African cities.
4. Scaling up the electric bus fleet.

The pilot deployment of 20 e-buses and the required charging infrastructure in Tshwane and eThekwini aims to reduce the financial and operational risks associated with the introduction of this innovative technology. This will be achieved by providing part of the necessary funds to put electric buses into service during the demonstration phase of the project. Benefits of this pilot study include enabling cities to gain the necessary experience, demonstrate the economic benefits of electric buses, conduct a policy review to create an enabling environment for the rollout of electric buses in South Africa, and build capacity for operation and maintenance.

This work falls under the demonstration phase and will include a comprehensive techno-commercial feasibility study within the selected cities covering:

- Identification of routes and operators for e-Bus demonstrations;
- Identification of potential depot(s)/terminals;
- Evaluation of energy requirement, battery pack specifications and charging strategy under different operational scenarios;
- Assessment of potential and pathways for renewable energy integration with e-Buses charging;
- Estimating TCO of e-buses in public transport;
- Development of viable and effective business model with potential financing sources (e.g. expected from co-finance);
- Assess various financial models for the demonstrations; and
- Identify avenues for increased inclusivity in public transport by evaluating and suggesting revisions in existing gender features.

The outputs for Component 2 are as follows:

**Output 2.1**: Comprehensive feasibility studies assessing the various options for the combined demonstration of electric buses and low carbon recharging, including battery life cycle management, development of business models and finance schemes and gender/EWCD aspects are carried out for select cities (with specificity of routes and operator selection; renewable offset.

**Output 2.2**: Procurement specifications for electric buses, chargers and other infrastructure and services for fleet transition are revised for select cities.

**Output 2.3:** Technical, operational, and managerial staff of the select city bus operating companies are trained across e-bus life cycle stages and change management is prepared.

**Output 2.4:** Electric buses and charging infrastructure are procured, tested, and commissioned with select city bus operating companies.

**Output 2.5**: Electric buses and charging infrastructure are operationalised, performance data collected and monitored, repair and maintenance established, and lessons are synthesized.

Table 29 provides an overview of the project costs for the e-bus pilot. Initially, GEF planned to procure a total of up to 50 e-buses for the demonstration phase through a combination of co-financing and GEF grants for Johannesburg, Tshwane, and eThekwini. However, during

*Table 29: Initial high-level cost analysis for 50 e-Buses*

**Total Project Costs**

*For 50 e-Buses*

| Cost Head | Cost (ZAR) | Cost (%) |
|---|---|---|
| Vehicle cost *(exclusive of battery cost and taxes)* | 180,000,000 | 50% |
| Customs Duty | 36,000,000 | 20% |
| Ad-valorem tax | 43,200,000 | |
| Battery Cost | 102,643,200 | 26% |
| **Vehicle cost (inclusive of Taxes and Battery)** | **361,843,200** | **~90%** |
| Charging Infra Cost + Commissioning | 32,160,000 | 10% |
| **Total Project Cost for 50 e-Buses** | **394,003,200** | **100%** |
| **Avg. cost per e-Bus (including charging infra)** | **7,883,264** | |

*Source: GEF 2023*

the demonstration phase 39 buses will be deployed – 20 buses in City of Tshwane, and 19 buses in the eThekwini Municipality.

The total project costs for 50 e-Buses amounts to approximately R400 million. The GEF investment allocation is R40 million, with the potential for the remaining funding (R360 million) to come from various sources, including the DBSA (and others) concessional facility, South African Government EV fiscal incentives, or City Government budgets.

Table 30 provides a high-level overview of eThekwini Municipality's phased e-bus deployment program. Phase 1 includes 6 e-buses with an estimated project timeframe of 2 years, ending in 2025, while Phase 2 includes 13 e-buses with an estimated completion date in 2028.

*Table 30: High-level overview of eThekwini municipality phased e-bus deployment*

| Financial Year | 2024 to 2025 | 2026 to 2028 | |
|---|---|---|---|
| Phase | P1 (0– 2 years) | P2 (3– 5 years) | |
| **No of E-Buses** | **6** | **13** | **19** |
| Cost per bus w/o taxes | 6 807 776 | 6 807 776 | 6 807 776 |
| Total cost of buses | 40 846 656 | 88 501 088 | 129 347 744 |
| Customs and ad Valorem | 11 536 800 | 24 996 400 | 36 533 200 |
| Infrastructure Cost | 4 852 800 | 9 929 400 | 14 512 200 |
| **Estimated Project Cost** | **56 966 256** | **123 426 888** | **180 393 144** |
| | | | |
| **Financing Options** | | | |
| 1) GEF Grant | 27 645 000 | - | 27 645 000 |
| **2) eThekwini Contribution** | **14 660 628** | **10 644 028** | **25 304 656** |
| 3) DBSA Facility | 14 660 628 | 56 095 372 | 70 756 000 |
| 4) Fiscal Incentives | - | 56 687 488 | 56 687 488 |
| **Total cost of buses** | **56 966 256** | **123 426 888** | **180 393 144** |

*Source: GEF 2023*

It is recommended in section 18 that cities and operators do not first plan to run extensive additional pilot projects, but use the data available from this report, the cost model as tested and tweaked through a further process coordinated by C40, as well as further data flowing from the pilot projects described above, and from implementation e-bus roll-out to update their cost models and adapt their plans in due course if required.

## 15 Cost modelling e-bus deployment

The cost of implementation of e-buses is a fundamental factor to consider in the transition to e-buses.

This section provides an overview of the outcomes of modelled costs associated with the deployment of e-buses in South Africa. It focuses on a comparison between the costs of a 12m Euro VI diesel bus and an equivalent 12m BEB, although some details regarding other bus types are also provided.

Generally, capital costs of e-buses are significantly higher than the diesel equivalent; on the other hand, operating costs are significantly lower. Even if the life-cycle costs between the core bus types are comparable, or if the life-cycle costs of e-buses are lower, some capital costs must be paid upfront and others could be funded through loans, repayable over the relevant lending period.

This means that e-bus implementation would require changes to budgets and funding, which cities and bus operators would need to understand well.

In the base case model, the above two bus options have been modelled to determine:

- the total cost of ownership (TCO) over the useful life of the bus;
- the changing costs per year over the useful life, including the different types of costs;
- the breakeven point where an e-bus becomes cheaper than a diesel bus (if the TCO of an e-bus is lower).

## 15.1 Modelling framework

Fundamentally, the C40 cost model calculates the cost of owning and operating a bus fleet in South Africa. The framework for this model is presented in Figure 32. The costs are divided into two components: capital costs and operating costs.

Capital costs, for the purpose of this analysis, include all expenses associated with deploying the bus fleet, and major mid-life costs, such as refurbishment and battery replacement. Capital costs include the costs related to the charging infrastructure requirements of electric buses.

Operating costs encompass all expenses related to the ongoing management of the bus fleet and infrastructure. These costs can be further categorised into two components: variable and fixed costs. Fixed costs remain constant regardless of the number of operational kilometres travelled per bus, while variable costs are incurred based on the distance travelled.

The TCO is the sum of capital and operating costs for a given fleet mix over the bus life. TCO can also be expressed in terms of the cost per distance, reflecting the cost of ownership for every kilometre travelled.

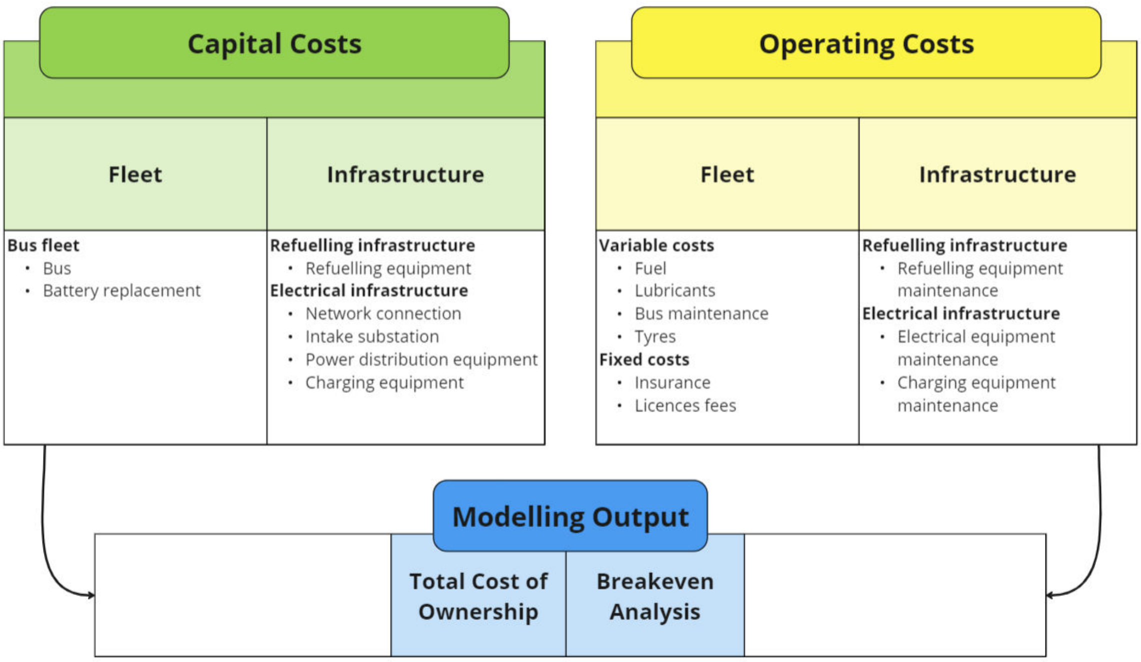



*Figure 32: C40 cost model framework*

## 15.2 Scenarios modelled

To demonstrate the financial viability of procuring and operating an electric bus fleet, a base case scenario was developed for conducting sensitivity analysis. Table 31 provides an overview of modelling assumptions used in this scenario and indicates where toggles[23] have been built in to test the outcomes where key assumptions are adjusted.

For comparison purposes, certain variables were kept constant for both bus types, where applicable.

*Table 31: Overview of cost modelling assumptions*

| Category | Input variable | Base case assumption | Toggles (alternatives available in the model) |
|---|---|---|---|
| Economic | Monetary value | Nominal | Fixed |
| | Bus life[24] | 16 years | 12, 16, and 18 years |
| | Residual value of bus | 20% of the purchase price | Variable input value |
| | Interest rate[25] | 11% | Variable input value |
| | Repayment period for buses[26] | 10 years | Fixed |
| | Repayment period for batteries* | 8 years | Fixed |
| | Insurance | 4.5% of carrying value | Variable input value |
| | Electrical infrastructure useful life* | 30 years | Fixed |
| | Charger useful life* | 16 years | Fixed |
| Operational | Fuel consumption | 38 litres per 100 km | Variable input value |
| | Price of diesel[27] | R21.50 per litre | Variable input value |
| | Electricity consumption* | 1.10 kWh per km | Variable input value |
| | Price of electricity | R0.99 per kWh | Variable input value |
| | Fleet size | 50 Euro VI diesel buses or 50 BEBs | Variable input value |
| | Annual operating kms | 50 000 km per bus | Variable input value |

[23] In a costing model, a "toggle" refers to a switch or an option that allows the user to quickly change between different sets of parameters or assumptions. By using a toggle, one can easily see how variations in certain inputs affect the overall cost projections. This feature is particularly useful for performing sensitivity analyses or exploring different scenarios in financial models.

[24] A 16-year bus life was chosen as the base case scenario as this aligns well with the assumed 8-year replacement period for batteries, and accounts for power wear on electric motors, provided the bus body is built well. However, future batteries may have a longer life, which would potentially extend the bus useful life, reducing capital costs. Additional scenarios modelled are 12 years, as this is the assumed bus life for BRT buses in Latin America, as well as an 18-year bus life, as followed by GABS. The useful life of electric buses could be even longer, but this requires real-life testing over many years.

[25] Based on the prime lending rate of 11.75% set by the South African Reserve Bank in November 2023.

[26] It is not likely that a bus operator will be able to get a vehicle-related loan in South Africa over a longer period. However, if the loan is taken as a general loan by a credit-worthy city, this period can be longer. This will reduce the annual capital repayment but will increase the overall interest component, increasing the TCO.

[27] Average coastal price of 0.005% sulphur diesel in South Africa: Nov 2022 to Oct 2023.

| Category | Input variable | Base case assumption | Toggles (alternatives available in the model) |
|---|---|---|---|
| Infrastructure | Cost of installing refuelling equipment[28] | R2 000 000 | Variable input value |
| | Electrical infrastructure | Network connection, substation, and power distribution equipment. | Variable input value |
| | Charger configuration | Overnight charging cabinet, with 3 charging dispensers i.e., 3 buses per charger | Variable input value |
| * Informed by GABS pilot as shared during interviews, Sept-Nov 2023. | | | |

*Source: C40 SA Financial Model*

## 15.3 Modelling inputs

This subsection provides details on the capital and operating costs used in the base case scenario.

### 15.3.1 Electricity tariffs

In South Africa, Eskom or a city electricity department supplies electrical energy at various tariffs to be negotiated during the power application process for a bus depot. A bus depot is a significant electricity consumer, and due to the capacity required for charging the buses, a notified maximum demand regime must be negotiated with the supplier.

Figure 33 provides an overview of Eskom's electricity demand cycle: Eskom offers three tariff rates based on the day of the week and time of day, including peak, standard, and off-peak. These tariffs also vary with seasonal fluctuations.

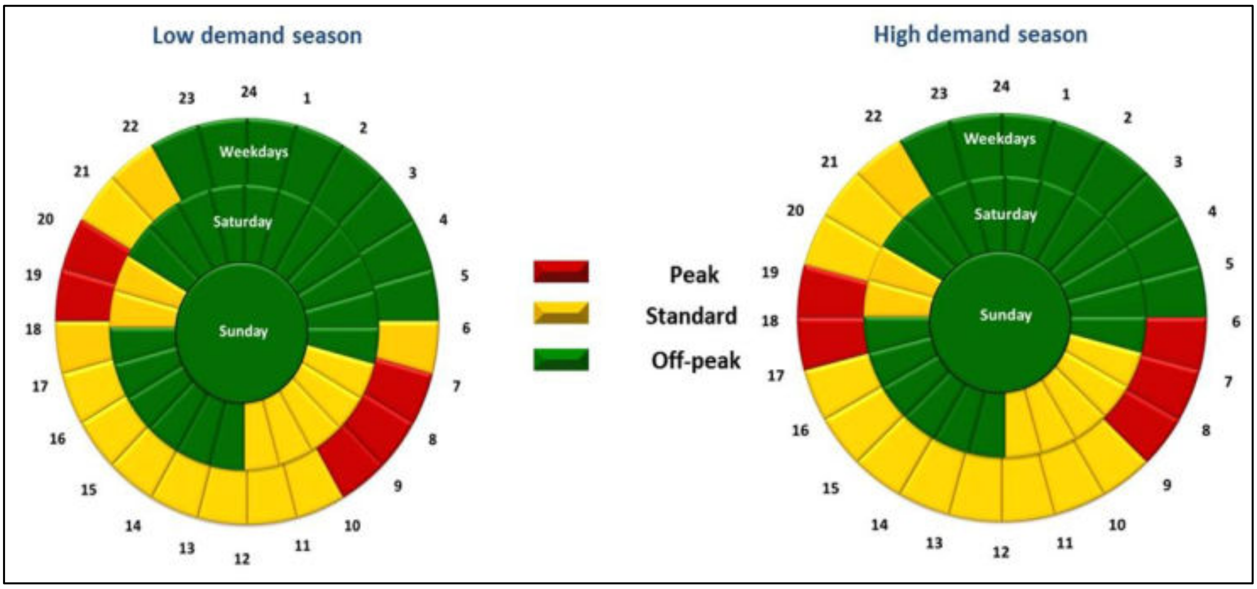



*Figure 33: Eskom electricity demand cycles*

*Source: Eskom tariffs and charges booklet 2023/2024*

[28] Cost of installing the infrastructure required for a diesel bus refuelling depot, which includes fuel storage tanks, fuel dispensing equipment, and fuelling stations. The cost is addressed as a once off initial capital cost in the model.

Table 32 reflects Eskom's latest tariff publication, based on the Megaflex non-local authority charges table. In e-bus operations, utilising an overnight charging strategy allows operators to benefit from the more economical off-peak tariff. However, for modelling purposes, it was assumed that some charging might be required outside of the off-peak period. For example, top-up charging which would take place at designated staging area during the day. Therefore, a blended rate of 99.61 c/kWh was calculated to account for this. This rate was calculated based on a blended rate of 40% at the standard rate and 60% at off-peak hours, as detailed in the below table.

*Table 32: Eskom MegaFlex tariff rates*

| Season | Peak | Standard | Off-peak |
|---|---|---|---|
| High demand season (June to August) | 534.27 c/kWh | 161.85 c/kWh | 87.91 c/kWh |
| Low demand season (September to May) | 174.26 c/kWh | 119.96 c/kWh | 76.10 c/kWh |

*Source: Eskom tariffs and charges booklet 2023/2024.*

The above rates were assumed in the model, although this may vary depending on the negotiated tariffs and who the supplier is (e.g. how much would a city as supplier charge). The costs may be higher or lower as renewable power is sourced from private electricity generators, including the cost of wheeling the power over the electricity network.

### 15.3.2 Capital costs

Capital costs encompass all expenses related to deploying the bus fleet, including significant costs like refurbishment and battery replacement, possibility incurred mid-life. It also includes new electricity supply to the depot at the required draw, power distribution infrastructure within the depot and chargers.

#### (a) Bus capital costs

The capital costs of buses are often one of the main barriers transit agencies and bus operators need to navigate. Cost figures are context-specific and often vary between countries or regions due to different circumstances such as taxation, fees, buying incentives or subsidies (Draexler and Jain, 2021). Table 33 sets out the capital costs used in the base case scenario.

*Table 33: Base case bus capital costs*

| | Option A: Euro VI Diesel | Option B: Battery Electric |
|---|---|---|
| Bus purchase cost | R5 000 000 | R7 000 000 |
| Battery cost | n/a | R2 000 000 |
| **Total cost** | **R5 000 000** | **R9 000 000** |

*Source: C40 SA Financial Model*

The total cost of a 12m e-bus is approximately 80% more expensive than comparable diesel bus. A significant portion of this cost can be attributed to the cost of the battery, which based on current technology needs to be replaced every 8 years. The model has a built-in toggle feature that allows the user to conduct sensitivity analysis by switching between the BRT or the commuter bus option. The results of the sensitivity analysis are discussed later in this section.

#### (b) Infrastructure capital costs

The infrastructure capital costs include expenses associated with electricity supply, encompassing the network connection, a substation, power distribution equipment, and the chargers themselves. In practice, this may also involve the provision of new depots or the expansion of existing facilities (if more space is required), but these costs were excluded from this analysis. Excluded here are the basic costs of a depot, which is likely to be similar between the two technologies.

When purchasing new diesel buses, additional infrastructure costs are typically not incurred as the necessary refuelling stations already exist. However, for this modelling exercise, the cost of refuelling infrastructure was included as part of the analysis, which would apply to new depots where neither diesel nor electrical infrastructure is available. Table 34 provides approximate costs associated with the necessary infrastructure costs for the base case scenario.

The modelling for electrical supply infrastructure was calculated assuming a fleet of 50 x 12m BEBs.

*Table 34: Base case infrastructure capital costs*

| | **Option A: Euro VI Diesel** | **Option B: Battery Electric** |
|---|---|---|
| Network connection costs | n/a | R7 500 000 |
| Intake substation | n/a | R5 200 000 |
| Power distribution equipment | n/a | R26 500 000 |
| Number of charging cabinets[29] | n/a | 17 |
| Cost per charging cabinet | n/a | R1 000 000 |
| EV fleet charging equipment | n/a | R17 000 000 |
| Refuelling infrastructure cost | R2 000 000 | n/a |
| **Total cost** | **R2 000 000** | **R56 200 000** |

*Source: C40 SA Financial Model*

### 15.3.3 Operating costs

The assumed operating cost items are listed in Table 35. For diesel buses, the most significant costs are fuel costs, which heavily depend on the price of diesel, and maintenance costs. In comparison, the operating costs for EVs are considerably lower.

Oil costs were calculated as 0.5% of the annual fuel cost for diesel vehicles and 0.15% of the annual fuel cost for EVs. This is a conservative estimate as the cost of oil and lubricants in an electric bus is negligible.

Insurance costs and license fees are the two fixed operating cost components. The insurance strategy may differ among operators; however, cities are encouraged to examine their existing

[29] One charging cabinet of the required specification is able to smart-charge three buses sequentially. This assumes a conservative scenario where all buses can be charged simultaneously at night, as opposed to a more efficient charging scenario where half the buses are charged at night and half interpeak.

*Table 35: Operating costs used in the C40 model*

| | Option A: Euro VI Diesel | Option B: BEB |
|---|---|---|
| Fuel (R/km)[30] | R8.17 | R1.10 |
| Lubricants | 0.5% of the annual fuel price | 0.15% of the annual fuel price |
| Bus maintenance (R/km) | R16.20 | R8.80 |
| Tyres (R/km) | R0.80 | R0.80 |
| Insurance (per annum) | 4.5% | 4.5% |
| Licences (per annum per vehicle) | R24 702 | R24 702 |

*Source: C40 SA Financial Model*

insurance policies to facilitate cost savings. A possible strategy would be to self-insure the bus fleet rather than purchasing insurance coverage from a third party. For the purpose of this modelling exercise, insurance for both bus types were calculated at 4.5% per annum based on the carrying value of the bus.

Tyre costs were assumed to be the same for both bus types at R0.80 per km. However, without a controlled acceleration device installed in the electric bus, tyre costs are likely to be higher than those of a diesel bus because the higher torque delivered by electric motors.[31]

Other cost items which have not been included as part of this modelling exercise includes overheads and driver remunerations. These have been excluded as this model is a relative comparison and these costs are common to both scenarios. The potential cost associated with the disposal of batteries have also been excluded due to lack of available information.

## 15.4 Results and findings

### 15.4.1 Base case scenarios

As discussed, the TCO calculations consider the up-front capital investment (assuming a 50-bus fleet), as well as operational costs (including maintenance), and other indirect costs over the life of the asset. As part of the base case scenario, it was also decided that the modelling would be based on the BRT bus option. Subsequently, sensitivity analysis has been conducted to compare the cost implications of the commuter bus option.

The modelling results are presented at three levels, the reason for this being that different government / bus company departments will be interested in the costs that most directly relate to their areas of responsibility as follows:

[30] The fuel cost assumes a diesel price of R21.50 per litre and an electricity price of R0.99 per kWh.

[31] Electric motors in commuter buses deliver higher torque compared to diesel engines, especially at low speeds due to electric motors producing maximum torque from zero RPM, enabling quicker and smoother acceleration. However, this immediate torque availability can lead to increased tire wear. The rapid acceleration and greater torque applied to the wheels, coupled with the substantial weight of the bus, heighten stress and friction on the tires, particularly in urban transit with frequent starts and stops.

It is assumed a device will be installed to regulate the electric motor to deliver torque values less than or equal to the requested torque without exceeding the acceleration limit. Alternatively, drivers need to be trained and managed to prevent uncontrolled acceleration is also advised as it affects not only vehicle operating costs and efficiency but also passenger comfort and safety

- **Level 1**: TCO, or total cost of ownership (charging infrastructure, bus capital costs & operational costs) – Which is of interest to fleet, finance, strategic planning and infrastructure provision departments for procurement and budgeting purposes when planning a transition from diesel to electric buses.
- **Level 2**: Bus ownership costs only (bus capital costs & operational costs) – Which is of interest to fleet procurement and operations management departments. Subsequent or replacement bus purchases will not require additional charging infrastructure.
- **Level 3**: Bus operating costs only – Which is of interest to bus operations management departments. This indicator is important, for example, when infrastructure and buses are procured via grant funding.

#### 15.4.2 Total cost of ownership

Table 36 and Figure 34 show the TCO of bus and infrastructure costs on a cost-per-kilometre basis for the base case, enabling a useful comparison between various bus technologies. The TCO was calculated based on the assumption that every bus will travel 50 000 kms per annum.

The base case analysis shows that the overall TCO of a BEB and a Euro VI diesel bus is practically on par. However:

- Diesel buses have higher operating costs, specifically the cost of fuel and maintenance.
- In BEBs a significant portion of the bus cost (27.5%) is attributed to the initial and replacement costs of batteries.

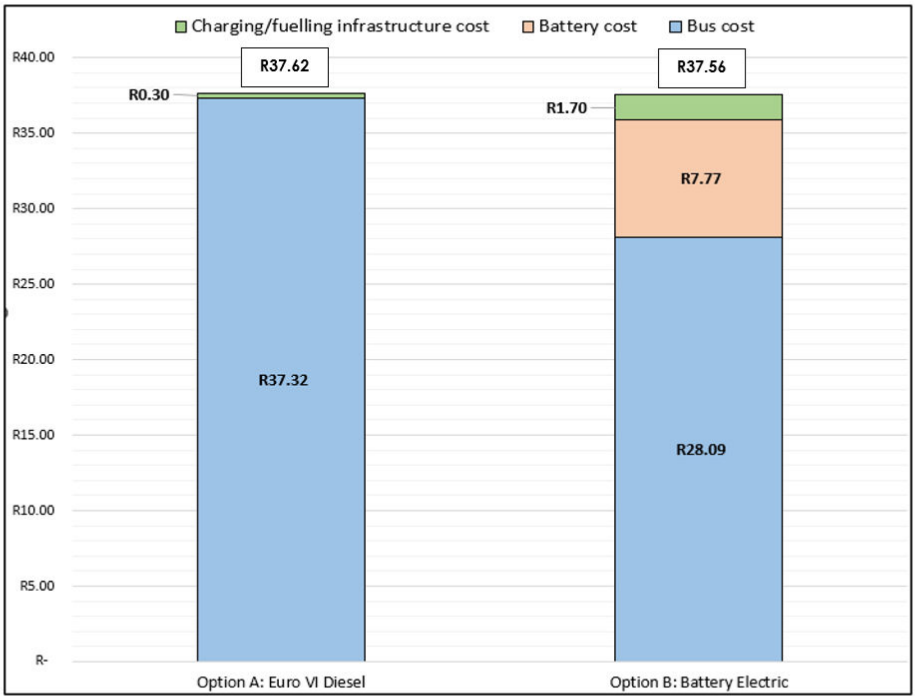



*Figure 34: TCO (R/km) where bus and infrastructure costs are included*

*Source: C40 SA Financial Model*

Additionally, the cost of electrical and charging infrastructure for e-buses is considerably higher than infrastructure required for a diesel bus fleet.

*Table 36: TCO (R/km) – TCO: Bus and Infrastructure Costs*

| | Option A: Euro VI Diesel | Option B: Battery Electric |
|---|---|---|
| Bus cost | R37.32 | R28.09 |
| Battery cost | n/a | R7.77 |
| Charging / fuelling infrastructure cost | R0.30 | R1.70 |
| **Total cost of ownership** | **R37.62** | **R37.56** |

*Source: C40 SA Financial Model*

Figure 35 shows the cumulative annual TCO for bus and infrastructure costs over a 16-year period, while electrical infrastructure is assumed to have a life of 30 years and has been depreciated proportionally over this period. It illustrates how the annual total cost of an e-bus gradually decreases compared to a diesel bus, with a breakeven point being reached between the 12th and 13th years. For BEBs, there are high costs associated with supplying the electrical charging infrastructure and chargers, which is evidenced by the initially higher cost in year 1. In terms of e-bus capital costs, buses are assumed to be purchased using a loan with an 11% interest rate over a repayment period of 10 years, see Table 31.

In the model, all infrastructure costs (other than bus purchases) are handled as a one-time capital cost. This means that the expenses associated with infrastructure are considered as upfront expenditure that occur at the beginning of the project. The costs are not amortised or spread over time through a loan or financing arrangement. Instead, the entire cost is incurred upfront, and there is no ongoing financial obligation related to these specific infrastructure elements.

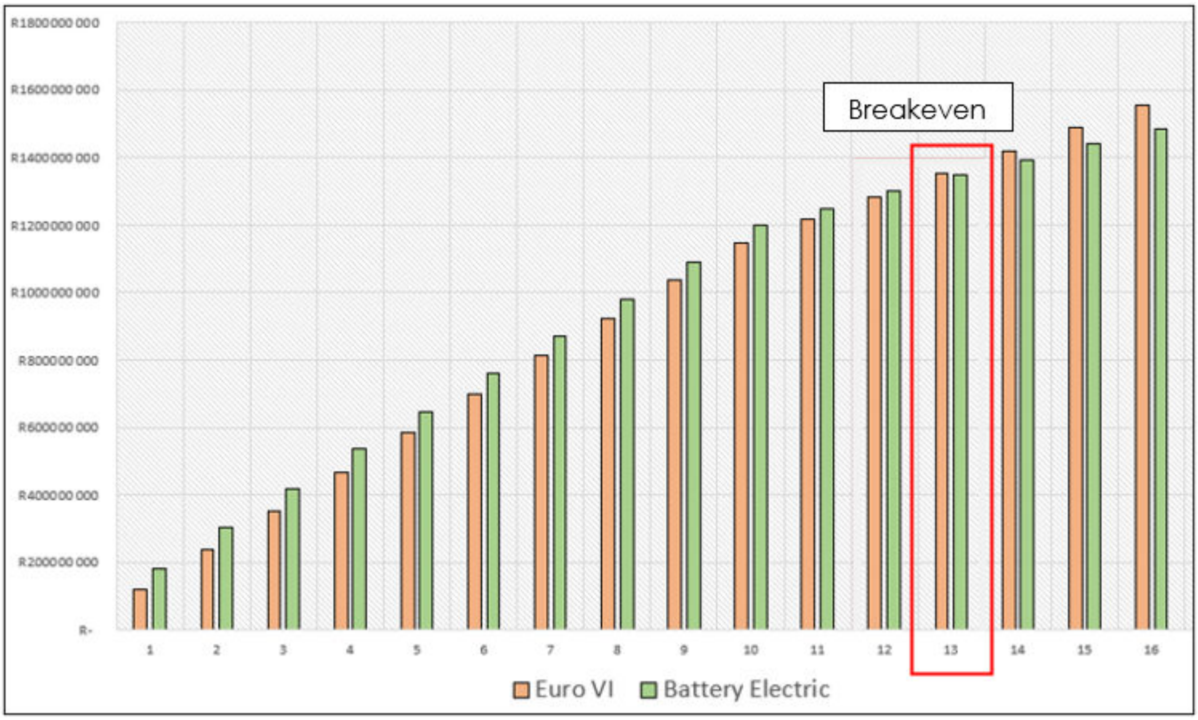



*Figure 35: Cumulative annual TCO (where bus & infrastructure costs are included)*

*Source: C40 SA Financial Model*

### 15.4.3 Bus ownership and operating costs only (excluding electrical charging infrastructure)

Table 37 and Figure 36 include the cost of bus purchase and operating costs only, on a cost-per-kilometre basis over the assumed useful life of the bus. It breaks costs down between fixed and variable costs for each bus type. When charging infrastructure costs are excluded, the cost of a BEB over the useful life of the bus is 4% lower than a diesel bus (R35.86 vs R37.32 per km).

This is a useful comparison for private operators such as GABS where the responsibility for providing electrical infrastructure to a specific site might be for the relevant city; and for the bus operations departments of cities where the infrastructure cost may be paid out of a separate capital budget from another department. In addition, once the charging equipment is installed, subsequent bus purchases and/or expansion of the fleet will not necessarily be encumbered with this cost. This topic is addressed in more detail as part of the sensitivity analysis later in this section.

*Table 37: Bus ownership and operating costs (R/km) (no infrastructure)*

| | **Option A: Euro VI Diesel** | **Option B: Battery Electric** |
|---|---|---|
| Bus capital cost | R9.36 | R13.11 |
| Battery cost | n/a | R7.77 |
| Fuel | R8.17 | R1.10 |
| Lubricants | R0.04 | R0.002 |
| Tyres | R0.80 | R0.80 |
| Bus maintenance | R16.20 | R8.80 |
| Insurance and licensing | R2.74 | R4.28 |
| **Totals** | **R37.32** | **R35.86** |

*Source: C40 SA Financial Model*

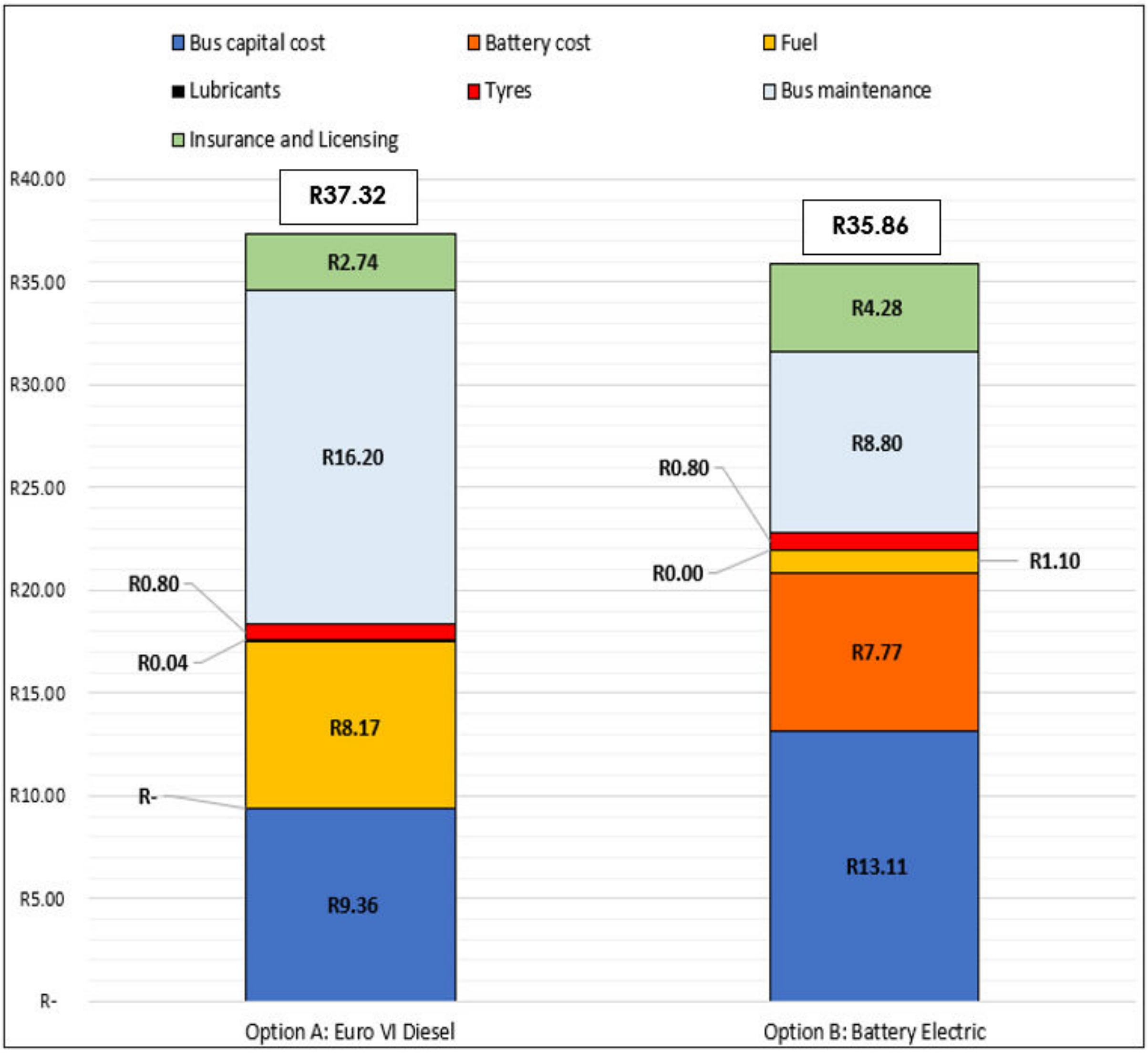



*Figure 36: Bus ownership and operating costs only (R/km) (no infrastructure)*

*Source: C40 SA Financial Model*

Figure 37 shows the cumulative bus costs over a 16-year period. By excluding infrastructure costs, a BEB becomes more cost-effective than a diesel bus around year 8 or 9. Given the volatile price of diesel, it may be possible to achieve this breakeven point even sooner.

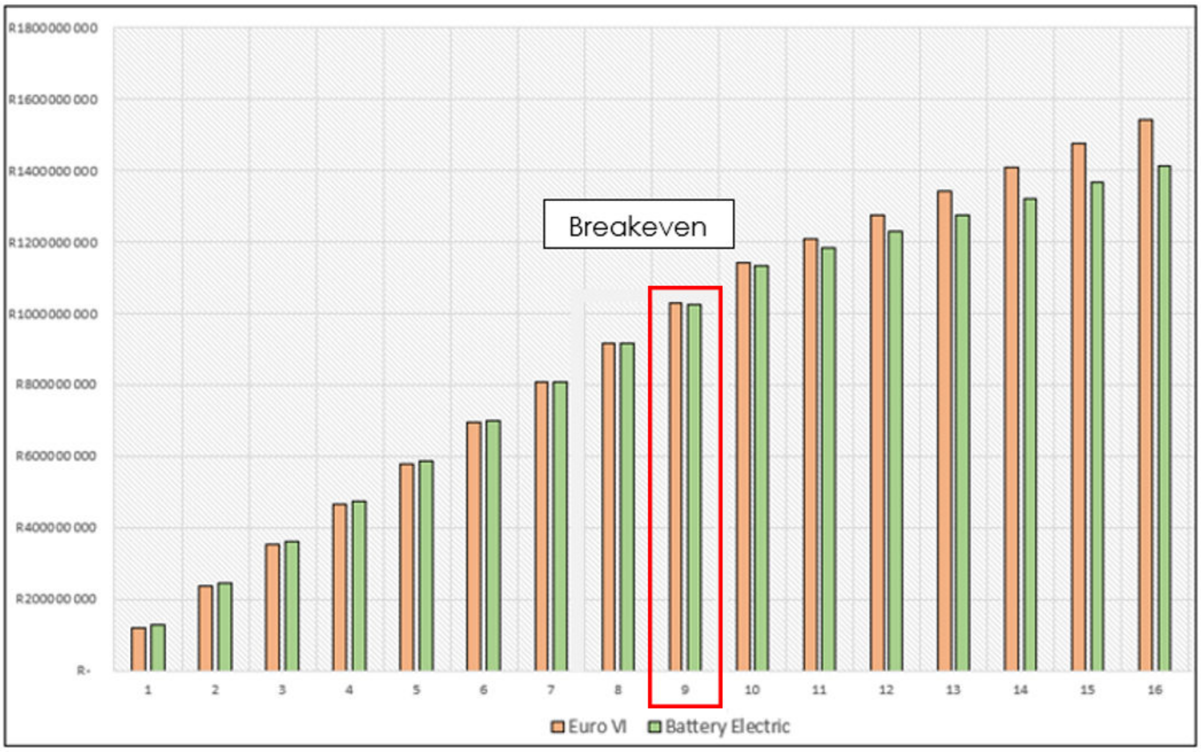



*Figure 37: Cumulative annual bus ownership and ops costs only (no infrastructure)*

*Source: C40 SA Financial Model*

#### 15.4.4 Bus operating costs (excl. electrical charging infrastructure and bus ownership costs)

Table 37 and Figure 38 includes the bus operating costs only, on a cost-per-kilometre basis. It breaks them down between fixed and variable costs for each bus type and excludes charging infrastructure and bus ownership costs.

The cost of a BEB (including these cost elements) is 46% lower than a diesel bus (R14.98 per km vs R27.95 per km).

This is a useful comparison for the bus operations departments of cities where the infrastructure and bus capital costs may be paid for, as an example, by a grant. This cost will then be of primary interest as the government authority will only be required to fund the ongoing operational cost.

As mentioned, the largest cost component of a diesel bus is fuel and maintenance. Figure 36 shows that (at the assumed fuel price of R21.50 per litre and an electricity price of R0.99 per kWh), the fuel / propulsion cost of a diesel bus 85% s more expensive than that of an e-bus (R1.10 per km vs R8.17 per km). Similarly, regarding maintenance costs, a diesel bus is approximately 55% more expensive to maintain when compared to an e-bus.

*Table 38: Bus operating costs (R/km): Bus ops costs only (no infrastructure or bus capital)*

| | **Option A: Euro VI Diesel** | **Option B: Battery Electric** |
|---|---|---|
| Fuel | R8.17 | R1.10 |
| Lubricants | R0.04 | R0.002 |
| Tyres | R0.80 | R0.80 |
| Bus maintenance | R16.20 | R8.80 |
| Insurance and licensing | R2.74 | R4.28 |
| **Totals** | **R27.95** | **R14.98** |

*Source: C40 SA Financial Model*

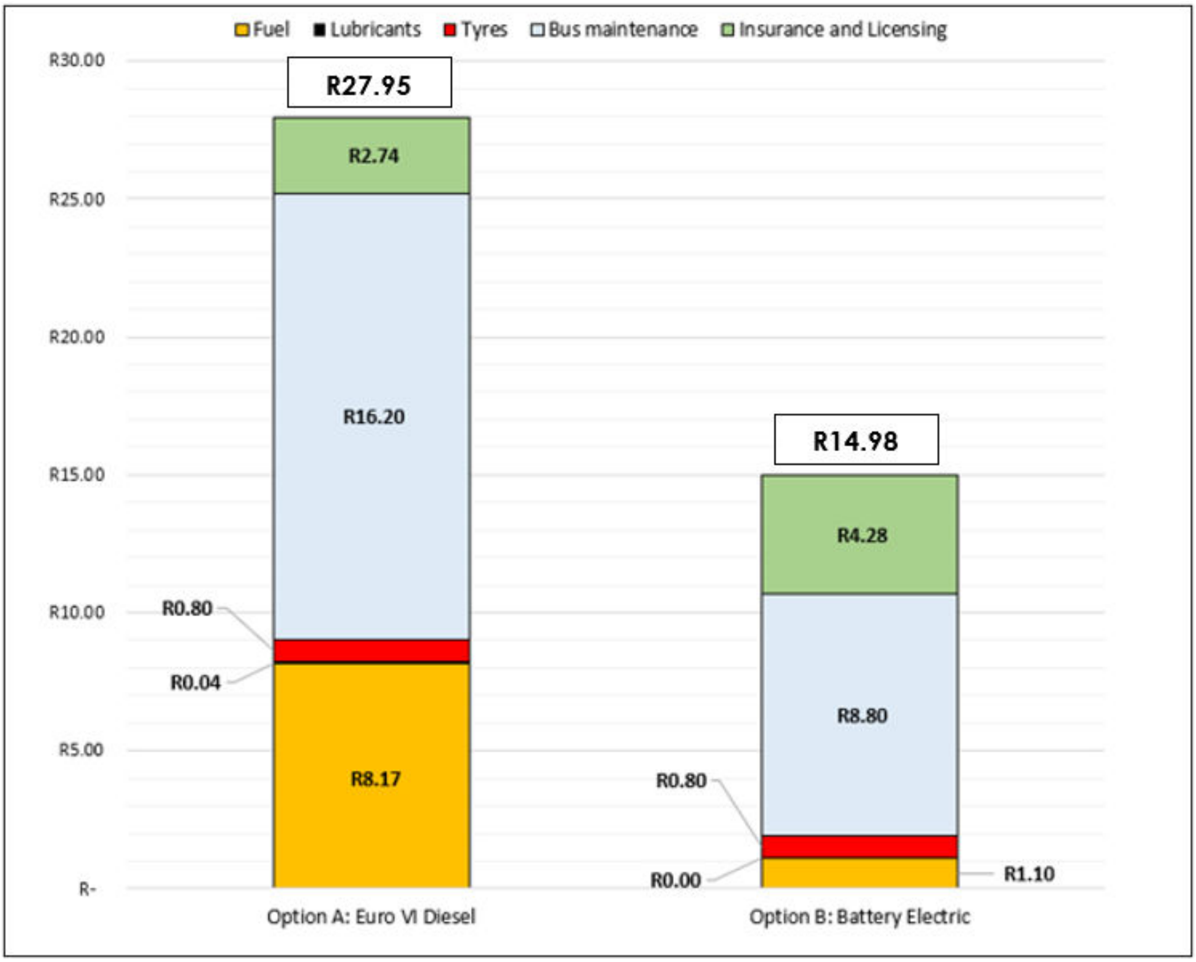



*Figure 38: Bus operating cost only (R/km), no capital costs*

*Source: C40 SA Financial Model*

Figure 39 shows the cumulative bus costs over a 16-year period. By excluding infrastructure and bus procurement costs, a BEB is always more cost-effective than a diesel bus.

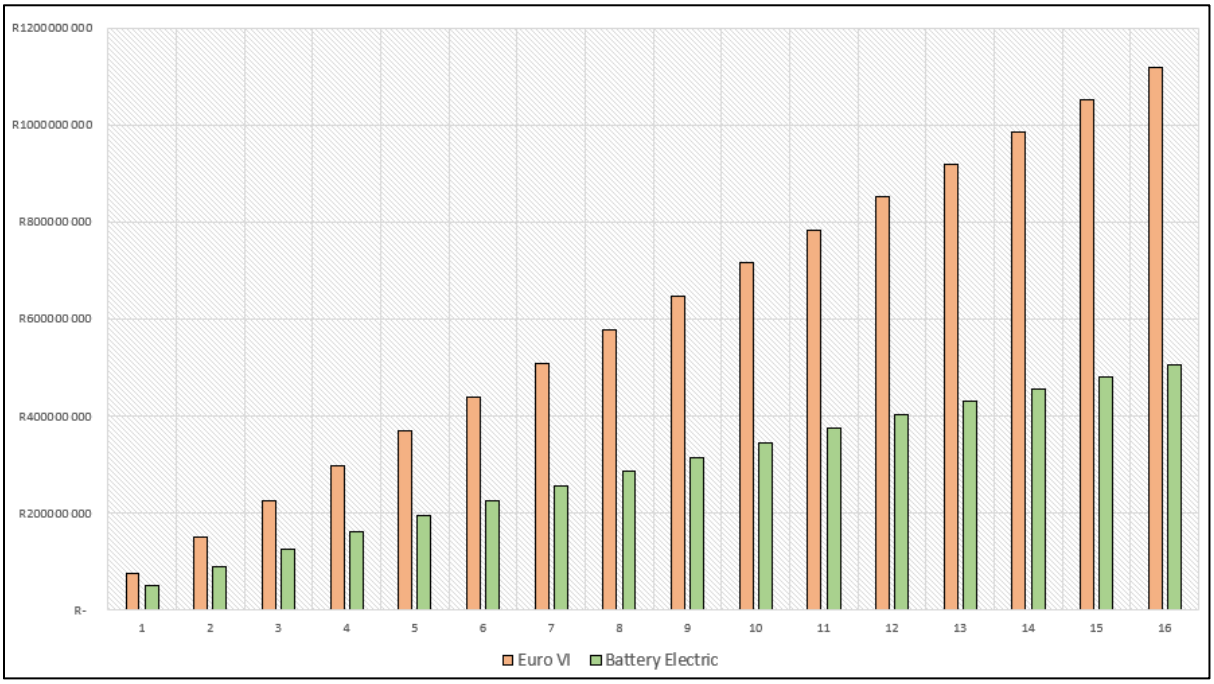



*Figure 39: Cumulative annual bus operating costs only*

*Source: C40 SA Financial Model*

### 15.4.5 Summary

The findings from this C40 South African model confirm the findings in most of literature on the issue, indicating that e-buses have a high upfront capital cost primarily associated with an expensive battery and the need for replacement after about eight years, as well as the high cost of supplying charging infrastructure. However, e-buses are more cost-effective to operate than conventional buses, offering significant long-term financial benefits.

In addition, the cost, lifespan, and weight of the batteries is improving all the time. So, while this model assumes current battery technology for the battery replacement costs, the likely improved battery technology in future will result in lower costs. The output of the model can therefore be considered to be conservative, and the TCO of e-buses are likely to be even lower as technology improves.

### 15.4.6 Sensitivity analysis

#### (a) Useful life of the bus

Figure 40 compares the TCO over 12 years and 18 years, the results show that an BEB with a 12-year lifespan has a 2% higher TCO compared to an equivalent Euro VI diesel bus (R41.60 per km vs R40.79 per km). Conversely, in the 18-year bus life scenario, the TCO of an BEB is 5% lower than that of an equivalent Euro VI diesel bus (R34.66 per km vs R36.56 per km).

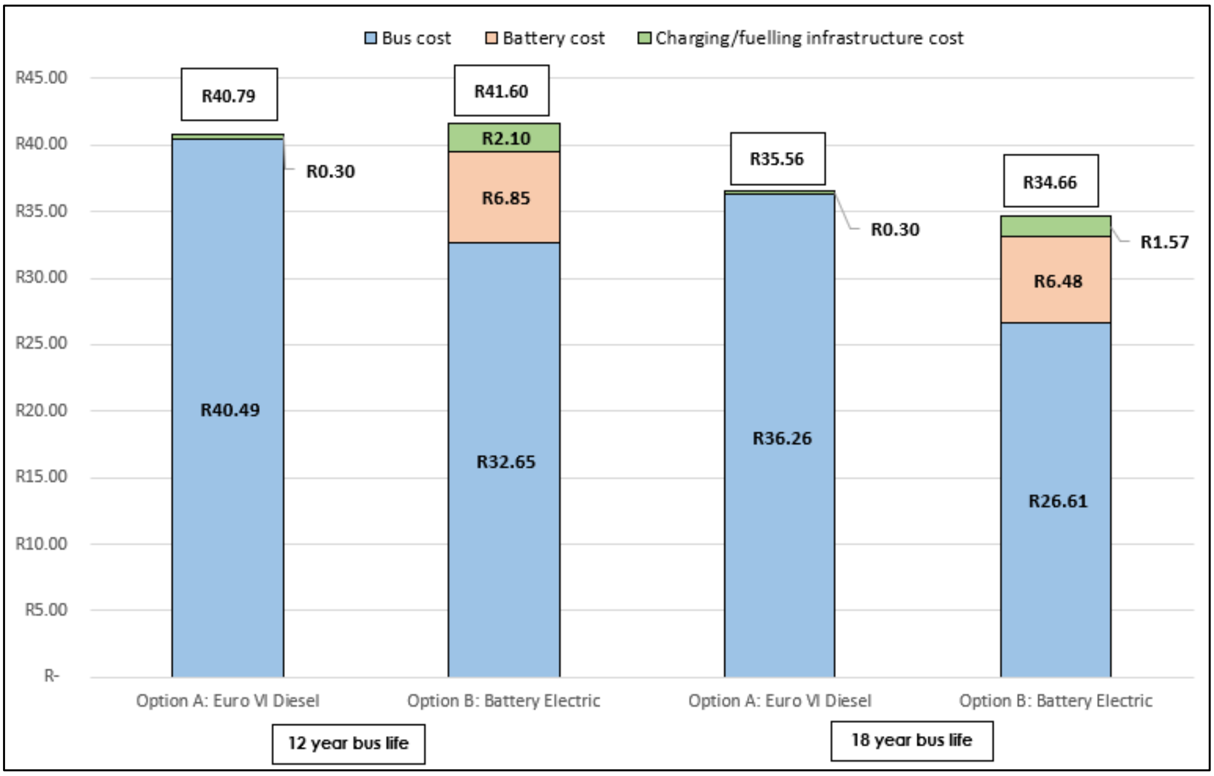



*Figure 40: Comparison: R/km sub-elements over bus useful life of 12 vs 18 yrs*

*Source: C40 SA Financial Model*

While the battery cost is proportionally higher in the 18-year bus life (with battery replacements every 8 years), significant savings in variable operating costs occur over the bus's lifespan. When compared to the base case scenario of 16 years (see 15.4.2), the TCO of a BEB with a 12-year useful life increase by 16.23%. On the other hand, in the 18-year scenario, BEB costs decrease by 5% compared to the base case. As mentioned previously, these savings can be mainly attributed to reductions in fuel and vehicle maintenance costs.

**(b) Annual distance operated per bus**

Figure 41 compares the TCO associated with the two bus types across varying annual operating kilometres per bus. Sensitivity analysis reveals a crucial insight regarding BEBs: the lower the annual operating kilometres per bus, the higher the cost per kilometre becomes (if the assumed useful life remains the same).

This finding has significant implications for cities and bus operating companies. To ensure the cost-effectiveness of electrifying the bus fleet within cities, it is strongly recommended that bus operating companies prioritize efficiency and productivity of the use of their buses. Specifically, efforts should be made to its operations plan to ensure that each bus covers a minimum of 40,000 kilometres per annum, but preferably more.

By reaching this minimum threshold, bus operators can mitigate the rising cost per kilometre associated with BEBs. This would make the transition to electric fleets a financially viable and sustainable option for urban transportation systems. Of course, there is also a significant capital cost-related benefit to operators using a diesel bus more efficiently, but because its price is lower, the relative benefit is less.

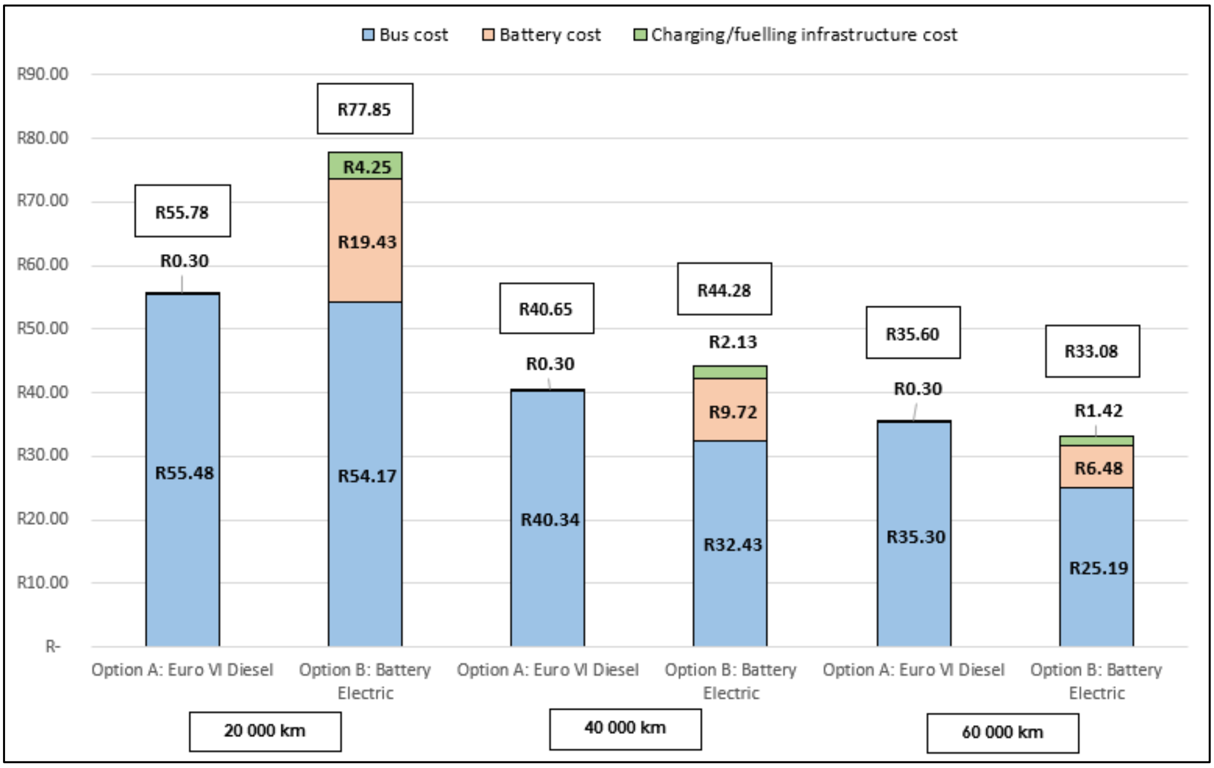



*Figure 41: Comparison of TCO (R/km) over different annual operating kms per bus*

*Source: C40 SA Financial Model*

### (c) Bus type

Figure 42 compares the capital costs of a commuter bus and a BRT bus. Commuter buses are cheaper than BRT bus as they are designed for transporting passengers between suburban or outlying areas and urban centres. They often cover longer distances, have fewer stops, and serve commuters traveling from home to work and back. The BRT buses are more expensive as they are designed for high-capacity, efficient urban transit. BRT buses operate within city limits, with frequent stops and dedicated lanes or rights-of-way to ensure faster service. They are typically part of an integrated urban transit network.

The cost of BEBs has decreased over recent years due to advancements in technology, economies of scale, and increased competition among manufacturers (Bloomberg New Energy Finance, 2023). As technology continues to improve and more electric buses are produced, it's likely that their costs will continue to decrease in the future. Additionally, government incentives and environmental regulations may play a role in further reducing the cost gap between electric buses and their traditional counterparts. However, the specific rate and extent of cost decrease in the future will depend on various factors, including technological advancements, market dynamics, and policy decisions (World Resource Institute, 2022).

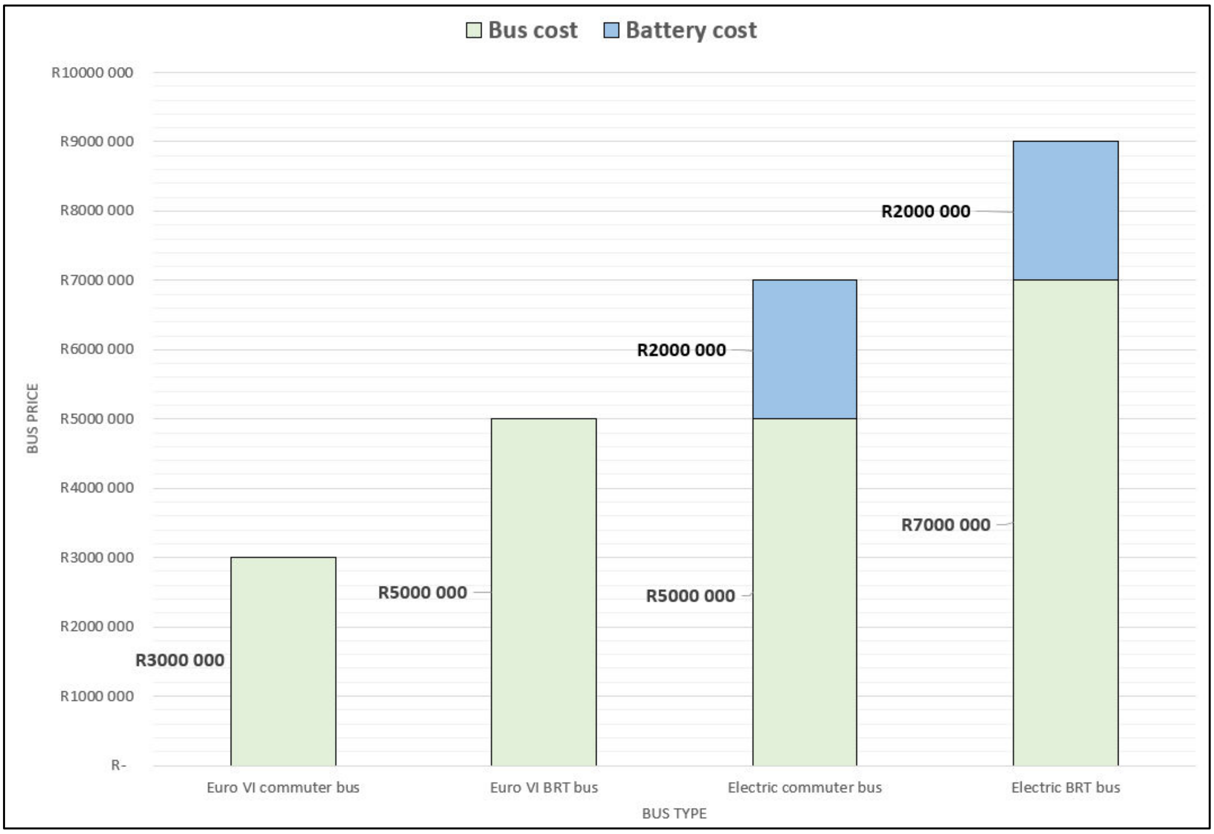



*Figure 42: Capital cost of different bus types*

*Source: C40 SA Financial Model*

Table 39 shows the modelling results of the TCO for different bus types over a 16-year period, where the other assumptions are the same as in the base case.

As expected, the TCO of a commuter BEB is significantly lower at R4.64 per kilometre compared to an electric BRT bus. This cost saving can be attributed to significant savings in bus capital and finance costs over the 10-year repayment period. Charging and infrastructure costs remain the same for both scenarios. When comparing capital repayment of a commuter BEB to that of an electric BRT bus, the commuter bus option results in savings of approximately R100m in capital costs and R70m in finance costs over the 10-year repayment period.

*Table 39: TCO R/km – BRT vs commuter bus (bus useful life: 16 yrs)*

| | **BRT Bus** | | **Commuter Bus** | |
|---|---|---|---|---|
| | Euro VI Diesel | Battery Electric | Euro VI Diesel | Battery Electric |
| Bus cost | R 37.32 | R28.09 | R32.67 | R23.44 |
| Battery cost | n/a | R7.77 | n/a | R7.77 |
| Charging/fuelling infrastructure cost | R0.30 | R1.70 | R0.30 | R1.70 |
| **Total cost of ownership** | **R37.62** | **R37.56** | **R32.98** | **R32.92** |
| **Variation betw. BRT & commuter bus** | **12.33%** | **12.35%** | | |

*Source: C40 SA Financial Model*

#### (d) Bus insurance

In the model, insurance is calculated at 4.5% of the depreciated value of the bus, using a straight-line depreciation method. However, the interview with GABS revealed that a better strategy might be to self-insure the bus fleet, a strategy which is followed by GABS themselves. Self-insuring a bus fleet, as opposed to using third-party insurance, involves setting aside funds and creating a financial strategy to cover potential losses or damages that would otherwise be covered by an insurance policy.

In a self-insurance strategy, the city or bus operator would create a reserve fund which can be based on historical figures of how many buses are lost annually to accidents or vandalism. This fund must be large enough to handle claims that would normally be covered by insurance. Cities or operators are likely to find that the cost of buses written off annually is significantly less than what they pay for by insuring buses in the market. This is likely to result in long-term savings since the benefits of not paying premiums can outweigh the costs of occasional claims.

It is important to note that the self-insurance option is only viable if insurance coverage for calamitous events, typically referred to as 'Catastrophic Event Insurance' or 'Catastrophe Insurance,' is in place. This type of insurance provides financial protection against large-scale and catastrophic losses, such as natural disasters, fires, accidents, or other events that can cause significant damage or destruction to assets, including an entire fleet of buses. It is designed to help businesses and organizations recover from such devastating events by providing compensation to repair or replace the lost assets and cover related expenses.

As part of the sensitivity analysis, the insurance premium was reduced to 1% of the depreciated value of the bus, in an attempt to model a 'self-insurance' strategy. The modelling results show significant operating cost savings, equating to R70 million for Euro VI diesel buses and R118 million for e-buses. These cost savings will have a significant effect on the TCO of each bus type and will also positively impact the cash flow.

The modelling results indicate that self-insurance can be more cost-effective in the long run if claims are infrequent or minor, but can be risky if large, unexpected claims occur. It is important to consider that if cities or operators handle claims internally, it would involve an additional administrative burden of assessing damages, determining the validity of claims, and paying out claims from the reserved fund.

## 15.5 Conclusions

### 15.5.1 Beneficial scenario

The findings from the C40 SA financial model suggest that BEBs represent a cost-effective alternative to their diesel counterparts, depending on some variables. This conclusion is based on a thorough analysis of various factors, including lifecycle considerations and operational costs. This favourable outcome hinges on specific conditions being met, referred to here as a beneficial scenario.

One of the key sensitivities that can significantly impact the cost-effectiveness of BEBs is the efficiency of the bus operational plan of a city or an operator. If the operational plan does not utilise buses efficiently, the potential cost savings offered by BEBs may not be fully realised. BEBs tend to be more cost-effective when they cover a higher number of kilometres annually. Cities and operators should in any event invest in optimising their bus operations, irrespective of the bus type used, but this becomes even more critical of transition to BEB's is desired since this is a key factor to make them more economically viable than diesel buses.

Furthermore, the useful life of the buses plays a crucial role in determining their overall cost-effectiveness. BEBs are often more expensive upfront, but they can become more cost-effective over their lifetime, especially if they remain in service for an extended period. To achieve this, cities and operators should carefully consider the type of buses they order, ensuring that they are well-suited for the local operating environment and conditions, and that they are built to have a longer useful life. By doing so, they can minimize bus breakdowns and extend the lifespan of these vehicles to at least 12 years, but ideally to 16 or 18 years.

Finally, cities and operators should aim to implement innovative cost-saving strategies. For instance, they can consider options such as self-insuring a bus fleet instead of relying on third-party insurance, of leasing the batteries or contracting with an on-bus energy provider.

In conclusion, while electric buses offer promising economic and environmental benefits, their success in realising these advantages depends on certain conditions. Table 39 shows the modelling results for a beneficial scenario, whereby:

- Annual operating kilometres per bus is 50 000 kms;
- Useful life of the bus is 16 years;
- Self-insurance strategy is employed.

*Table 40: TCO R/km – beneficial scenario (50 000 kms pa, 16-yr bus life, and self-insurance)*

| Operating cost per kilometre | Option A: Euro VI Diesel | Option B: Battery Electric |
|---|---|---|
| Bus cost | R35.57 | R25.14 |
| Battery cost | - | R7.77 |
| Charging/fuelling infrastructure cost | R0.30 | R1.70 |
| Total Cost of Ownership | **R35.87** | **R34.61** |

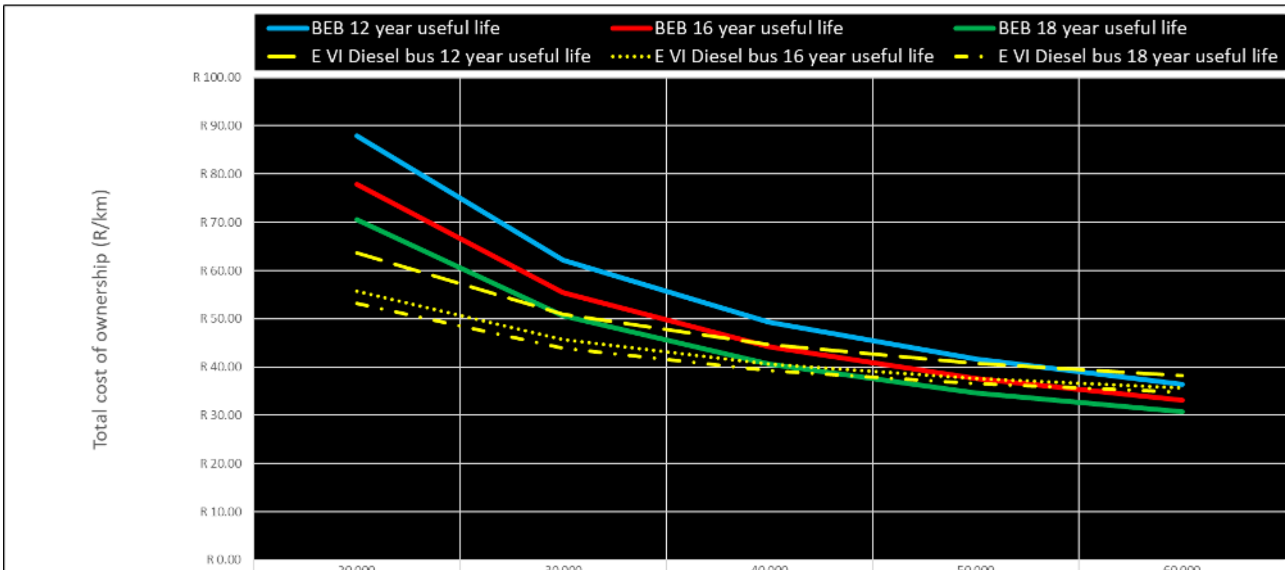
*Source: C40 SA Financial Model*

By addressing these sensitivities, cities can pave the way for a more sustainable and cost-effective public transportation system where transition to BEBs is the better way, thus benefiting both the environment and their communities.

Figure 43 clearly illustrates the impact of varying annual operating kilometres on the TCO for different BEB useful life scenarios. The graph shows that as annual distance per bus decreases (moving left), the TCO increases. Conversely, the TCO improves for all bus types, both diesel and BEB, as annual kilometres and useful life increases..

The yellow lines in the graph represent Euro VI diesel buses with useful lives respectively of 12, 16, and 18 years. The blue, red, and green lines depict BEBs for these same life spans. Initially, BEBs are more expensive than diesel buses for low to medium average annual bus distances. However, in scenarios where buses travel between 40,000 and 50,000 kms/year, the graph demonstrates a crossover point where BEBs become more cost-effective than their diesel counterparts.

In summary, both the length of the useful life of a bus and its annual kilometres greatly influence operational cost-effectiveness, regardless of bus type. Specifically, the TCO of a BEB bus becomes increasingly competitive compared to diesel as annual kilometres increase (becoming more economical from around 40,000 kilometres per year onwards) and as useful life increase. These findings should be considered by cities and bus operators in designing future public transport systems and operational plans.




| | 20 000 | 30 000 | 40 000 | 50 000 | 60 000 |
|---|---|---|---|---|---|
| BEB 12 year useful life | R 87.96 | R 62.21 | R 49.33 | R 41.60 | R 36.45 |
| BEB 16 year useful life | R 77.85 | R 55.47 | R 44.28 | R 37.56 | R 33.08 |
| BEB 18 year useful life | R 70.60 | R 50.63 | R 40.65 | R 34.66 | R 30.66 |
| E VI Diesel bus 12 year useful life | R 63.71 | R 50.98 | R 44.61 | R 40.79 | R 38.24 |
| E VI Diesel bus 16 year useful life | R 55.78 | R 45.69 | R 40.65 | R 37.62 | R 35.60 |
| E VI Diesel bus 18 year useful life | R 53.14 | R 43.93 | R 39.33 | R 36.56 | R 34.72 |

Annual Operating Kilometres per Bus

*Figure 43: Varying annual operating kilometres for different BEB useful life scenarios*

*Source: C40 SA Financial Model*

### 15.5.2 Further insights

The following further insights summarise the main findings of the C40 financial model:

- E-buses have a high upfront capital cost, mainly associated with the expensive battery and the need for battery replacement after 8 years, as well as the high cost of supplying charging infrastructure.
  - More than a quarter of the bus capital cost (27.5%) is required for the initial purchase and replacement of the battery.
  - The cost of electrical and charging infrastructure for e-buses is considerably higher than the infrastructure costs for a diesel bus fleet (e.g. fuel tanks and refueling equipment).
- However, it costs less to operate e-buses than diesel buses. Diesel buses have significantly higher operating costs, making them approximately 85% more expensive to operate than e-buses, where operating costs include fuel, maintenance, tyres and overheads such as license fees and insurance (see Figure 36 for cost breakdown).
- When all capital and operating costs are considered together, in the base case scenario, the overall TCO for a BEB is almost identical to that of a Euro VI diesel bus.
- The relative TCO of e-buses is likely to decreases in the future because of a confluence of

factors, including technological advancements, economies of scale, increased competition, infrastructure development, and government support (especially if cities drive key costs down such as insurance), the cost of capital and improved efficiencies of operational plans. On the other hand, the TCO of diesel buses are likely to rise as fewer diesel buses are ordered globally (diseconomies of scale), and the cost of fuel increases or the volatility of fuel costs drive overall costs up.

- These factors are expected to continue influencing the cost landscape of electric buses in the future and are likely to make them an increasingly attractive and cost-competitive option for public transit systems and private operators. However, the rate and extent of TCO reduction will depend on the interaction of these factors, highlighting the importance of ongoing investment, innovation, and supportive policies in the electric bus sector and of ongoing updates to cost models.
- Key conclusions form the sensitivity analysis are:
  - When considering the useful life of a bus, the results show that an BEB with a 12-year lifespan has a 2.5% higher TCO compared to an equivalent Euro VI diesel bus. Conversely, in the 18-year bus life scenario, the TCO of an electric bus is 5.2% lower than that of an equivalent Euro VI diesel bus.
  - The purchase price of a BRT BEB is 28% higher than an equivalent commuter BEB. This difference arises because commuter buses are designed for transporting passengers between suburban or outlying areas and urban centres, whereas BRT buses are designed for high-capacity, efficient urban transit systems operating within city limits.
  - As expected, the TCO for an electric commuter bus is significantly lower, at R4.64 per kilometre, compared to an electric BRT bus. This cost-saving is due to substantial reductions in bus capital and finance costs over the 10-year repayment period. However, if BRT buses has significantly higher seat renewal, then the cost per passenger kilometre of BRT buses may be equal or lower than that of commuter buses.
  - Reducing the insurance premium from 4.5% to 1% (modelled to reflect a self-insurance strategy) of the depreciated value of the bus would offer significant benefits to cities, resulting in substantial operating cost savings. This reduction equates to R70 million for Euro VI diesel buses and R118 million for e-buses for a 50-bus fleet. However, such a strategy can carry risks if large, unexpected claims occur. Therefore, it is important to note that the self-insurance option is only viable if insurance coverage for catastrophic events is in place.
  - Cities may decide to take on the responsibility for the cost of electrical infrastructure required to bring power to the depots of bus operators. Cities may be able to manage such costs more easily since they can take loans over the long lifecycle of such infrastructure, while operators cannot. Additionally, operators may want to avoid the upfront costs of chargers and batteries by contracting private companies to provide them, as discussed in 17.2.3.
  - E-buses hold significant promise for economic and environmental advantages, yet realizing their cost-effectiveness hinges on specific conditions. A beneficial scenario for BEB deployment would be characterised in relation to three key factors: an annual operating distance of 50,000 kilometres per bus (or at least 40 000km), a bus lifespan extending to 16 years (or at least 12 years), and the adoption of cost saving strategies such of a self-insurance strategy. These variables represent critical considerations in achieving the cost-effectiveness and sustainability goals associated with BEB adoption in a public transport system.

# Part E Scope & conditions for e-bus deployment

## 16 Obstacles and business issues in e-bus deployment

This section highlights general obstacles and business issues in e-bus deployment. It is followed in section 17 by a focus on issues relating specifically to financing. Access to financing depends on the economics of e-buses, so some of the issues identified in this section are discussed further in section 17.

### 16.1 Key identified obstacles

*Table 41* provides a summary of the identified obstacles to e-bus deployment in South Africa.

*Table 41: Obstacles to e-bus deployment in South African C40 cities*

| Category | Obstacle | Description | Severity |
|---|---|---|---|
| Vehicles | High upfront costs | In South Africa, e-buses cost approximately 100% more than their equivalent diesel counterparts. This higher cost is primarily attributable to the expensive battery, which accounts for about 30% of the total bus cost. Furthermore, components specific to e-buses, such as electric motors and power electronics, can be more expensive than their diesel counterparts. Additionally, e-bus manufacturing processes often require specialised technology and expertise, further increasing production costs. | |
| | High import tariffs | EVs are subject to higher customs and excise import duties, and other ad valorum taxes in comparison to ICE vehicles. Higher import taxes for e-buses distort the market, increasing the capital costs compared to diesel buses.<br>The reason for these higher taxes is that because there is no e-bus manufacturing industry in South Africa, e-buses are currently imported fully built, while diesel buses are built in South Africa. Local manufacture of e-buses must be encouraged to reduce the purchase price of buses and bus parts over time; so removing these taxes may be counter-productive. However, there have been calls for interim relaxation of such taxes for a short period to accelerate the initial shift to e-buses. This is specifically relevant for electric buses used in pilot projects, thus to allow the importation of fully assembled buses for such tests. The quantum of ad valorem taxes is very large, rendering pilot projects extremely expensive, which could disincentivise such tests. Pilots are important to test use of these buses under local conditions. Once this technology is further proven, the possible exemption can be removed, stimulating local manufacture. On the other hand, as discussed below, the GABS, Tshwane and eThekwini pilots (already funded) may be sufficient, and thus extensive new pilot projects may not be required. If so, this change may not be required. | |
| | Procure-ment challenges | Procurement models, particularly in the public sector, typically focus on upfront cost, while requiring the flexibility of considering the TCO (total cost of ownership) over the lifespan of the e-bus. | |
| Charging & grid | Capital costs | E-buses require significant capital investments in grid and charging infrastructure. These investments entail not only procuring charging stations but also undertaking preparatory work, such as excavating concrete, | |

| Category | Obstacle | Description | Severity |
|---|---|---|---|
| infra-structure | | enhancing or expanding underground utility connections, and upgrading electrical systems, including distribution transformers and substations. | |
| | Grid instability | A lack of grid stability is currently a barrier for cities that have inadequate or unreliable electricity networks. The challenge lies in ensuring that the local utility companies can provide a reliable flow of electricity for e-bus operations. The renewable energy can be used in addition with the traditional energy network to reduce the instability, but it has a cost to implement. | |
| | Depot space require-ments | Space at depots is often very limited, and creating additional depots is prohibitively expensive in some urban areas It is estimated that the charging infrastructure and new parking schematics may require depots to be up to 30 percent to 40 percent larger to accommodate new e-buses and charging infrastructure., although future chargers may have a smaller footprint. | |

## 16.2 Some key business issues

### 16.2.1 The fundamentals regarding costs

section 13 has described the GABS pilot, and explained how GABS has now taken a decision based on financial grounds to shift to e-buses.

section 15 contains the model developed as part of this research to explore the viability of e-bus deployment. It generally uses more conservative assumptions than apply in the case of GABS, but nevertheless shows that the TOC of e-buses will be on a par with that of diesel buses, or somewhat cheaper, provided certain conditions are met.

If this holds true within the operational model of many or most operators, then in due course other operators with a similar type of operation should logically come to a commercial decision to convert to e-buses – provided that key strategies are in place to enable this decision.

There remains in the market a significant recalcitrance for operators to make the move to e-buses, likely driven in part by their fear of the unknown achieved. Understanding the underlying reasons for this hesitancy is crucial to developing a strategy for transitioning to e-buses in the short to medium term. As the e-bus fleet expands, operators will become more familiar with this technology. This enhanced understanding coupled with improved cost projections will enable operators to overcome their reluctance and embrace the transition to e-buses.

### 16.2.2 Passenger demand patterns helpful to e-bus adoption in South Africa

Bus services in C40 cities in South Africa are both very peaked and tidal in nature, with relatively low demand during inter-peak and off-peak. The reasons for this have been explained in 4.1 above.

This demand pattern causes a range of problems in public transport provision in the country, including:

- Lower passenger-to-bus ratios (as compared to many other world cities) since many buses can be used only for one trip in the morning and one trip in the afternoon, and seat renewal is quite low.

- Higher bus requirements to move the same number of passengers, and therefore higher capital requirements in acquiring the buses.
- The peaks are very 'peaky' (peaks are very high and relatively short), with the effect that drivers can be productively used only for relatively short hours in the morning and in the afternoon, increasing the costs of labour.
- Low service levels outside the major peak period, reinforcing the peaky demand patterns.

However, these factors are to some extent beneficial for e-bus deployment, as found in the GABS pilot, since the lower passenger demand in its operations during inter-peak (usually about 9am to 3pm) allows a significant part of its total fleet of over 1 000 buses (if, in due course, all are converted into e-buses) to be charged during the day using available solar power, and the remainder of the fleet can be charged overnight, when buses are unused – subject, of course, to electricity and charging infrastructure being available.

Thus, with the required infrastructure, a significant percentage of buses can be charged inter-peak, during the daytime when direct solar power is available, without the need to store the power first.

Charging during these periods should also reduce the cost of charging: Eskom and cities usually charge less for electricity consumed at night; and logically in future (although not at the moment) electricity should also be cheaper inter-peak, because of lower general power demand during this period.

### 16.2.3 Reliable electricity supply in the correct locations

Table 41 above highlights electricity supply issues. There are a number of different dimensions to this.

#### (a) Operator confidence regarding electricity supply

Cities are unlikely to take major steps towards conversion to e-buses unless they have a high level of certainty that the issue of electricity supply will be resolved.

In some cities, such as Cape Town, there is already a higher level of confidence that the issue will be resolved at least in the medium term, especially due to the steps being taken by the city to source electricity from independent power producers, who are likely to generate such power mainly through solar and wind. This is probably why GABS have sufficient confidence to switch their recapitalisation programme from 2024 fully to e-buses.

The GABS study further shows that more hours of scheduled loadshedding at a charging facility would require more chargers and more electricity supply when the power is on, potentially increasing the cost of operating e-buses. However, it appears relatively confident that such eventuality is not insurmountable.

#### (b) Facilities for recharging in the correct locations

A significant proportion of buses in many South African operations are unused between peaks (being an inter-peak period roughly from 9am to 3pm).

Sunshine is usually abundant in South African cities (depending on the season and the weather), meaning that if solar power is available a significant percentage of buses could be charged during such inter-peak periods. This should permit smaller and cheaper batteries to be deployed, reducing the capital cost of e-buses.

The most practical and cost-effective way to do so will be to have charging infrastructure available close to morning destinations (such as inner city and industrial areas and other nodes).

Cities can play an important role here to:

- Give assistance and planning permissions to operators to establish such charging infrastructure in such locations;
- Ensure that the planning and infrastructure of electricity supply anticipate and support such charging infrastructure;
- Secure or make available municipal land in such areas for such charging;
- Support the creation of battery owning and charging businesses (see 17.2.3(a) and (b)), which could set up such charging infrastructure, potentially shared between different operators.

# 17 Financing issues in transitioning to e-buses

## 17.1 Introduction

It has been explained that the capital cost of e-buses is significantly higher than that of diesel buses and that this difference is significantly attributable to the cost of the battery. Additionally, the transition to e-buses requires new supporting infrastructure, such as charging stations and the electrical power connections required to support the significant new power needs.

On the other hand, operating costs are significantly lower, assuming reasonably priced and reliable access to electricity for charging, especially outside periods of peak electricity demand. Not only is electrical power required per bus kilometre generally cheaper, but electricity prices tend to be more stable than diesel prices. In addition, overall vehicle maintenance costs are lower.

This shifts the nature of funding requirements towards capital.

The financing requirements are not necessarily restricted to the bus operations themselves. Transitioning to e-buses also requires ensuring a reliable electricity supply in locations where buses need to be charged. In the C40 cities responsibility for distribution of electricity generally lie with the C40 municipalities and Eskom.

In other words, elements of the financing may need to be directed at municipalities and the electricity industry, or entities that specialise in electrical charging and batteries.

Although financing terms depend on the overall macro-economic environment that determines the level of capital availability, at a fundamental level financing is about risks around repayment. If the risks of not being repaid are high, financing terms will be onerous. Financing charges are lowered if, firstly, the responsibility for managing a risk is allocated to the party that is in the best position to manage the risk, and secondly, that such party is able to do so.

As technologies shift from diesel to e-buses, costs structures and risks change. Changes in institutional forms (i.e. which institutions do what) may reduce risk – or perceptions of risk – and lead to lower financing charges. This is one of the issues addressed in this discussion.

The Just Energy Transition Implementation Plan (JET-IP) supported by international donors, should be making cheaper finance available to support the transition to zero-emission solutions. In this section we note the significance of this plan, and progress being made towards accessing finance through it.

South Africa has a relatively sophisticated financial sector capable of putting together complex financing structures in innovative ways. The objective of this section is not to seek to propose any such structure, but to explain the overall terrain, highlight some of the possibilities that may arise for financing a transition to e-buses, and identify key priorities that must be addressed by relevant role players.

## 17.2 Three sets of issues in securing finance

Irrespective of what technology is used – whether diesel or electric – there are critical factors affecting the availability and cost of capital. For example, we have explained how currently in South Africa there is uncertainty relating to the future of commuter bus contracts. There is also significant differentiation in the creditworthiness of different bus operators. In any actual financing of e-buses, the issues relating to contract certainty and operator creditworthiness that apply to diesel bus financing become increasingly important given the increased relative weight of the capital requirements.

There are, however, new issues that arise specifically from the shift from diesel to e-buses, apart from the greater capital costs. These are to do both with new possible approaches to financing the cost of the battery, as well as the financing needs of new charging infrastructure, in particular.

Since the most important steps that need to be taken to finance a transition to e-buses are often the same steps that are required to improve availability of capital for all bus technologies, we take an integrated approach to the question and discuss three sets of issues:

1. Creating a suitable external environment for bus financing irrespective of technology or bus operator.
2. Characteristics of bus operators that influence their ability to raise finance, irrespective of technology.
3. Financing to support the shift from diesel to EVs.

### 17.2.1 A suitable external environment for bus financing and related requirements

This relates mainly to the certainty of the environment into which bus services are provided. Key factors include:

**(a) Does the bus operator have a clear and secure right to operate for a sufficiently long period?**

Running a bus service – whether diesel or electric – requires investment in buses and a range of ancillary facilities. Where the operator purchases and owns the buses, if the operator has a right to operate for a sustained period, either through a concession or service contract, its income is more secure, and repayment can potentially be spread over much of the useful life of the bus.

Because e-buses are more expensive to purchase, making capital requirements higher, the need for longer, secure contracts is heightened for e-buses where services are run by private operators on concession or contract, and these operators are required to purchase the vehicles.

The South African government provides subsidies for commuter bus services linked to such concessions or contracts:[32]

- regarding PTOG funded services, with the bus operating model referred to as Group A, mostly contracted by Provinces; and
- regarding "Integrated Rapid Transit Service Networks"[33], focusing mostly on BRT services, and with the bus operating model being referred to as Group C, which are contracted by cities / municipalities.

The statute that regulates (land-based) public transport, the NLTA, provides only two possible contract terms for (new) government contracted public transport services:[34]

- Up to 12 years for negotiated contracts where "rationalised" services are contracted to existing operators, which is meant to be limited to one such term of 12 years only; and
- Up to seven years for all other contracts.

The latter term of seven year maximum is theoretically the main envisaged contract term used in government public transport contracts, since the former is available only the first time a public transport contract is concluded regarding a given area (s41).

Seven years is a short period to sustain the purchase by the operators of expensive e-buses. However, the contracting system is not functioning as was intended by the NLTA.

This must be considered against the background that many contracts let by Provinces (linked to the PTOG grant), have been operated under "interim order" contracts, concluded under the preceding statute.[35] These have effectively been extended on a relatively short-term basis of three years of less. Some bus companies exposed to the risk of termination of contracts at

[32] With bus operating models described in Table 17, p. 65.

[33] This is the term used in the Department of Transport's PTS&AP of 2007. However, the NLTA uses the term "Integrated Public Transport Network" (omitting "rapid) and is the more inclusive term across different modes of public transport. In recent years, the Department is favouring the latter term due of its more inclusive approach, although the administration of the PTNG grant seems to remain more focused on BRT systems.

[34] These contract types are described in more detail in the IPTNs of the C40 Cities, and related documents, such as the 2018 MYFIN of the City of Cape Town (City of Cape Town, 2018).

[35] The National Land Transport Transition Act (NLTTA).

relatively short notice have continued to invest in new buses on the assumption that contracts will continue despite the NLTA's provisions that require a new tender at least every seven years.

Thus, the industry has adjusted to this to some degree. Apart from bus operators, adjustments have had to be made by lenders and bus suppliers interested in doing business. And indeed, the reality that contracts have lasted for such a long time despite the uncertainties has meant that actual disruption has been avoided – and that the industry has apparently concluded that the risk of termination is not significant. As an example, GABS in Cape Town, with a fleet of 1 100 vehicles, continues to invest in new fleet. As reported above, GABS has been purchasing approximately 60 new buses per year and has decided to switch new purchases to e-buses in its bus replacement programme, starting 2024.

On the other hand, in the Gauteng area, after a long period of lack of legal and institutional clarity, agreement was reached earlier this year through negotiation between contracted bus companies and the Gauteng Province to adjust and extend bus contracts for a seven-year period. This is likely to lead to new initiatives to recapitalise existing fleets, and although the intention appears to be to use legacy technologies, it may offer an opportunity for operators to follow GABS' example in deploying e-buses.

The e-Natis figures show that in the context of this uncertainty and other considerations, bus replacement has fallen in recent years. The improvement anticipated because of the recent Gauteng agreements has not yet impacted the numbers of registrations.

If buses are well-built and properly maintained, and road conditions are sound, their commercial life can easily extend to a period of between 15 to 20 years. NaTIS registration figures show that 21% of all buses in C40 cities are older than 20 years. This does not mean that contracts need to be 20 years long to be viable. Longer contracts are better for writing off capital costs, but bus operators would respond to shorter contract terms if there were a strong likelihood of securing new contracts when the current one ends (or if there will be scope to resell vehicles to other operators for a fair price if this is not the case).[36]

In the case of municipally owned conventional bus services as exist in all the C40 cities other than Cape Town, the assets are on the balance sheet of the municipality and the seven-year restriction on contracting length is not relevant. Lending depends mainly on the financial creditworthiness of the municipality. Historically, the large metropolitan municipalities have generally been regarded as credit worthy, although there are some questions around this in some of the cities.

In the case of the BRT projects, all operations are provided by private operators. But in some cases, the operators own the buses, while in other cases they are owned by the municipalities. Thus far these projects have been based on 12-year contracts; although some contracts are coming up for renewal and will be subject to the seven-year restriction.

The national government's draft subsidy policy envisages that in future, the public sector will purchase and own the buses required for contracted services and private bus contractors will operate the buses in terms of a contract on government's behalf. This is a major change regarding the Group A operators. If this were to transpire, the risks relating to the capital cost

[36] In big cities such as London, for example, services are divided into multiple contracts which are retendered on a staggered basis. This means that while each individual contract may be relatively short, operators have a reasonable chance of winning new contracts and spreading the use of a single bus over a series of multiple contracts. It also serves as an incentive for operators to bid reasonably low prices to enable them to use their existing bus fleets.

of vehicles would be removed from the operator and instead fall on the municipality. At the end of an operating contract the vehicles, which are owned by the municipality, are then made available to the subsequent contractor. The merits of separating ownership of vehicles from provision of operations is discussed further below.

**(b) Are subsidies secure?**

Current formal, contracted Group A bus operators in C40 cities receive subsidies equivalent to about between 55% and 85% of total revenue.[37] The security of the contract length or right to operate depends on a continuation of the subsidy flow. If subsidies are terminated or significantly reduced the bus operator's ability to repay debt is compromised. Where capital subsidies are paid, and where they are paid up-front, the negative impact of an end to subsidies will only be encountered at the next contract.

However, the PTOG funding, which subsidises the existing private bus operators that fall within Group A, is an operating subsidy; so contract termination will impact on the flow of revenue available to pay capital charges on buses.

Regarding BRT services, with operators falling within Group C, subsidies are paid through PTNG to the relevant municipalities. The relevant grant framework indicates that subsidies regarding bus purchases are preferably paid over the life of the contract, on an interest and redemption basis. The risk of subsidies being reduced or cancelled is effectively borne by the municipalities.

The minibus-taxi sector only receives a capital subsidy covering approximately a fifth of the cost of the purchase of a 16-seater minibus-taxi, and once only per operator subject to various conditions. There is significant pressure on government to shift more of the available subsidy to the competing minibus-taxi sector, which means that the extent of subsidies that have to date flowed to formal bus operators may be at risk.

**(c) Is the market secured against reduction in ridership levels?**

A key concern for a bus operator is not only whether they will be allowed to continue to operate, but whether others will be permitted to operate in competition.

In South Africa the authorities have largely not managed to prevent informal minibus-taxi operators from competing in an unregulated manner along the routes operated by the formal, private bus companies. In many cases this has led to reductions in the size of formal bus operators.

On the other hand, it may be that some form of equilibrium has now been reached where the formal companies retain sustainable ridership levels in the face of informal sector competition, based on the service they provide with available subsidies – provided these subsidies are maintained at a similar level as in the past.

**(d) Conclusion**

If the service model is based on private operators owning their own vehicles and providing services on contract or by concession to the authorities, then the contract and associated subsidies must be secure for a sufficiently long period to enable financing to be raised on reasonable terms. Furthermore, there ought to be a reasonable level of predictability

[37] See the analysis of the contracting authority's reports to NDoT regarding PTOG use, per C40 city in Paper 2.

regarding the market served and the knowledge that the service will not have to encounter new, extensive and unregulated competition.

The environment in South Africa seems to meet these requirements currently to some degree, but there is significant uncertainty ahead which will constrain the availability of reasonably priced finance for new buses in future. Government needs to address this uncertainty, including:

- which part of government will be responsible for the contracts in future,
- how long the contracts will be,
- how contracts will be structured, and operators procured, and
- what the short- medium- and long-term subsidy arrangements will be.

In several instances, the public sector (i.e., the municipality) owns the buses. In some such cases operations are also run by the public sector in a traditional municipal conventional bus service model (Group B). In other such cases (BRT services, falling in Group C, and Durban's municipal bus service, falling in Group B) operations are contracted out.

Where the public sector owns the vehicles, the capital charges for new buses are paid by the municipality and availability of finance and the terms on which it is provided depends on the creditworthiness of the municipality.

Government's draft subsidy policy envisages public ownership of vehicles in future, although mostly assumes privately run operations. Although not stated clearly, the assumption seems to be that if bus purchase is covered by government there will be limited need for operating subsidies. The policy also helps realize government's objective of making it feasible for emerging companies that do not have the ability to raise capital to win bus operating contracts.

All these considerations apply whether electric or diesel buses are deployed. However, because e-buses are more expensive than diesel buses – although cheaper to run – the requirements to ensure the right external conditions for bus financing apply more stringently.

### 17.2.2 Characteristics of bus operators and related requirements

The previous subsection discussed the need for creating the right external environment to support the financing of buses. However, establishing the right external conditions is insufficient if the prospective bus owner itself is not creditworthy.

Where the bus operator is not required to own the buses, but rather the municipality or other government entity, it is the creditworthiness of that entity that is critical. If the municipality is raising finance specifically for buses, the lender may wish to ensure that the buses are going to be well maintained. But ultimately it will be the municipality's creditworthiness that is critical.

#### (a) Private operator creditworthiness

If the buses are to be purchased and owned by a private operator the creditworthiness of the operator is fundamental, irrespective of the technology used – although the technology may drive different capital and therefore financing requirements.

The following aspects are key:

- Track record: Lenders will not usually make substantial loans to companies or organisations that do not have a good track record.
- Transparent finances: Lenders must be able to see the flow of revenues to be able to assess and manage risks. The greater the transparency the better. While clear and well audited financial accounting is critical, additional elements such as automated fare collection systems that make fare payments visible and clear are a significant advantage.
- Competent management: Lenders will seek to establish that there is competent management in place. This is closely related to track record.
- Sufficient scale: Financial transaction costs per vehicle fall significantly as fleet size increases.

**(b) Large bus operators**

Amongst the five C40 cities there are two large private bus operator companies that stand out: namely, Golden Arrow Bus Services (GABS) in Cape Town, and PUTCO in Gauteng.

GABS has a fleet of approximately 1100 vehicles and a history going back more than 160 years. It is the major component of a company called Frontier Transport (Pty) Ltd, which is listed on the Johannesburg Stock Exchange and 82.05% owned by South African holding company Hosken Consolidated Investments Limited (HCI). HCI is a sizeable listed South African conglomerate with significant interests in e-media, hotels and entertainment, mining and gas exploration amongst others. Its roots are in the trade union movement, with the Southern African Clothing and Textile Workers' Union ("SACTWU") being a major shareholder.[38] HCI has little difficulty in raising capital on good terms. This supports GABS' current core strategy relevant to this project, which is to shift all operations to EVs.

PUTCO has a fleet of approximately 1 400 buses, and its services include Johannesburg and Tshwane. It was founded in 1945 and listed on the Johannesburg Stock Exchange from that year till 2005, when it delisted as part of a restructuring to enable a process of black economic empowerment. It is now owned by the Larimar Group, which is 51% black owned.[39] It also has partnerships with various black-owned trusts that run smaller bus operations.

PUTCO has shrunk from the late 1980s, when it had 3 440 vehicles, partly as a result of competition from the relatively unregulated minibus-taxi industry, social unrest, and difficulties in its relationship with the Gauteng Provincial Transport department over contracting conditions. This resulted in an inability to recapitalise its fleet. A recent agreement facilitated through the Gautrain Management Agency, an agency of the Gauteng provincial government, has seen the conclusion of new 7-year negotiated contracts on better terms, replacing the uncertainty of short-term rollovers. It has reportedly now embarked on a new fleet renewal process, albeit with diesel vehicles.

While not as secure as GABS, PUTCO should have a reasonably good ability to raise capital to purchase vehicles.

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[38] According to HCI's Annual Report (2023) its latest black economic empowerment (B-BBEE) verification showed HCI having 78.54% black ownership and 50.48% black women ownership.

[39] According to its website Larimar Group has 27% ownership by black women and 22% of its shares are held by its 3600 employees.

These two companies meet the key criteria for creditworthiness and have undergone major restructuring to ensure majority black ownership and other empowerment criteria allowing them to meet requirements for public procurement.

Their challenge is that they still tend to be viewed antagonistically by the minibus-taxi industry, which accuses them of competing unfairly based on subsidies while subsidisation of the minibus-taxi industry is minimal. This can feed through to political authorities, which currently appear receptive to increasing subsidies to the minibus-taxi industry.

Moreover, despite changes in ownership, GABS and PUTCO's perceived association with South Africa's pre-democratic history can result in an unsympathetic attitude from the governing authorities in some instances. There is also a view that the dominance of each company in their respective environments, and their long effective contract periods without tenders are anti-competitive and that alternative companies need to be established and supported. All these factors can create a somewhat challenging business environment.

On the other hand, their operational and other experience make these companies significant assets in South Africa's bus sector. The progressive strategic intention and ability of GABS to take the first steps in transitioning its whole fleet to e-buses is a clear demonstration of this.

**(c) Separating bus ownership from operations**

It is common internationally for bus operators to face challenges in raising capital to finance vehicle purchase.

Sometimes this is addressed **by separating bus ownership from bus operations**. Asset owning companies with sufficient financial power then purchase and own the vehicles which they rent or lease to bus operators.

In South Africa this approach has tended to be used by municipalities seeking to empower new black operators, mostly in the course of developing new BRT systems, but with the difference that instead of the assets being owned by private asset companies they are owned by the municipality, or a special ownership entity created by the municipality. In such cases, the new operators have mostly been created out of the previous informal minibus-taxi owners. Some of these contracts with these emerging operators have been structured to enable them to take ownership of vehicles in the course of – or at the end of – the BRT contracts.

Different cities have different approaches regarding their BRT business model. For example, in Johannesburg the Phase 1A operator owns the buses. In Cape Town, for the initial Phase 1A contract, the municipality owns the buses; however, for the next contract of the Phase 1A services, it is envisaged that the operator will own the buses.

In the early period of developing the BRT program it tended to be assumed that fare revenue would be sufficient to cover bus operating and maintenance costs, although not the capital costs of the buses. While this has proven over-optimistic in the South African BRT context, the national draft subsidy policy prefers subsidisation through the purchase of buses.

This view has some merit. Internationally, the experience is that operating subsidies are unpredictable, subject to reduction or termination when governments' fiscal pressures become too great. A capital subsidy paid in full upfront cannot be subsequently removed; operators can then fund operations through fare revenues, most likely through a net contracting model. This also creates the discipline for the operator to keep costs under control.

In some countries operating subsidies have led to escalating wage demands as bus companies pass these costs onto governments. Of course, if the capital subsidy is paid not as an up-front amount but on a recurrent basis to cover interest and redemption charges as tends to be favoured in the current grant framework then this certainty advantage falls away.[40]

A further factor in favour of capital subsidies is that in the public sector there generally tends to be **more pressure on operating budgets than capital budgets**. There are three reasons for this:

- First, when money becomes tight it is easier to cut capital budgets than operating budgets. Cutting capital budgets usually just means spending is deferred but does not require operational restructuring. Cutting operating budgets often means cutting existing personnel and services, which is always challenging. This makes public sector public finance departments less anxious about expanding the capital budget than the operating budget.
- Secondly, there is a perception – not necessarily valid – that spending on capital supports economic growth, while operating spending holds it as is.
- Thirdly, political representatives can show visible 'delivery' with new vehicles, which they cannot do in the same way through payment of ongoing operating costs.

On the other hand, **there are clear benefits where private bus operators purchase and own their vehicles**.

- Firstly, they are more likely to buy the right vehicle with the right specifications. The operator, if experienced, understands precisely what is required to deliver the services and how to minimize total costs over the lifetime of the asset; external asset owners are often subject to pressures that compromise this.
- Secondly, when they need new buses to supplement the fleet, they can easily place a new order, usually of the same make to simplify stocking of parts, and the engineers' work in the workshop.
- Thirdly, they have an incentive to look after the vehicles, retaining as much value as possible in the asset through maintaining and operating it prudently and effectively. This should translate into savings which hopefully assists to reduce fares or the need for subsidies.

Regarding the latter, even where vehicles are purchased by the municipality and lent to operators, structures can be introduced to incentivise operators to look after the assets, including through preferential options to purchase the asset after a certain number of years. The City of Cape Town created such a bus ownership scheme for its MyCiTi Phase 1 BRT service which has resulted in buses being well looked after by operators despite their not being the owners. But generally, direct purchase and ownership is probably more effective. To try to do it in different ways makes contracting complicated and may have unintended consequences.

The draft national bus subsidy policy envisages the public sector purchasing and owning the vehicles which are then operated by private companies on contract. This position is being opposed by the South African Bus Operators Association, it does not align with the approach

[40] The approach of the national government to cover interest and redemption charges costs the public sector more in the long run because sub-national governments are seldom able to borrow at a lower interest rate than national government.

adopted in some C40 cities, and it also contradicts the current grant framework of one of the two main public transport grants, the PTNG.

If bus ownership is held separately from the operator the contract length becomes somewhat less important in that a new operator can take over the vehicles of the previous operator. There are, however, other motivations for longer contracts; building an effective operating company takes time and requires stability, which shorter contracts are less likely to offer, depending on how the system is structured overall.

**(d) Conventional municipal bus services**

As discussed, the purchase of fleet by municipal bus services depends on the creditworthiness of the municipality and, to some extent, on the viability of their plans for vehicle operations. Municipalities with conventional municipal bus services mostly own and operate their fleets through their transport departments or through wholly owned municipal companies.

The City of eThekwini is an exception here, where Durban Transport uses an independent private operator, but the city purchases and owns the fleet.[41]

**(e) Conclusion**

In sum, within the five C40 cities South Africa there are two well established operators easily capable of arranging finance for their fleets, especially if the right external conditions are created in terms of contract length and terms.

However, given the national government's policy of increasing the number of operators to make the market more competitive, combined with a desire to establish new firms – especially with roots in the minibus-taxi sector – the separation of bus ownership from operations is likely to be a key feature of the bus industry in future.

The draft subsidy policy envisages the state purchasing and owning buses which are then operated by independent private operators. It is not known whether this will be the confirmed approach once the policy is finalised.

It would be unfortunate if the mode of subsidisation and other considerations led to a failure to benefit from the expertise and capacity of the larger firms, such as GABS and PUTCO, those that have become well-established in context of the BRT process, and others in non-C40 cities.[42] An approach is required to procurement and contracting that enables both ownership models to co-exist comfortably.

### 17.2.3 Requirements for financing the shift from diesel to e-buses

In the preceding part of this section, this report has discussed the conditions required, and related business requirements, for financing of vehicle purchase, irrespective of type of technology. This subsection discusses new models that might arise as part of a shift to e-buses.

[41] For more detail, see 2.6.5(b) in Paper 2.

[42] There are strong bus companies, for example, in Mangaung and Mbombela with an ability to raise capital to purchase vehicles.

**(a) Separate battery ownership, and related models**

One internationally adopted model separates battery ownership from the bus itself, with bus operators leasing batteries.

Under the ZEBRA program in Latin America, for instance, leasing models have gained popularity. Leasing mitigates the high upfront costs of e-buses by spreading payments over time, thereby aligning with the operational and maintenance savings of e-buses. Leasing entities, including capital providers and equipment companies, offer service contracts with maintenance and warranties, reducing uncertainties about rapidly evolving battery technologies.

The motivations for these models are twofold. First, the high cost of batteries contributes significantly to the higher purchase price of e-buses. Separating battery ownership reduces the vehicle's cost, easing the financing process. Second, bus operators often lack understanding of the risks associated with batteries. An independent battery-owning company can assume these risks, manage them more effectively, and potentially offer lower costs. A model exemplified by companies like Hitachi involves battery manufacturers owning the batteries. These manufacturers can raise capital for this purpose, address battery issues efficiently, replace batteries when newer, cost-saving technology emerges, and have a vested interest in the system's performance.

On the other hand there are clearly additional costs involved in separating ownership of the battery, including managing the relationship between operator and battery owner. But where the technology is new there are advantages to the operators in transferring risk to the battery owner – if seeking to be a specialist in battery technology – of learning about the performance of the technology.

In an interview with GABS, the company representative indicated that they would not be interested in this approach.[43] Given that the shift to EVs is core to their new strategy, and battery management will thus become core to their operations, GABS would prefer to become fully knowledgeable itself about how the technology works and how to manage operations and batteries best to improve performance at lowest cost. GABS also saw benefit from using old batteries for storage once they had deteriorated to be no longer effective for bus operations but still have good storage capacity. Leasing batteries would mean some profits would flow to the battery leasing company, and GABS saw no reason why they should not seek to capture this profit themselves.  Raising finance to purchase batteries will not be challenging for GABS.

However, other bus operators may take a different view, especially initially.

The separation of battery and bus ownership may be more appealing to the public sector, where the public sector owns the bus but leases the battery. This appeal is more likely to be motivated by a desire to transfer the risk of an unfamiliar technology to another party better able to manage the risk, and to make use of ongoing innovation in this fast-developing field. Until now, municipalities have usually been able to raise finance at lower cost than they would face in an independent leasing arrangement (although this may change if municipal finances deteriorate in future).

[43] Interview with the authors, September 2023.

Where the bus and the battery are owned by different entities and operations are run by a third entity that owns neither the bus nor the battery, there may be challenges in assigning accountability within the operational space. This could be resolved if the public sector leaves the arrangements with a third-party battery owning and management company to the bus operator, this avoiding separate public sector contracts which could result in the above challenges.

**(b) Independent charging entities, which may extend to providers of on-bus power**

The strategy discussed above could also encompass a comprehensive model where on-bus battery power is purchased from a third party supplying the battery, charging infrastructure, and potentially the electricity.

A key new area to operators of converting to e-buses, is the field of battery charging. The initial assumption tends to be that bus operators will create their own charging infrastructure, purchasing power from the grid to charge the vehicles.

Designing the charging infrastructure in a way that supports operational requirements favours operators as owners of this infrastructure. However, other options should also be explored. For example, in the previous section the importance of establishing charging infrastructure in the vicinity of morning peak destinations has been discussed. Currently, because of the highly peaked nature of the South African bus market, this enables buses to be charged during the inter-peak downtime during the day. This, in turn, enables vehicles to use smaller batteries, which significantly reduces capital costs, and reduces the need for overnight charging.

There may be merit in establishing independent charging facilities that more than one bus company can make use of, expanding the likely use of the infrastructure. The charging entity then plays a role not dissimilar to current independent diesel suppliers.

Daytime charging has the merit of being more able to use solar power. Reducing the battery size requirement because of more frequent charging reduces the capital costs as well as related costs (such as insurance), and will reduce the weight of the bus, and the operating cost per kilometre. It may also result in higher passenger capacity of buses, reducing operating costs per passenger on busy routes.

Specialist charging entities, which may specialise in daytime charging could extend their business to the generation of solar power, or partner with renewal power suppliers, which they could wheel via the municipal grid to appropriately located charging facilities.

Such entities may be well positioned to own batteries in instances where battery and bus ownership is separated. Through the charging process they would develop expertise in important aspects of battery management. In fact, such entities may sell on-bus power to bus operators, taking care of the battery supply and ownership, charging infrastructure (both in-depot and remote charging at staging areas located close to the morning destinations in case of tidal flow of passengers) and may partner with independent power producers – although they may use general grid-fed power at night as was described above.

Such models open up new opportunities for financing that may be appealing and could both improve the efficiency of e-bus operations – making a wider range of operations feasible – while also contributing to emissions reduction.

### (c) Conclusion

Financing is often understood from a narrow financial perspective. Instead, it needs to be understood in conjunction with operational matters supporting institutional approaches that better manage risk, forming part of an integrated business approach.

The shift to EVs creates new operational needs and dynamics. This subsection has explored two key areas that offer new options for institutional design that in turn could be reflected in new financial models.

## 17.3 Options for procurement

There are several procurement options for acquiring buses of any technology, each of which affects the need for and availability of various financing options. The procurement options for public and private operators include cash or loan purchase as well as several kinds of leasing agreements (International Council on Clean Transportation, 2017). As shown in Table 42, the choice of these options can shift the credit, operational, and technology risks to the lender, operator, or manufacturer.

*Table 42: Overview of bus procurement options*

| Method | Description | Ownership model | Risk |
|---|---|---|---|
| Cash purchase | Full purchase price paid upfront | Operator | Operator bears technology risk |
| Loan purchase | Part of the cost is paid upfront; remainder is borrowed | Operator | Lender bears credit risk, which can increase the cost of borrowing |
| Capital lease | Lease payments are paid for the vehicle and/or fixed infrastructure for specified term | Operator may purchase at a specified residual value at end of lease | May be limited to local governments with investment-grade credit |
| Operator lease | Operator pays for use of the bus over a specified term | Operator may purchase at a specified residual value at end of lease | Manufacturer assumes operational risk |
| Component lease | Operating savings pay for specific subcomponents (e.g., battery) over time | Battery supplier typically owns the battery during the lease term | Battery supplier assumes technology risk (see 17.2.3). |

***Source:*** *ICCT. Financing the transition to soot-free urban bus fleets, 2017.*

For a cash or loan purchase, the bus is legally owned by the operator and listed on the operator's balance sheet as an asset. The operator may then write off part of the asset's value as depreciation from the balance sheet. Under a leasing agreement, either the bus or some of its components (e.g., the battery) are legally owned by the lessor, not the operator (International Council on Clean Transportation, 2017). Leasing agreements are becoming more common and can be offered either directly by manufacturers or through specialised financing companies; in Sweden, for example, approximately 40% of buses are leased (International Council on Clean Transportation, 2017).

"In the United States, leasing companies are used to pay for e-bus batteries. Typically, federal grant funding is available for bus acquisition but is not sufficient to cover the full cost of the more expensive electrics. In these cases, battery leases are designed based on the peculiarities of the grant funding: paying for the bus purchase price on par with that of a diesel bus but procuring the battery through a leasing structure that matches the lease costs with the operational savings of the e-bus technology.

## 17.4 Some potential funding and financing mechanisms

### 17.4.1 Farebox revenue

Fare revenue represents one of the main sources of commercial revenue available to bus operators to cover both operating costs and investment in rolling stock, although often the revenue generated is insufficient to fully fund the business including vehicle purchase, resulting in the need for some form of grant.

### 17.4.2 Grants

Grants are generally non-reimbursable funds that are made available either through government budget allocations (whether national or local governments) and/or international development finance institutions (DFIs).

The main South African public transport grants are the PTOG and PTNG, the former that is usually paid to private bus operators[44] on the basis of kilometres operated on subsidised routes through net contracts, and the latter to municipalities who, in turn, can conclude net or gross-based contracts with private operators.

Both PTOG and PTNG are currently technology agnostic. It should be possible to incentivise the take up of non-emitting vehicles through grant conditionalities, recognising the complex implications this may have on pricing.

As noted previously, the grant framework of the South Africa's PTNG provides for funding of up to 100% of the capital and finance charges of new buses. This mechanism has and is being used to purchase buses for the various cities BRT programs. However, because the grant pool is limited, spending on buses reduces the availability of funds for building infrastructure and other priorities. Using the grant to purchase more expensive electric buses exacerbates this challenge.

### 17.4.3 Tax breaks

Tax breaks and related instruments are valuable incentives and especially useful in cases where direct grants for the purchase of EVs are not easily available. Tax breaks need to be simple and avoid market distortions.

In South Africa the tax structure is distorted against e-bus technology, as opposed to diesel. This clearly needs to be reversed, although import duties to encourage local manufacture will and should be retained. Where local manufacture is not possible taxes that punish e-bus adoption should be avoided.

[44] Other than in the case of Durban Transport in eThekwini, discussed in 8.3.5.

Allowing accelerated depreciation of capital items is another, highly effective mechanism for providing tax advantages supporting bus purchase and could be directed at specific technologies such as e-buses. The South African tax system already permits capital assets to be depreciated and generally permits buses to be so depreciated over six years.[45] Because buses as capital assets actually have a useful life of much more than six years, this in effect constitutes accelerated depreciation. Government could possibly investigate an even more aggressive accelerated depreciation scheme to encourage conversion to e-buses, although in the current fiscal environment there will be huge reluctance to give such tax breaks.

In very specific cases, corporate tax reductions can promote the establishment of bus manufacturing facilities. The provision of tax breaks is a political process involving mostly national authorities, depending on the fiscal competencies of the public stakeholders involved.

#### 17.4.4 Bus scrapping schemes

National or local governments could make use of bus scrapping schemes to incentivize the progression to e-buses. By means of scrapping schemes public authorities can make the retirement of older buses compulsory, (thus compelling operators to recapitalize to newer buses that meet lower emission standards), and they may provide a scrapping allowance that could serve as a deposit towards the acquisition of the new fleet.

This has been done in South Africa to support the renewal of the minibus-taxi fleet.

However, it appears unlikely that such provision can be made in the short to medium term in South Africa due to fiscal constraints.

#### 17.4.5 Green bonds

A green bond can be issued by bus operators or local authority, for example to finance the shift to e-buses. Green bonds have been gaining popularity as an additional revenue source for the financing of environmental projects (e.g., clean water, renewable energy, energy efficiency and climate change mitigation projects).

Green bonds operate under the same logic as normal bonds, in which issuers raise revenue by selling the bonds to investors at a fixed interest rate and for a defined period. The difference, besides the green bonds being earmarked for environmental projects, lies in potential tax incentives, such as tax exemptions and tax credits for green bonds, which make them attractive for a wider range of investors.

Some investors require that a certain proportion of their investments be in environmentally friendly activities, which created a market for green bonds even where there is no tax break or other monetary advantage. Besides being an attractive instrument for local governments, green bonds may only be suitable for large operators, as green bonds carry the same credit rating as the issuers' other debt obligations and are backed by the issuer's balance sheet. In order to be assured that spending does, indeed, meet environmental conditions green bonds need to be certified by legitimate organisations.

Municipalities in South Africa have some experience with green bonds. The City of Cape Town was the first issuer of a green bond, which it did in 2017, amidst a severe drought. The ZAR1

[45] In terms of the SARS Binding General Ruling (Income Tax) re. Wear-and-tear or depreciation allowance, 2021.

billion green bond was used to fund and refinance a number of green projects, including the procurement of e-buses,[46] energy efficiency in buildings, water resilience initiatives, sanitation treatment, and the coastal structure protection and rehabilitation. (https://www.gihub.org/innovative-funding-and-financing/case-studies/cape-town-green-bond/). However, it is understood that the CCT green bond did not deliver a lower rate of interest than would have been available through other commercial lending.

The City of Cape Town's green bond was accredited by the Climate Bonds Initiative (CBI), and receive Moody's certification, with the agency rating the bond as GB1 (excellent).

In conclusion, C40 cities may wish to consider issuing such green bonds to access an additional savings pool, although while in theory it should result in a lower cost of capital, it is not inevitable that it will.

#### 17.4.6 Vendor financing

Often the manufacturer of a vehicle will provide financing in the form of loans to the purchaser to purchase the vehicle. Where there is a competitive market amongst manufacturers, vendor financing can play a significant role in making financing available and improving the terms for the purchaser.

An advantage of vendor financing is that, if there is a failure to repay, the vehicle can easily be repossessed by the manufacturer, who can then address any maintenance issues and sell the vehicle to another purchaser second-hand.

Vendor financing could be a key component in the financing of EVs and is something that will be pursued in the market where conditions favour it.

#### 17.4.7 Export credits

Many countries have a system of export credits, usually supported ultimately through national taxes, to support the purchase of goods manufactured within the country. Export credits are loans provided generally by a bank or other financial institution in the country of manufacture to purchasers in other countries.

These export credits not only make financing available but are often on particularly good terms as countries seek to out-compete manufacturers in other countries in exporting manufactured goods.

## 17.5 Some significant international financing sources

There are several financing sources that support the introduction of e-buses due to their benefits for air quality and the climate. These sources include the Clean Technology Fund (CTF), the Green Climate Fund (GCF), and the Global Environment Facility (GEF), which offer various financing mechanisms, including grants, concessional loans, guarantees, and equity (ownership stakes).

[46] These electric buses were purchased as part of a pilot, which was subsequently aborted because of procurement challenges. It was some of these buses that GABS then purchased and used to pilot its electric bus project which has been referred to extensively in this set of reports.

### 17.5.1 Clean Technology Fund

The CTF is a multi-donor trust fund under the Climate Investment Funds (CIF) framework, which promotes scaled-up financing for the demonstration, deployment, and transfer of low-carbon technologies with significant potential for long-term greenhouse gas emissions savings in the implementation of clean transport in both emerging market middle-income and developing economies (Climate Funds Update, 2023a).

Channelled through the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and World Bank Group, the CTF finances 19 country programmes and one regional programme with over 90 individual projects. The CTF amounts to USD 5.6 billion and attracts up to 7 times that amount in co-financing (Climate Funds Update, 2023a). The CTF uses a blend of financial instruments, including grants, contingent grants, concessional loans, equity, and guarantees to make investing in low-carbon technologies more attractive to both public and private sector investors.

### 17.5.2 Green Climate Fund

The GCF is part of the financial mechanism of the UN Framework Convention on Climate Change (UNFCCC). It serves a similar function for the Paris Agreement, aiming to make an ambitious contribution to the implementation of the Agreement's mitigation and adaptation goals. The GCF supports the paradigm shift in developing countries toward low-carbon and climate-resilient development pathways and is currently the world's largest dedicated multilateral climate fund and the main multilateral financing mechanism to support developing countries in responding to climate change (Climate Funds Update, 2023c).

The GCF has cumulatively pledged funding totalling approximately USD 10.3 billion, while also attracting additional co-financing. The financial instruments include grants, contingent grants, concessional loans, equity, guarantees, and results-based finance. In terms of eligibility, all developing country parties to the UNFCCC are eligible to receive resources from the GCF (Climate Funds Update, 2023c).

### 17.5.3 Global Environment Facility

The GEF was established on the eve of the 1992 Rio Earth Summit to assist in protecting the global environment and promoting environmentally sustainable development. The Fund supports the implementation of several multilateral environmental agreements and serves as a financial mechanism for the UN Framework Convention on Climate Change and the Paris Agreement. It is the longest-standing dedicated public climate change fund. The GEF also administers several funds established under the UNFCCC, including the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) (Climate Funds Update, 2023b).

The GEF amounts to USD 4.4 billion and attracts up to 5 times that amount in co-financing (Climate Funds Update, 2023b). The financial instruments include grants, concessional loans, equity, and guarantees. Countries are eligible for GEF funding if the country has ratified the UNFCCC and conforms to the eligibility criteria decided by the Conference of the Parties of the UNFCCC. Alternatively, a country is eligible if it already qualifies to receive World Bank funds or if it is a recipient of technical assistance from the United Nations Development Program (UNDP).

## 17.6 South Africa's Just Energy Transition Investment and Implementation Plans

The Just Energy Transition Partnership (JETP) has been discussed in 6.2. Through the partnership a combination of grants, reduced interest loans and guarantees have been promised by the participating countries amounting to approximately US$11.8 billion as at end September 2023.

South Africa's investment plan on how these funds will be utilised was presented in 2022 at COP 27 in the JETP Investment Plan. The strategy has three key components, namely:

- transitioning the energy sector towards renewable energy,
- the development of the electric motor industry,
- green hydrogen.

Much the most attention currently in the plan is on addressing the electricity crisis through, inter alia, expanding renewable generation and improving the transmission network. But while the plan as a whole is relevant, the focus on NEV – which is focussed on Battery EVs – is of particular significance for this study. The JET-IP identified a number of scenario's, noting the inter-linkages between various elements.

Based on this, it proposed planned investments in the following areas:

**Just Manufacturing Transition**: Supply chain investments to support the retention and growth of jobs for the automotive sector, as it transitions to NEV. Such jobs include assembly and component supply chain jobs in existing and new products. This segment also has strong linkages to the energy sector for localising energy storage inputs, such as batteries and fuel cells.

**Public Transport (Public Buses and Taxis)**: This is an area where both the national government and local (city) governments could advance procurement and incentives. It includes the private fleets providing passenger services to local government (for example, GABS and

**Extract from JET-IP on implementation**

Within parameters set by the National Treasury and relevant legal mandates, opportunities will be encouraged for **institution-specific funding agreements** to be concluded directly between the providers of finance (for example, an MDB or international DFI) and the implementing institution of a programme or project (for example, Eskom, a province, or a municipality), subject to the respective parties' policies and due diligence. In each case, the implementing institution is contractually bound to the terms of that funding agreement, including its governance and monitoring provisions. These implementing institutions will be required to report into the national JET IP Results Monitoring system on defined high-level indicators.

Where there are direct funding agreements between the providers of finance and the **National Treasury** these will be governed accordingly, and the National Treasury will disburse funds to the relevant implementing organ of state (national department, province, municipality, SOC, or DFI), either through annual budget votes or by project-specific transfers under National Treasury's control frameworks. The implementing institutions will be required to report into the national JET IP Results Monitoring system on defined high-level indicators.

In instances where **national intermediary institutions** (for example, DBSA or IDC) manage the disbursement of funds by agreement with international providers of finance (for example MDBs or international DFIs) and thus oversee project execution by implementing institutions (for example, municipalities, private companies, or NGOs), the intermediary will have its own governance requirements. In this instance, the intermediary institution will be required to report into the national JET IP Results Monitoring system on defined high-level indicators. (JET-IP p137)

PUTCO); and MBTs that are a large component of the transport sector and the largest private transport sector in South Africa, serving lower-income households.

**Mobility emissions abatement**: This area addresses the decarbonisation of the NEV market segments for goods and services logistics, private transport, and government fleets.

**Early Adoption and Innovation**: Supporting investments in early adoption projects for NEV and developing local supply chain and innovation ecosystem may also entail collaborations and partnerships with international research institutions and sharing intellectual property and patents.

**Charging and renewable infrastructure**: Amongst others, this area is seen as cutting across all the funding programmes.

**Technical assistance**: Considering the integrated nature of pivoting the automotive sector where projects are not standalone or greenfield developments, a robust sector transition framework is needed. It should incorporate accurate studies to guide policy transformation and implementation to ensure just and sustainable outcomes.

The plan then proceeded to propose a number of investment programs for the period 2023-2027.

These categories and figures were updated in the JET-ImP. Table 43 summarises the proposed NEV Portfolio and estimated investment required as shown in the JET-ImP.

*Table 43: Proposed NEV* Portfolio and estimated investment required, 2023–2027/8

| **Funding programs** | **Description** | **ZAR million** |
|---|---|---|
| NEV supply chain investment | Investments required for the automotive supply chain to transition to NEVs and NEV auto projects, including assembly, infrastructure, and component manufacturing for both local and export applications | 26 538 |
| NEV auto-related projects | New auto projects include assembly, infrastructure, and supplier part projects across scoping, piloting, and commercialisation phases for both local and export applications | 5 000 |
| NEV battery and critical mineral supply chain/battery cell manufacturing | NEV battery mineral projects include investments in battery mineral extraction and beneficiation, and the development of precursor materials and components | 23 670 |
| Mobility emissions programme/ fund | Decarbonising the NEV market segments for goods and services, logistics, private transport, and government fleets; charging infrastructure; and energy storage (including associated infrastructure and programme support); supply chain investments in local assembly | 5 944 |
| Public transport programme | Support investments in public transport, such as buses, taxis, and fleets; funding the charging infrastructure and integrated energy storage (including associated infrastructure); supply chain investments in the local assembly | 10 463 |
| Total funding required | | 71 616 |
| Total funding required (public transport and mobility) | | 16 408 |

*Source: (The Presidency Republic of South Africa, 2023)*

The significance of the proposals is that government envisages spending in these areas. A process is currently underway is to identify projects and secure financing arrangements consistent with these proposals enabling the preferential financing opportunities to be accessed.

## 17.7 South Africa's financial sector

South Africa has a strong and well-established financial sector for an economy of its size.

### 17.7.1 Private financial sector

According to *The Banker*, South Africa's largest banks by asset size in 2023 were:

| Bank | Tier 1 Capital (US$ million) | Global Ranking by size |
|---|---|---|
| Standard Bank Group | 11 690 | 155 |
| FirstRand | 10 087 | 171 |
| Absa Bank | 8 041 | 203 |
| Nedbank | 5 925 | 255 |
| Investec Bank | 2 528 | 469 |
| Capitec Bank | 1 900 | 562 |

*Source: BusinessTech, 2023*

The global ranking by size gives an indication of the relative scale and likely sophistication in an international context.

Each of the banks have a variety of divisions specialising in different forms of banking. All have a corporate lending arm, which sometimes has a different brand name. For example, Rand Merchant Bank is the well-known merchant banking component of First Rand, providing lending to corporates and municipalities, and advising on instruments such as bond issues. It would be this component of each bank that would arrange bus or charging infrastructure finance.

Current private bus operators would have experience of these banks, as would municipalities.

### 17.7.2 Government employees pension fund

An important institution to note in the financial sector is the Government Employees Pension Fund (GEPF).

Unlike many countries in the world that pay pensions to former government employees out of current tax revenues, the South African government pre-funds its pension obligations. Pension contributions are deducted from government employees on an ongoing basis and invested by the GEPF, which was established in 1996 and is a defined benefit pension fund.

GEPF is a large pension fund by global standards, with more than 1.265 million active members, close to 500 000 pensioners and approximately R2.3 trillion in pension assets (see website at https://www.gepf.co.za/). Assets are invested through the Public Investment Corporation, which is wholly owned by the South African government.

While the core mandate of the GEPF and the PIC is to invest assets to earn a good return so as to fund its pension obligations, it's ownership and governance tends to orient it towards socially responsible and developmental investments. It could potentially be a source for e-bus financing.

### 17.7.3 Development finance institutions

There are two key public sector development finance institutions that have or would most likely have an interest in financing of e-buses, or related activities, namely the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation.

#### (a) Development Bank of Southern Africa

The DBSA is a government-owned development finance institution, established in 1983, with the mandate to promote economic growth as well as regional integration for sustainable development projects and programmes in South Africa, SADC and the wider Sub-Saharan Africa.

DBSA describes its purpose as being "to 'Build Africa's Prosperity' by driving inclusive growth and securing innovative solutions that drive socio-economic development in emerging economies in sub-Saharan Africa". It does so through "mobilising funding resources, which are channelled into projects aimed at building sustainable infrastructure planning and development across the continent".

The transport sector is one of its key areas of activity, including public transport, amongst others. While tending to invest in infrastructure, it also invests in buses, which it describes as 'sub-core infrastructure'. Lending to municipalities is also a significant part of its portfolio.

The DBSA has access to various financial sources on favourable terms and is therefore able to lend on preferential terms. Part of its modus operandi, which it has successfully pioneered in the building of student accommodation at universities, is to pilot projects, develop financial models and build institutional arrangements that enable developmental financing to proceed on a profitable basis.

As indicated above, working with DoT, DBSA has been designated a lead institution for driving the programs related to public transport in the JET Implementation Plan.

In order to advance in this space, it is currently implementing a pilot project with funding from the Global Environmental Facility (GEF) to introduce e-buses in Tshwane and eThekwini. During the demonstration phase, 39 buses will be deployed – 20 buses in City of Tshwane, and 19 buses in the eThekwini Municipality. While DBSA is the 'Implementing Agency', the 'Executing Entity and Project Manager' is an organisation called SANEDI. This project is still at an early stage but demonstrates intent on the part of DBSA.

#### (b) Industrial Development Corporation

The Industrial Development Corporation (IDC) of South Africa Limited was established in 1940 through the Industrial Development Corporation Act 1940) and is fully owned by the South African Government.

Its priorities are aligned with national policy directions as set out in the National Development Plan (NDP), Industrial Policy Action Plan (IPAP) and industry Master Plans. Its mandate is to maximise its development impact through job-rich industrialisation, while contributing to an inclusive economy by, among others, funding black-owned and empowered companies, black industrialists, women, and youth-owned and empowered enterprises.

While doing so, the IDC must, according to its website, ensure its long-term sustainability through prudent financial and human resource management, safeguard the natural environment, and increasingly position itself as a Centre of Excellence for development finance.

In the more than 80 years since it was established, the IDC has contributed to the implementation of South Africa's industrial policy and taken the leading role in establishing, amongst others, the petro-chemicals, and minerals beneficiation industries. It has stimulated large industrial projects in these industries – acknowledged today as the cornerstones of the country's manufacturing sector – and influenced the establishment of industries in fabricated metals, agriculture and clothing and textiles.

The IDC is the critical public sector development banking partner in the re-orienting of South Africa's current internal combustion engine (ICE) motor vehicle manufacturing industry to producing EVs instead. Thus, while it may not finance the purchase of e-buses, it would likely play a key role in financing the establishment of e-bus manufacturing in South Africa.

# Part F Recommendations

## 18 Recommendations

Many options of government policy, legislation and financial incentives have been considered in this report.

Taking into consideration the discussion above, the following recommendations are made for consideration by national government, the C40 cities, bus operators and the financial services industry:

**(a) Cities to model the cost of e-buses in their operational environments, and to drive costs down to render transition to BEB viable**

Cities and bus operators should study this report's findings, which indicate that the total cost of ownership (TCO) for battery electric buses (BEBs) is likely to be lower than diesel buses. Due to the likely ongoing, incremental increase in financial benefits from transitioning from diesel buses to e-buses, there is a strong argument for immediately starting this transition where local modelling is favourable, rather than waiting for further pilot study outcomes.

This study shows that cities and bus operators are likely to achieve a beneficial scenario for *immediate* BEB deployment if they have an operational plan with efficient bus utilisation (with the kilometres per bus on average amounting to more than 40 000 per year), procure and maintain buses such that they have a longer useful life (preferably 16 years or longer) and implement the cost saving measures which are influenced by the capital cost of buses, such as a self-insurance strategy.

In addition the operational efficiencies and significantly lower running expenses for e-buses, as compared to diesel alternatives, will help offset the initial capital costs. However, cities and operators are encouraged to first conduct their own TCO assessments, considering their specific operational plans, as costs and benefits will vary.

Continued budget planning should include provisions for battery replacement around every 8 years, based on current technology. This significant aspect of the TCO is poised to become less frequent and less costly with advancing technology. Given the likely increase in financial benefits to cities and operators from steadily transitioning from diesel buses to e-buses, provided they have assessed costs in relation to their operational plan, it is potentially appropriate to immediately start this transition to e-buses, rather than waiting for the outcomes of further pilot studies. When data from pilot studies become available, they should be worked into the model, allowing for adjustments to the original plans.

Two cities, Tshwane and eThekwini, are initiating pilot studies with the Development Bank of South Africa's support. These cities should progressively release their findings annually, contributing to the C40 e-bus cost model's ongoing update as new data from these studies emerge.

The initial high investment in e-buses is anticipated to decrease as technology advances. This includes the costs of vehicles, batteries, charging infrastructure, and electrical connections, some of which have a long lifespan. Improving battery technology will likely reduce costs per kilometre, possibly making today's financial models conservative.

Cities and operators should stay updated with these advancements to ensure their investments remain economically advantageous.

It is recommended that C40 support these efforts by:

- Publishing the C40 cost model for comment and improvement by all stakeholders, including cities.
- Enhancing the cost model based on stakeholder input, and by further developing sensitivity analyses that will assist stakeholders in better understanding the model's sensitivities to different cost-related decisions.
- Reviewing the cost model annually, as new data and analyses become available, which should include:
  - Considering findings and lessons learned from any relevant pilot studies, including those of Tshwane and eThekwini.
  - Assessing the cost implications of new and improved technology.
- Assisting cities and bus operators, upon request, with their own cost modelling, aimed at informing their decisions and planning.

**(b) The first priority is to ensure reliable power supply connectivity in appropriate locations**

Bus operators and cities are unlikely to take major steps towards conversion to e-buses until they have enough certainty regarding a reliable power supply of sufficient capacity.

Cities are not primarily responsible for generation, although some cities have begun to take measures to expand local production of electricity. However, they are mostly responsible for distribution – and therefore for bringing sufficient distribution capacity specifically to localities where e-bus charging facilities are to be installed.

Cities can improve overall availability in the short term by sourcing power from independent power producers, but addressing generation issues is needed primarily at a national scale. The shifts in policy – most notably the decision taken by national government in July 2022 to permit private power production at scale, combined with measures to address Eskom challenges makes it likely that load shedding reduce substantially by 2025.

The key constraint will then become the availability of sufficient capacity in appropriate locations for e-bus charging.

It is therefore recommended that the C40 cities prioritise providing the bulk connections to appropriate locations in these cities to enable buses to be charged at the scale needed.

It is also recommended that the C40 cities investigate playing an active role in the provision of charging infrastructure close to morning destinations, in locations that support charging during the daytime off-peak for use across bus operators to do inter-peak charging before buses depart on afternoon trips. This should reduce the required battery size, reduce capital and some operating costs, and will allow greater use of renewable solar power for BEB charging.

### (c) Consider temporary reducing in import taxes on e-buses and reconsider treatment of VAT in public transport

There have been calls to reduce import and related taxes on e-buses (such as ad valorem-taxes) to reduce the cost of e-bus pilot projects, where fully-built e-buses are imported in the absence of locally manufactured / assembled e-buses.

The quantum of ad valorem taxes is very large, rendering pilot projects extremely expensive, which could disincentivise such tests. Pilots are important to test use of these buses under local conditions, which is likely to stimulate the take-up of the new technology pending the establishment of new e-bus manufacturing capacity.

However, the establishment of a local e-bus manufacturing industry is very important in the long term for reducing bus and parts costs and improving their availability, and for national economic development.

It is arguable that the GABS pilot plus the Tshwane and eThekwini pilots (for which costs are already allowed), will provide sufficient pilot information, and that extensive new pilot projects may not be required.

On balance, there is an argument to be made for temporary exception from ad valorem taxes on electric buses used in pilot projects, thus, to allow the importation of fully assembled buses for such tests.

Turning to VAT: The very high purchase cost of BEB places financial stress on the transition to e-buses, and this exacerbated because of the treatment of VAT on public transport. In essence, VAT paid on the purchase price of a bus cannot be claimed as input VAT, rendering e-buses and related infrastructure even more expensive. It is recommended that National Treasury investigate zero-rating VAT in public transport, which would mean that municipalities would be able to claim VAT paid for e-buses and charging infrastructure back.

### (d) Providing certainty regarding assignment of legacy contracts to cities

Concerted steps are required to resolve the uncertainty regarding the future of the contracted, subsidised bus industry in South Africa.

It is recommended that national government resolve the uncertainty regarding the future of PTOG-related contracts. This is intertwined with long-term disputes and uncertainty as to which level of government (between provinces and municipalities) is ultimately the responsible contracting authority.

### (e) Amending the NLTA to permit longer contract terms

Ideally the NLTA should be amended to allow a maximum legal contract term of longer seven years. The main reason for this is that the main asset, namely buses, are likely to have a much longer useful commercial life, and contracts running as long as the life of the asset allow the capital costs to be spread over a longer time, thereby reducing the total cost of ownership. This is especially the case with e-buses, which are likely to have a longer useful life than diesel buses (other than regarding the replacement of batteries) because due to it having fewer moving parts and less mechanical wear and tear.

Accordingly, a full investigation of this issue, possibly towards amendments to the NLTA, should be launched and the amendment processed with due urgency.

**(f) Settling the government subsidy policy, and related approach to bus ownership**

It is recommended that national government takes concerted steps to resolve the apparent contradiction between the draft subsidy policy, which envisages the state purchasing and owning buses, and the grant framework of the PTNG which envisages that operators should own buses. Also, bus operators are strongly opposed to this subsidy policy, and may litigate on this matter.

An approach is recommended permitting both ownership models to co-exist comfortably, with the one of the other being deployed where appropriate.

Now that government has adopted the Electric Vehicles White Paper, consideration must also be given to using the subsidies to incentivise a shift to e-buses in alignment with this official policy.

**(g) Innovative business models for e-bus deployment: allocating responsibilities and risks**

The deployment of e-buses introduces distinct cost structures and risks, differing from the traditional diesel bus industry. This shift necessitates consideration of innovative business and financing models from operators, governments, and financiers, tailored to the evolving technology.

In South Africa, the transition to BEB technology, although advancing, presents some uncertainty regarding the potential role of third-party battery owners or charging providers in the successful adoption of e-buses.

It could be beneficial for stakeholders, including the government, to consider models like third-party ownership or on-bus power provision, especially with the potential integration of renewable energy sources.

Such models allow operators to potentially benefit from future technological improvements in batteries, up front. In such an agreement, battery payments could be included in fixed service fees for the asset's lifetime or another defined period. The responsibility for upgrading or replacing batteries then rests with the service provider, enabling an expert in battery technology to anticipate and incorporate likely advancements, effectively reducing the upfront costs of batteries compared to current technology prices.

Additionally, an operator could consider leasing batteries, thereby distributing the high initial costs over time, offsetting them with operational savings, unless they have easy access to low-cost finance.

Considering this, C40 cities should evaluate the feasibility of engaging private service providers for battery supply, ownership, and charging infrastructure. This approach could streamline the transition to e-buses, ensuring a smoother integration of this sustainable transportation method.

Furthermore, it is recommended that C40 should:

- Further study different battery supply options, ranging from 3rd party ownership of batteries and/or charging infrastructure to contracting of suppliers of a full electricity supply service on-bus (including battery supply and charging, including provision of the required electricity to the charging locations);

- Investigate mechanisms for the shared supply of charging facilities to public transport operators investigate the shared supply of charging facilities to public transport operators at central locations in the destination side of daily commute;
- Where bus services are contracted out, investigate financing by cities of infrastructure, such as electricity provision to the depot gate, charging infrastructure, and provision of depots, with operators potentially being responsible for maintenance of such infrastructure (together with taking responsibility for operations).

**(h) Drive implementation of the actions to manufacture EVs White Paper action plan**

Government needs to drive its Electric Vehicle White Paper's action plan for manufacturing of EV, summarised in 7.2.5. It needs to do so with a focus on BEBs.

As such, the following action in support of the development of a South African market for EVs should take priority: "Developing and implementing a framework for fleets to transition to SA-produced new energy vehicles, including government-owned, public transport, … "

**(i) Financial services industry to pro-actively explore mechanisms to lower the cost of financing e-buses and related infrastructure**

The private financial services industry and the development finance institutions, especially DBSA and IDC, must proactively explore mechanisms to lower the cost of e-buses and related infrastructure, including lowering the cost of financing the capital cost of e-buses.

This is of particular importance for the shift to e-buses where capital costs represent such a large portion of the total cost of ownership.

An area of special focus should be the opportunities offered by the JET Partnership through which significant favourable financing has been offered by the international community to support a shift from fossil fuel to renewable energy technologies. Although this study has not sought to address this issue in depth, we have encountered some scepticism as to whether the pledges translate into actual benefits to the activities supposedly being supported.[47]

It is important both for the shift away from fossil fuels, including through the deployment of e-buses, as well as the legitimacy of international pledges in terms of the JET Partnership and other mechanisms, that practical mechanisms are developed to realise apparently available benefits.

The local South African financial services industry, including the private sector and parastatal lenders such as the Development Bank of Southern Africa (DBSA) and the Industrial Development Corporation working with international JET Partnership stakeholders have a key role to play in this regard.

[47] For example, indications are that the City of Cape Town did not receive better terms through their Green Bond than they could have accessed through non-environmental linked mechanisms. Similarly, GABS indicated that none of the green financing mechanisms they explored offered better terms than they could source elsewhere.

# Appendix A Detailed bus service information in C40 cities

## A.1 Bus numbers, operations, and related finances per C40 city

*Table 44: Finances of bus operations in C40 cities (R million)*

| Key categories. Amounts: R million | | | System income | | | Subsidy/funding | | | | | | | | Operating costs | | | Total costs | Proportions | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| City | Model | Operator | Fare income | Other system income | Total system income | City direct ops funding[1] | City other funding[2] | PTNG indirect operating[3] | PTNG capital: vehicles[4] | PTNG: other capital[5] | PTOG | Other subsidy[6] | Total subsidy | Total dir ops cost | Total indirect ops cost | Sub-total: Ops cost | Total Cost (incl. profit)[7] | Fare income as % of Total direct ops Cost[8] | Fare income as % of Total Cost (incl. profit)[9] |
| Cape Town | PTOG | Contracted | 960 | n/a | 960 | | | | | | 1 127 | | 1 127 | n/a | n/a | n/a | 2 087 | n/a | 46% |
| | PTNG (2022/23) | Multiple operators | 303 | 14 | 317 | 548 | 282 | 398 | | 506 | | 186 | 1 734 | 851 | 864 | 1 715 | 2 221 | 36% | n/a |
| | **Sub-total** | | **1 263** | **14** | **1 277** | **548** | **282** | **398** | | **506** | **1 127** | **186** | **2 861** | **n/a** | **n/a** | **n/a** | **4 308** | | |
| Johannesburg | PTOG | Various | 269 | | 269 | | | | | | 757 | | 757 | n/a | n/a | n/a | 1 026 | n/a | 26% |
| | PTNG (2022/23) | | 220 | | 220 | 678 | 130 | 390 | | 792 | | - | 1 990 | 899 | 519 | 1 418 | 2 210 | 25% | n/a |
| | Other municipal | Metrobus | 65 | 4 | 69 | | 570 | | | | | | 570 | 234 | 473 | 708 | 711 | 28% | n/a |
| | **Sub-total** | | **554** | **4** | **558** | **678** | **700** | **390** | | **792** | **757** | **-** | **3 317** | **n/a** | **n/a** | **n/a** | **3 947** | | |
| Tshwane | PTOG | Various | 237 | | 237 | | | | | | 758 | - | 758 | n/a | n/a | n/a | 995 | n/a | 24% |
| | PTNG | n/a | 81 | | 81 | 174 | 7 | 167 | 72 | 394 | | - | 814 | 255 | 239 | 494 | 888 | 32% | n/a |
| | Other municipal | Tshwane bus | 63 | | 63 | | 191 | | | | | | 191 | 202 | 254 | 456 | 456 | 31% | 14% |
| | **Sub-total** | | **381** | **-** | **381** | **174** | **198** | **167** | **72** | **394** | **758** | **-** | **1 763** | **457** | **493** | **950** | **2 339** | | |
| Ekurhuleni | PTOG | None | | | | | | | | | | | - | | | | | | |
| | PTNG (2023/24) | Multiple operators | 46 | | 46 | 102 | - 20 | 54 | 89 | 420 | | - | 645 | 148 | 55 | 203 | 623 | 31% | n/a |
| | Other municipal | Ekurhuleni bus | 14 | - | 14 | 92 | - | - | - | - | - | - | 92 | 80 | 12 | 92 | 78 | 18% | n/a |
| | **Sub-total** | | **60** | **-** | **60** | **194** | **- 20** | **54** | **89** | **420** | **-** | **-** | **737** | **228** | **67** | **295** | **701** | | |
| eThekwini | PTOG | Various | 269 | | 269 | | | | | | 757 | - | 757 | n/a | n/a | n/a | 1 026 | n/a | 26% |
| | PTNG | Not yet operational | - | | - | 76 | 358 | 379 | | 573 | | - | 1 386 | 76 | 86 | 161 | 735 | 0% | n/a |
| | Other municipal | People Mover: Copper Sunset | 9 | | 9 | 63 | 1 | | | | | | 63 | | | | 72 | 12% | n/a |
| | **Sub-total** | | **278** | **-** | **278** | **138** | **358** | **379** | **-** | **573** | **757** | **-** | **2 206** | **76** | **86** | **161** | **1 833** | | |
| Totals | PTOG | | 1 735 | | 1 735 | | | | | | 3 399 | - | 3 399 | n/a | n/a | n/a | 5 134 | n/a | 34% |
| | PTNG | | 632 | 14 | 646 | 1 404 | 941 | 1 220 | 89 | 2 291 | - | 186 | 5 945 | 2 175 | 1 778 | 3 953 | 6 244 | 30% | n/a |
| | Other municipal | | 151 | 4 | 155 | 155 | 762 | - | - | - | - | - | 916 | 516 | 739 | 1 256 | 1 317 | 29% | n/a |
| | **TOTAL** | | **2 518** | **18** | **2 536** | **1 559** | **1 703** | **1 220** | | **2 291** | **3 399** | **186** | **10 260** | **2 691** | **2 517** | **5 209** | **12 695** | | |

Sub-totals and Total exclude missing data marked n/a ("not available").

**Footnotes:**

1. PTOG data as reported by contracting authority to NDoT 2022/23; except for eThekwini, where it was provided by the city.
2. PTNG data as reported by City to NDoT, 2022/23, or as updated in direct engagement with Cities. Of Cape Town, "PTNG Ops funding" cover most the city's expenditure on public transport, not only BRT (although bus and pax numbers in the accompanying table report only on BRT). "Other municipal" data as supplied by the relevant cities.
3. Direct vehicle operating cost minus total fare revenue as per PTNG report.
2. City funding (rates) minus city direct ops funding
3. PTNG for operating
4. PTNG capital, for outright purchases of buses
5. PTNG for planning , equipment and infrastructure + PTNG for transition/compensation
6. Other grants + Other local operating revenue
7. For PTOG, the total "cost" was assumed by adding fare revenue to PTOG funding. Actual cost may be higher, due to income categories that are not reported on such as charters and advertising. Operators' costs include facilities such as depots and bus purchases but excludes costs borne by cities, such as building of busways and bus terminuses on city land, except (possibly) in case of eThekwini, where the PTOG services are contracted by the city itself.
8. PTNG percentages reflect only direct operating costs, as indirect costs may not fully pertain to BRT services. Excluded are indirect expenses like bus purchases and fare system and station operating costs (see following note). In the table's totals, eThekwini is omitted (due to non-operational PTNG services) to prevent distorting the figures.
9. For PTNG this % is not calculated, since cities sometimes include costs of other public transport services, unrelated to the BRT services, as well as capital costs such as building roads, buslanes and stations.

## A.2 Planned bus purchases in C40 cities

The tables in this annex detail the information gathered about <u>specifically</u> planned bus purchases from 2023 to 2040, sourced from C40 cities and provincial reports to NDOT related to PTOG services. They outline confirmed plans for the next 17 years, although actual purchases are likely to be higher, especially in later years. Table 45 summarises totals for all C40 cities, while Table 46 to Table 50 offer detailed breakdowns per city. Note: In contrast, the bus numbers in 11.2 and 11.3 (pages 94 and 98) are modelled from NaTIS registration data and are broader in scope but not informed by stakeholder input.

*Table 45: Planned bus purchases in C40 cities*

| **Total number of buses planned to be purchased, by category** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| Cape Town | **Total** | 87 | 78 | 164 | 133 | 60 | 60 | 60 | 60 | 60 | 181 | 60 | 60 | 140 | 60 | 60 | 60 | 60 | 60 | 1503 |
| | 18m | 27 | 18 | 85 | 57 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 253 |
| | 12m | 60 | 60 | 79 | 76 | 60 | 60 | 60 | 60 | 60 | 154 | 60 | 60 | 101 | 60 | 60 | 60 | 60 | 60 | 1250 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ekurhuleni | **Total** | 16 | 24 | 25 | 50 | 99 | 116 | 71 | 5 | 4 | 109 | 66 | 94 | 201 | 64 | 0 | 0 | 0 | 0 | 944 |
| | 18m | 0 | 0 | 0 | 12 | 13 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| | 12m | 6 | 0 | 12 | 14 | 27 | 32 | 40 | 5 | 0 | 84 | 66 | 94 | 174 | 64 | 0 | 0 | 0 | 0 | 618 |
| | 9m | 10 | 24 | 13 | 24 | 59 | 84 | 28 | 0 | 0 | 25 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 294 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| eThekwini | **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 100 | 0 | 17 | 0 | 28 | 100 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 395 |
| | 9m | 0 | 0 | 101 | 96 | 60 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 348 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Johannesburg | **Total** | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400 |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tshwane | **Total** | 0 | 0 | 0 | 15 | 6 | 10 | 55 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| | 18m | 0 | 0 | 0 | 15 | 6 | 10 | 55 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C40 Cities | **Total** | 143 | 142 | 229 | 238 | 205 | 226 | 226 | 118 | 108 | 330 | 126 | 154 | 341 | 124 | 60 | 60 | 60 | 60 | 2950 |
| | 18m | 27 | 18 | 85 | 84 | 19 | 10 | 58 | 13 | 8 | 27 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 388 |
| | 12m | 106 | 200 | 131 | 147 | 127 | 160 | 240 | 155 | 150 | 328 | 126 | 154 | 275 | 124 | 60 | 60 | 60 | 60 | 2663 |
| | 9m | 10 | 24 | 114 | 120 | 119 | 175 | 28 | 0 | 0 | 25 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 642 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Table 46: Planned bus purchases in City of Cape Town*

| **Cape Town: Number of buses planned to be purchased, by category** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| **PTNG subsidised (in part)** | **Sub-total** | **27** | **18** | **104** | **73** | **0** | **0** | **0** | **0** | **0** | **121** | **0** | **0** | **80** | **0** | **0** | **0** | **0** | **0** | **423** |
| | 18m | 27 | 18 | 85 | 57 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 253 |
| | 12m | 0 | 0 | 19 | 16 | 0 | 0 | 0 | 0 | 0 | 94 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 170 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PTOG subsidised (in part)** | **Sub-total** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **60** | **1080** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 1080 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **In-house municipal services** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | | | | | | | | | | | | | | | | | | | 0 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **Totals** | **Total** | **87** | **78** | **164** | **133** | **60** | **60** | **60** | **60** | **60** | **181** | **60** | **60** | **140** | **60** | **60** | **60** | **60** | **60** | **1503** |
| | 18m | 27 | 18 | 85 | 57 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 253 |
| | 12m | 60 | 60 | 79 | 76 | 60 | 60 | 60 | 60 | 60 | 154 | 60 | 60 | 101 | 60 | 60 | 60 | 60 | 60 | 1250 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Table 47: Planned bus purchases in City of Ekurhuleni*

| **Ekurhuleni: Number of buses planned to be purchased, by category** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| **PTNG subsidised (in part)** | **Sub-total** | **16** | **24** | **25** | **50** | **99** | **116** | **71** | **5** | **4** | **109** | **66** | **94** | **201** | **64** | **0** | **0** | **0** | **0** | **944** |
| | 18m | 0 | 0 | 0 | 12 | 13 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| | 12m | 6 | 0 | 12 | 14 | 27 | 32 | 40 | 5 | 0 | 84 | 66 | 94 | 174 | 64 | 0 | 0 | 0 | 0 | 618 |
| | 9m | 10 | 24 | 13 | 24 | 59 | 84 | 28 | 0 | 0 | 25 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 294 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PTOG subsidised (in part)** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | | | | | | | | | | | | | | | | | | | 0 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **In-house municipal services** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | | | | | | | | | | | | | | | | | | | 0 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **Totals** | **Total** | **16** | **24** | **25** | **50** | **99** | **116** | **71** | **5** | **4** | **109** | **66** | **94** | **201** | **64** | **0** | **0** | **0** | **0** | **944** |
| | 18m | 0 | 0 | 0 | 12 | 13 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| | 12m | 6 | 0 | 12 | 14 | 27 | 32 | 40 | 5 | 0 | 84 | 66 | 94 | 174 | 64 | 0 | 0 | 0 | 0 | 618 |
| | 9m | 10 | 24 | 13 | 24 | 59 | 84 | 28 | 0 | 0 | 25 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 294 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Table 48: Planned bus purchases in City of eThekwini*

| eThekwini: Number of buses planned to be purchased, by category | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| **PTNG subsidised (in part)** | **Sub-total** | **0** | **50** | **27** | **38** | **0** | **39** | **50** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **204** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 50 | 0 | 17 | 0 | 18 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 135 |
| | 9m | 0 | 0 | 27 | 21 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PTOG subsidised (in part)** | **Sub-total** | **0** | **50** | **54** | **45** | **40** | **70** | **50** | **50** | **50** | **50** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **459** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 50 | 0 | 0 | 0 | 10 | 50 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 260 |
| | 9m | 0 | 0 | 54 | 45 | 40 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 199 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Other municipal services: People Mover** | **Sub-total** | **0** | **0** | **20** | **30** | **20** | **10** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **80** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 20 | 30 | 20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals** | **Total** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 100 | 0 | 17 | 0 | 28 | 100 | 50 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 395 |
| | 9m | 0 | 0 | 101 | 96 | 60 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 348 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Table 49: Planned bus purchases in City of Johannesburg*

| Johannesburg: Number of buses planned to be purchased, by category | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| **PTNG subsidised (in part)** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PTOG subsidised (in part)** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **In-house municipal services** | **Sub-total** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **400** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals** | **Total** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **40** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **400** |
| | 18m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 12m | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 400 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Table 50: Planned bus purchases in City of Tshwane*

| **Tshwane: Number of buses planned to be purchased, by category** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fin. Year ending ->** | **Bus Type** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **2031** | **2032** | **2033** | **2034** | **2035** | **2036** | **2037** | **2038** | **2039** | **2040** | **TOTALS** |
| **PTNG subsidised (in part)** | **Sub-total** | **0** | **0** | **0** | **15** | **6** | **10** | **55** | **13** | **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **103** |
| | 0 | 0 | 0 | 0 | 15 | 6 | 10 | 55 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PTOG subsidised (in part)** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | | | | | | | | | | | | | | | | | | | 0 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **In-house municipal services** | **Sub-total** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| | 18m | | | | | | | | | | | | | | | | | | | 0 |
| | 12m | | | | | | | | | | | | | | | | | | | 0 |
| | 9m | | | | | | | | | | | | | | | | | | | 0 |
| | 6m | | | | | | | | | | | | | | | | | | | 0 |
| **Totals** | **Total** | **0** | **0** | **0** | **15** | **6** | **10** | **55** | **13** | **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **103** |
| | 18m | 0 | 0 | 0 | 15 | 6 | 10 | 55 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| | 12m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 9m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 6m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Appendix B References


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