# ELECTRIC MOBILITY TRANSITION & LOCALISATION

*Towards Unlocking the NEV Value Chain for Africa*

# SITUATIONAL AND BASELINE ANALYSIS REPORT SERIES REPORT 2: PUBLIC TRANSPORT



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# 1. INTRODUCTION

New Energy Vehicles (NEV) are seen as an important step towards achieving global climate change objectives. This study has undertaken a comprehensive review of the relevant literature as it relates to the current NEV industry globally, for South Africa and the Rest of Africa (RoA), whilst identifying key role players and stakeholders and highlighting current and emerging gaps and opportunities, in the NEV market.

In order to evaluate the NEV segments, markets and policy along the value chain, the literature review has been structured to provide a comprehensive overview of the most important NEV sectors in a logical framework as follows:

1. **NEV Landscape Overview:** New Energy Vehicles (NEVs) are vehicles that are powered by electricity or fuels made from non-fossil fuel sources. In May 2021, the dtic released the green paper on NEVs[1] for public comment and the intention was clear that the South African Automotive Value Chain was ready to transition from 'Internal Combustion Engines' (ICE) to NEV. The Just Energy Transition Implementation Plan (JET IP) provides a means to achieve the transition through investments spearheaded by various government authorities, private institutions and development finance institutions (DFIs).

2. **Micro-mobility:** The context and rationale for micro-mobility, market developments and particularly the rise in electrified two and three-wheelers, four-wheeler 'last mile' delivery vehicles, conversions and eco-tourism markets, together with closing comments.

3. **Public transport:** This section reviews buses from a global perspective and for best practice lessons, 'battery swapping' as an emerging trend, South African trends and developments, minibus taxis and case studies for Kenya, Ghana, Rwanda and Zimbabwe for consideration.

4. **Machinery and equipment:** A review of the production and sale of zero emission heavy duty vehicles and equipment is undertaken, with trucks, mining equipment, agricultural equipment and the general electrification of various categories of machinery and equipment, together with ownership models being analysed. Conversion of fossil fuel driven vehicles to NEV is also considered and then role players and stakeholders are identified, together with opportunities in the NEV value chains and for FCEV components.

5. **Infrastructure providing energy for NEV:** The NEV industry requires support infrastructure in the form of fuel supply infrastructure, charging stations and equipment, policy and incentives, together with other support and enabling investments, including finance and insurance. These issues are traversed and opportunities identified.

6. **Battery value chain:** The batteries in various NEV are becoming an important technology in themselves and underpin certain elements of the NEV industry and opportunities. Battery types have been analysed with smaller and larger mobility issues traversed and a brief review of battery studies conducted in South Africa.

7. **Trade policy conformity:** A range of trade policies, incentives and tax schemes are considered that various countries employ to accelerate the transition to NEVs. Tariffs and regional integration for trade enhancement are considered, including Rules of Origin (RoO) and the implications of the African Continental Free Trade Agreement (AfCFTA) on the emerging NEV industry in Africa.

[1] DTIC, 2021. Auto green paper on the advancement of New Energy Vehicles in South Africa, the South African road to production of electric vehicles (The Roadmap, 18th May 2021)

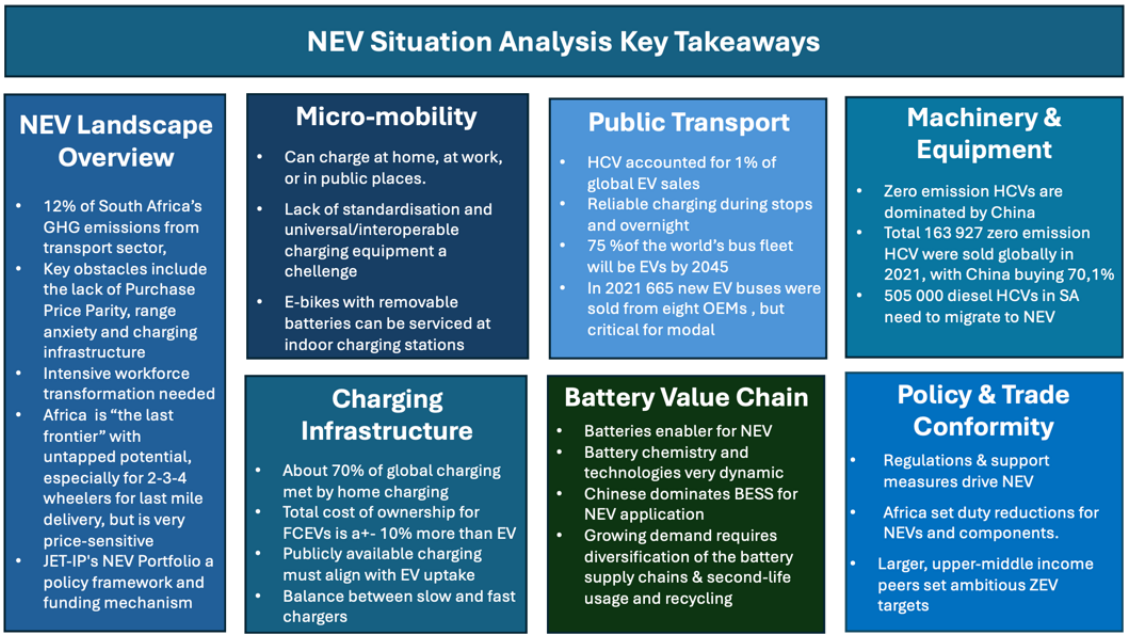



*Figure 1: NEV Situational Analysis Key Takeaways*

The key takeaways from each of the segments are summarised in the figure above. Each of these is dealt with in a separate chapter in the series review, highlighting key role players and stakeholders, culminating with an overview or statement of the opportunities which have been identified in the NEV segment considered.

# 2. PUBLIC TRANSPORT

## 2.1 Buses

### 2.1.1 Global performance

Cumulative global sales of EVs totalled 29 million vehicles in 2022, with light-duty vehicles comprising 99% of global sales, whilst heavy-duty vehicles accounted for 1% of global sales. In terms of heavy-duty vehicles, battery electric drive trains remained the dominant technology (94% of total heavy duty vehicle sales), whilst FCEV sales declined for the sixth consecutive year and represented only 0.4% of global sales (Chu and Ciu, 2023)[2].

Figure 2 illustrates total global annual heavy duty vehicles sales type; technology pathway; and market between 2018 and 2022. It illustrates that electric buses have been and continue to be the dominant vehicle type, albeit, decreasing 22% between 2021 and 2022. It is also evident that BEV technology is dominant, with an extremely small portion of FCEV buses and trucks sold between 2018 and 2022.

[2] Chu and Chu (ICCT), 2023. Annual Update on the Global Transition to Electric Vehicles (2022)

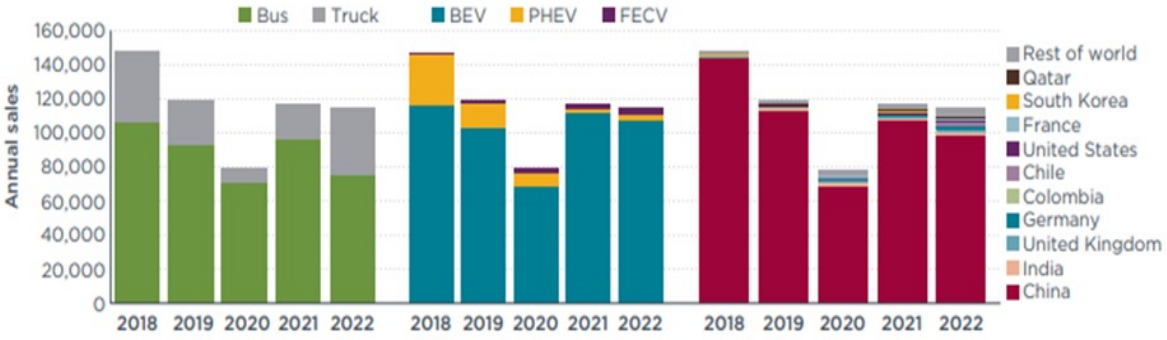



*Figure 2: Annual electric EV vehicle sales by vehicle type (left), technology pathway (middle) and market (right) between 2018 and 2022.*[3]

Of total global EV heavy duty vehicle sales of 115 000, China was responsible for 99 000 of those vehicles. The next highest performing sales locations were India (1 940 vehicles), the United Kingdom (1 650 vehicles), Germany (1 520 vehicles), Colombia (1 330 vehicles), Chile (1 320 vehicles) and the United States (1 300 vehicles).

Looking ahead at projected forecasts of the composition of global EV fleets, Bloomberg (2023) noted that by 2032, it is expected that nearly 50% of the world's bus fleet will be EVs, increasing to over 75% by 2045 (Figure 3), as the short driving ranges for typical public transportation are well-suited to buses charging during their multiple stops. As these buses tend to operate from a centralised depot, it is likely that these depots will be able to house reliable charging infrastructure both for during use and overnight charging.

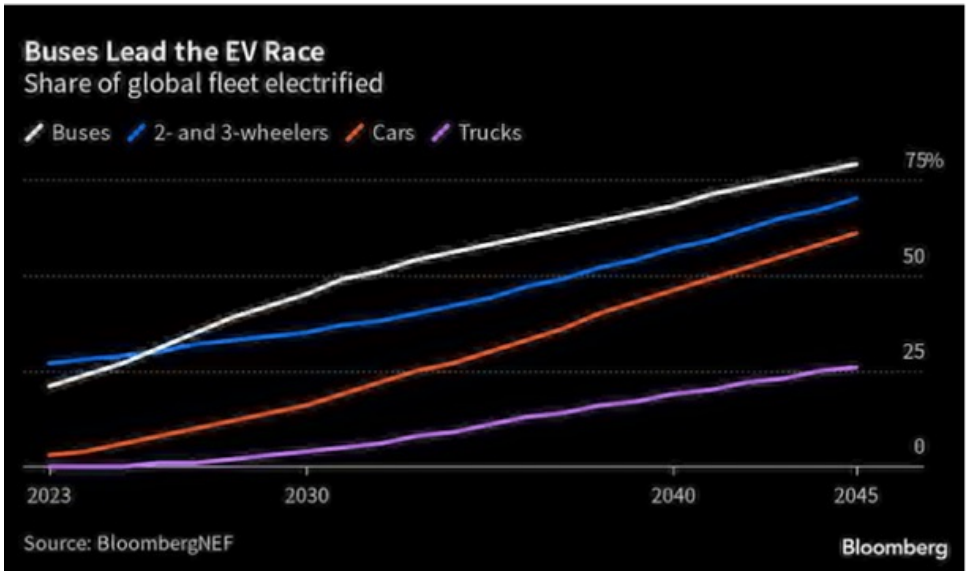



*Figure 3: Forecast of percentage share of global electrified fleet, by vehicle type.*[4]

### 2.1.2 South African trends and developments

In terms of new annual bus sales in South Africa, the AIEC (2023) reports that the market is small, comprising on average only 3% of new MCV and HCV sales annually. In 2021, 665 new buses were sold, all of which had an ICE powertrain and originated from eight OEMs, with 40 model derivatives. Sales of new buses in South Africa have been declining every year with a volume of 1099 units in 2017, down to 665 units in 2021 (AIEC, 2023)[5], as seen in Table 1 below.

[3] Ibid
[4] Bloomberg, Buses take the lead in the race to electrification (2023)
[5] NAAMSA, 2023. Automotive Export Manual (2022)

*Table 1: South African annual bus sales; and bus sales as a percentage of total MCV and HCV sales*[6]

| Year | Bus sales (units) | % of total MCV and HCV sales |
|---|---|---|
| 2017 | 1099 | 4,18% |
| 2018 | 1070 | 3,89% |
| 2019 | 931 | 3,32% |
| 2020 | 728 | 3,19% |
| 2021 | 665 | 2,46% |

The Competition Commission (2021) estimates that there are nearly 25 000 buses in South Africa, of which 19 000 (i.e., 76%) are involved in public transport activities, whilst the remainder form private fleets. The public transport services supplied by buses is responsible for 34 200 formal employment opportunities and nearly 171 000 informal employment opportunities. This part of the transport sector is supported by several local suppliers of bus bodies and chassis, as well as tyre and fuel service companies (Competition Commission, 2021)[7].

Bus operations are consolidated amongst a few large commuter operators[8]:

- The largest commuter bus operator in South Africa is the Public Utility Transport Corporation (PUTCO) with 1 307 buses operating predominantly in Gauteng and Mpumalanga.
- The second-largest commuter bus operator is Golden Arrow Bus Services (GABS) with 1 100 buses servicing 2 086 routes in the Western Cape.
- Other notable operators include North West Star SOC in Gauteng and the North West; Algoa Bus Company in the Eastern Cape; Great North Transport in Limpopo;
- Buscor in Mpumalanga; Metro Group of Companies in KZN; and Interstate Bus Lines in the Free State.
- Municipal bus operators include Metrobus and Gautrain in Johannesburg; eThekwini Municipality's People Mover; and the Buffalo City Metropolitan bus service.

In 2021, BYD Auto has supplied two Bus Rapid Transit (BRT) electric buses to Golden Arrow Bus Services through a funded trial from uYilo. Through a partnership with Busmark, the buses were assembled in South Africa. Whilst trials were still underway in 2022, (GreenCape 1b 2022[9]) notes that it is anticipated that BYD will manufacture a 65-seater electric bus for Golden Arrow Bus Services.

[6] NAAMSA, 2023. Automotive Export Manual, 2022.
[7] Competition Commission South Africa, LAND BASED PUBLIC PASSENGER TRANSPORT SECTOR (2021)
[8] Competition Commission South Africa, LAND BASED PUBLIC PASSENGER TRANSPORT SECTOR (2021)
[9] GreenCape, EV Opportunities in the ASEZ, (2022)

**Case study: MAN e-bus**

In October 2023, MAN delivered its Lion's Explorer E, an electric bus, in Cape Town. This is the first complete electric bus, delivered by MAN, as they traditionally supply chassis into the global market, which are then assembled into fully built-up vehicles with certified local body manufacturers. After consultation with the customer and evaluation of the local market requirements, MAN supplied the chassis and built the bus body, to supply a fully built electric bus.

## Production partnership:

- The e-bus chassis was initially developed by MAN in 2022 and will go into series production in 2024, at the company's Starachowice plant in Poland.
- Two South African production sites for MAN, were used for this project. The body was built at MAN's bus plant in Olifantsfontein, with support for the assembly of the high-floor chassis from MAN's Pinetown site. The Pinetown plant operates on a climate-neutral production basis, which supported minimising the life-time emissions of the bus.
- Technology:
- The Lion's Explorer E uses NMC battery technology (i.e. lithium, nickel, manganese and cobalt), with four battery packs (80 kWh each) to deliver a total installed capacity of 320 kWh.
- Peak power of up to 240 kWh will be generated by an integrated electric motor.
- Fleet operator:
- The vehicle was delivered to Golden Arrow Bus Services for a pilot testing project. Golden Arrow Bus Services is committed to replacing their ICE fleet with BEV models.

Source: Sustainable Bus (2023)[10]

[10] Sustainable-Bus, The first MAN e-bus delivered outside Europe goes in South Africa (2023)

## Case study: BYD Bus Mark Pilot [11]

Golden Arrow Bus Service (GABS) has been operating for 160 years and has a bus fleet size of 1,100 buses and a total of 2,500 employees. GABS currently transports 220,000 commuters per day on 1,300 operational bus routes. The company became the first commuter bus operating company in South Africa to pilot and field test the use of electric buses in 2021. GABS is using two BYD K9UR electric buses in the pilot. The case study notes that 7,000 km of field testing was conducted without passengers, where the maximum potential passenger weight was modelled using sandbags and an additional 50,000 km was carried out when passengers were introduced.

### BYD K9UR Specifications:

Range - 250KM
Top Speed - 100KM/h
Battery Type - Lithium (LFP)
Battery Capacity - 324KWh
Motor Type - AC synchronous permanent magnet
Maximum Power - 150KW x 2
Maximum Torque - 550Nm x 2

### Pilot program focus area and findings:

- Battery range – 300km
- Charging duration – 2h to 3h
- Energy efficiency
- Performance along local topography
- Maintenance impact - a 50% savings in spare parts and 80% savings in oils and lubricants.
- Energy cost savings (R/300 km) - R2 480.00 (Diesel) vs R683.10 (Electric)
- Passenger satisfaction

### Findings:

- The highlight of the study was that the electric BYD buses were successfully able to operate on some of the steepest inclines in Cape Town.
- Operational cost-benefit analysis that showed that, at current prices, GABS could save R657,000 ($34,000) in fuel costs per bus per year by switching from a diesel bus to an electric bus.
- Although electric buses are two to three times the cost of a diesel bus, the fuel savings that are accrued by the bus fleet operator result in the electric bus paying for itself over its lifespan of 8 to 12 years.

[11] GreenCape - Electrification of public transportation

### 2.1.3 Global best practice

Globally, there exists a market trend in the transition to the use of zero emissions buses, with the European Union being one of the leaders in the space. By 2021, buses with fully electric powertrains (i.e. BEVs) increased six-fold since 2016, increasing from 400 to just over 2500 buses. The reasons for the transition are driven by several factors aligned to the move from governments across Europe that have implemented legislation to phase-out the manufacture and use of ICE vehicles of all kinds, as well as set ambitious net zero emission targets for fleets. Although, these targets vary across countries and regions. Table 2 provides examples of global developments in ICE phase-outs for the bus sector. On the supply side, a few OEMs have committed to expanding their production of electric buses to support the regions they have historically supplied with ICE buses.

***Table 2: Select examples of global developments in ICE phase-outs for the bus sector.***

- Countries which have committed to phase-out targets for ICE buses by 2050, cumulatively represent 13% of all global new bus sales[12]
- Buses which operate in city regions in the European Union are expected to have a target of 100% zero-emissions vehicles by 2030[13]
- In South America, Chile and Colombia have been at the forefront of phase-out targets. By 2035, all new Chilean buses will be required to be zero emissions vehicles, whilst the same is expected of freight vehicles by 2045. In Colombia, all new urban buses sales for rapid transit systems will be required to be 100% zero emission or electric, by 2035[14]
- In Amsterdam and Copenhagen, it is expected that municipal fleets (which comprise mostly buses) will be fully electric as early by 2040[15]

Another trend observed in the HCV transition, is the implementation of fleet procurement targets and emissions targets. These targets or quotas for zero emissions vehicles are often utilised by governments to promote the increased adoption of NEVs in the HCV segment. If generous targets are set and implemented by government, it starts to create a critical mass for the manufacture, operation and maintenance of these vehicles which will encourage the private sector to follow suit. The ZEV Transition Council[16] in 2023 notes the following international developments, highlighted in Table 3.

[12] ZEV Transition Council, Accelerating ZEV adoption in fleets to decarbonize road transportation (2023)
[13] Ibid
[14] Ibid
[15] INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION, The rapid deployment of zero-emission buses in Europe (2022)
[16] ZEV Transition Council, Accelerating ZEV adoption in fleets to decarbonize road transportation (2023)

*Table 3: Select examples of global developments in fleet procurement and emissions targets for the bus sector.*

- The state of California has additionally committed to zero emissions purchases of new buses, with 25% of new bus purchases having to be zero emission from 2023 and ramping-up to 100% in 2030, under the Innovative Clean Transit rule[17]
- The Netherlands, under its climate agreement, commits to purchase 100% zero emission municipal buses by 2025 and have a 100% net zero emission fleet by 2035[18]

Globally, there are municipal bus operators who have already launched projects to support the transition to BEV buses. Table 4 below provides two such examples:

*Table 4: Select examples of global municipal bus operators and their approach to fleet electrification.*

| Country | Bus tech | Key partners/ role players | Description | No. of vehicles | Timeline |
|---|---|---|---|---|---|
| India (Mumbai) | BEV | Municipal bus operators<br><br>Mobility partners: Olectra Greentech Pvt Ltd (previously known as Goldstone Infratech); Volvo Eicher Commercial Vehicles (VECV) | • The initial approach was to convert existing ICE buses to hybrids. During the tender process, was found to be unviable due to estimated costs.<br>• A decision was then taken to replace ICE fleet with BEV buses.<br>• The BMC installed three different types of charging infrastructure to support the existing fleet of e-buses:<br>– 53 Tellus Power Green chargers (200kW capacity)<br>– 19 Exicom chargers (240kW capacity)<br>– 26 BYD chargers (150 kW capacity)<br>• Mumbai expects to have a fully electric bus fleet by 2028. | 386 buses (current)<br><br>3000 buses (new order under tender) | 2022 - 2030 |

[17] Ibid
[18] ZEV Transition Council, Accelerating ZEV adoption in fleets to decarbonize road transportation (2023)

| Country | Bus tech | Key partners/ role players | Description | No. of vehicles | Timeline |
|---|---|---|---|---|---|
| China (Shenzen)[19] | BEV | The buses were procured from three manufactures: BYD (79.1%), Nanjing Golden Dragon (17.0%) and Wuzhoulong (3.9%) | • Shenzhen Bus Group Co. Ltd. (referred as SZBG), UC Davis and China Development Institute, this case study outlines the main aspects of the full transition to electric buses of SZBG.<br>• Shenzhen's e-buses are dominated by BYD's K8 bus), which is 10.5-meters long with a theoretical 250km battery range, featured by 2 hour direct current fast charging.<br>• By the end of 2017, all urban buses in Shenzhen, around 17 thousand buses, are electrified. | 17 000<br>heavy-duty and medium-duty (shorter than 10 meters) | 2009 - 2017 |
| Germany (Berlin) | BEV | Municipal bus operators<br>Mobility partners: Daimler Truck, Iveco; Traton Group (MAN, Scania); etc. | • Federal government departments have funded investments in BEVs for local transport authorities.<br>• The city of Berlin intends to have a fully electric bus fleet by 2030. | 367 buses (including 17 articulated 18-metre buses) | 2021 - 2030 |

### 2.1.4 Technology development: Battery swapping

One of the challenges of utilising BEVs is that the modality of charging can make a business case unfeasible and increase the Total Cost of Ownership (TCO) of the vehicle. However globally, battery swopping has been used as an option to mitigate this. The challenge is that battery swopping may sometimes be more expensive and battery types sometimes differ between similar classes of vehicles.

Bernard et al (2022)[20] provide an overview of developments in NEV battery swopping, highlighted in Table 5 below.

[19] Case Study: Electric buses in Shenzhen, China - Berlin, A., Zhang, X., Chen, Y. (2020)
[20] ICCT, CHARGING SOLUTIONS FOR BATTERY-ELECTRIC TRUCKS (2022)

*Table 5: Examples of battery swopping for MCVs and HCVs*

Indicative outcomes[21]

## China (MCVs)

- The average capital cost to set-up a battery swopping station is R27 544 350,00 which is significantly higher than a charging station.
- 30% to 40% of the total capital cost of the battery swopping station is multiple batteries.
- However, fleet owners often purchase the vehicle without the battery and access them as "Battery as a Service" (BaaS), which reduces the upfront cost of purchasing a BEV.

## China (HCVs)

- Heavy duty truck OEMs, Sany Heavy Truck and Geely Commercial Vehicles have partnered with the Chinese State Power Investment Corporation and battery manufacturer CATL, to build 100 battery swopping stations to support 10 000 BEV HCV trucks in 2022.
- In the second half of 2021, the Chinese government announced a pilot program to promote battery swapping solutions for heavy duty trucks in three cities – Baotou in Mongolia, Tangshan in the Hebei province and Yibin in the Sichuan province. Most battery swapping routes in this pilot program are for short routes – typically 100-150 km, with the trucks often being used internally in mines and industrial sites. The aim of the pilot is to increase the number of vehicles with battery-swap technology to over 100,000 and build over 100 battery swap stations.
- Government initiatives have been the catalyst for further developments in battery swapping infrastructure. Yicai Global recently reported that a 175 km section of highway between the cities of Ningde and Fuzhou has been equipped with battery swapping stations for heavy goods vehicles and they have been in use as from February 2022.
- In 2022, 49.5% of the electric trucks sold in China were swap-capable. These swap-capable electric trucks are mainly used for short-haul applications at ports, mining sites and in urban logistics. They are typically equipped with a 141 kWh or 282 kWh battery and have a typical one-way trip length of less than 100 km. Based on our interviews with station owners, setting up a battery–swapping station costs around ¥7–8 million (~US$1–1.1 million) today.
- Hainan province, for example, provides subsidies equal to 15% of the total construction cost of a battery–swapping station.
- An additional 4 000 battery swopping stations are expected to be rolled-out by 2025.

[21] All costs are estimated at the November 2023 exchange rate

## 2.2 Minibus taxis

### 2.2.1 South African trends and developments

Minibus taxis are defined as "unscheduled public transport service operated on a specific route or routes, or where applicable, within a particular area, by means of a motor vehicle, taxi or minibus; and it can carry 16 to 35 passengers" (Competition Commission, 2021)[22].

Taxis are the predominant form of public transportation in South Africa, with 66.5% of all public transport users selecting taxis and only 23.6% selecting buses[23]. It is also the most expensive form of public transport, with an average passenger spending about R960 per month on taxi fare, compared to R 745 on bus fare[24]. The challenge, however, is the taxi sector is extremely fragmented and operates predominantly in the informal sector and exclusively utilises diesel-powered ICE vehicles.

The Competition Commission (2021) and SA Taxi estimates that there are about 150 000 minibus taxi owners or operators in South Africa, with an estimated national fleet size of 250 000 taxis. It is also estimated that the sector employs almost 1 000 000 people, including 100 000 rank marshals and vehicle washers and about 150 000 informal traders[25].

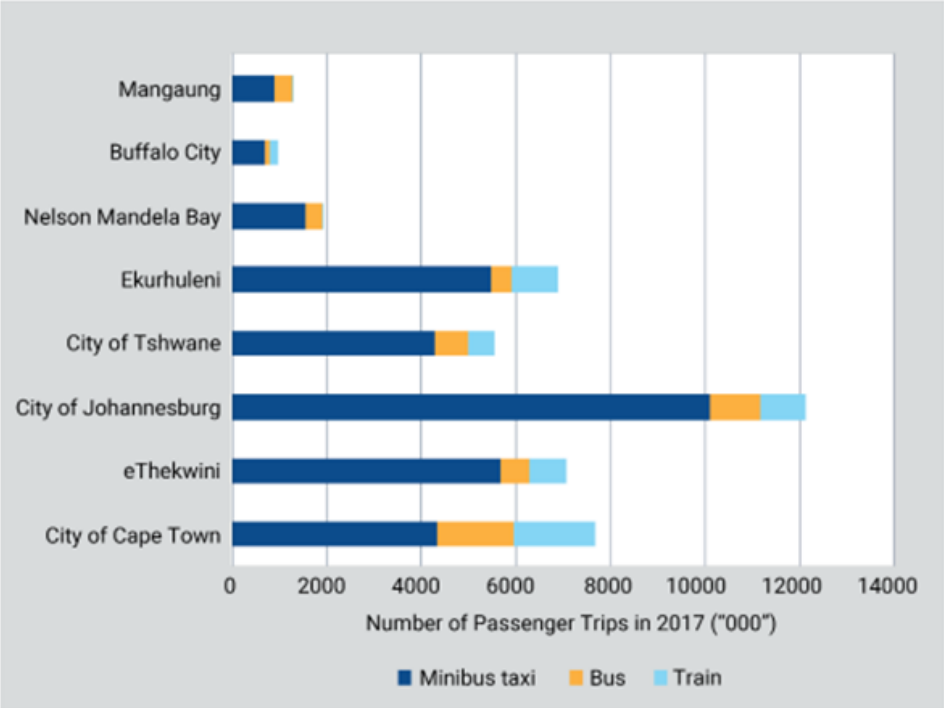



*Figure 4: City transport by modal split* [26]

Figure 4 illustrates that public transport at a city-level is dominated by taxis, with buses only playing a significant role in select cities (Cape Town, Johannesburg and eThekwini). The City of Johannesburg has the highest number of taxi trips in 2017, followed by Ekurhuleni, eThekwini and Cape Town.

Due to the informal nature of the sector and relatively expensive capital to finance fleets, the South African government in 1999, launched the Taxi Recapitalisation Programme, which encouraged taxi operators to scrap their old fleet by providing a scrapping allowance as an incentive – this allowance was to be used to either exit the sector, or purchase a new taxi. The programme did have a positive impact on the national fleet

[22] Competition Commission South Africa, LAND BASED PUBLIC PASSENGER TRANSPORT SECTOR (2022)
[23] DBSA, Going beyond the Infrastructure Funding Gap: A South African Perspective (2022)
[24] DBSA, Going beyond the Infrastructure Funding Gap: A South African Perspective (2022)
[25] Competition Commission South Africa, LAND BASED PUBLIC PASSENGER TRANSPORT SECTOR (2022)
[26] Competition Commission South Africa, LAND BASED PUBLIC PASSENGER TRANSPORT SECTOR (2022)

with the DBSA (2022) reporting that by 2018, 72 653 old taxis were scrapped, at a cost of R 4,4 billion (i.e R60 561,84 per vehicle).

Taxi Recapitalisation South Africa (2023)[27] notes that since April 2023, the scrapping allowance has been increased to R151 000 per unroadworthy minibus taxi, which was manufactured on or before 04 September 2006.

In evaluating the total cost of ownership (TCO) for ICE and BEV minibus taxis (MBTs) in South Africa, the NBI (2023)[28] suggests that in the absence of any import tariffs, BEVs could reach cost parity with ICE MBTs as early as 2025–2027 in South Africa with five-year TCO of R800 000 (Cumulative).

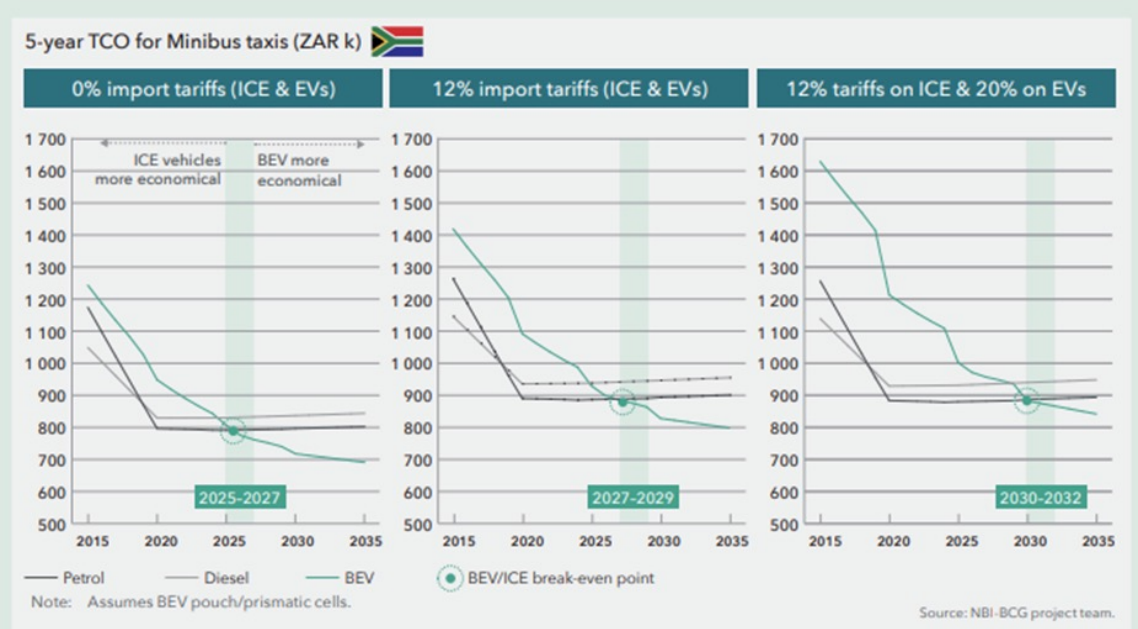



***Figure 5: Forecast of total cost of ownership parity for minibus taxis, under various import tariff scenarios[29]***

From Figure 5, it can be noted that without any import tariffs, a BEV minibus taxi can reach price parity with a BEV minibus taxi quite soon (2025 to 2027). If ICE and BEV minibus taxis are each subject to a 12% import tariff, the price parity will only occur by 2027 to 2029. In the worst-case scenario, should ICEV minibus taxis be subject to a 12% import tariff, whilst BEVs are subject to a 20% import tariff, then price parity will only be reached by 2030 to 2032.

### 2.2.2 Technology development: Flx EV

In the Western Cape, Flx EV is a start-up supporting the entry of electric minibus taxis into South Africa. Still at the pre-venture phase, the company will import three electric minibuses for in-field testing and to better understand the local operating environment. The vehicles seat 14 to 16 people and have an operational range of roughly 200 km. Flx EV, in collaboration with uYilo and Stellenbosch Municipality, have secured funding to support the installation of fast DC chargers and rooftop solar PV at the Bergzicht minibus taxi rank, to support the roll-out (GreenCape 1b, 2022)[30].

Whilst the cost of purchasing a new electric minibus may be prohibitive (GreenCape 1a 2023 estimates that the cost of an electric minibus may be twice as high as an ICE minibus), the electric minibus does offer lifetime savings for the minibus taxi operator. Top Auto (2023)[31] estimated that taxi operators could save up

[27] Taxi Recapitalisation South Africa, TAXI SCRAPPING APPLICATION PROCESS, (2021)
[28] National Business Initiative, DECARBONISING THE SOUTH AFRICAN TRANSPORT SECTOR (2023)
[29] National Business Initiative, DECARBONISING THE SOUTH AFRICAN TRANSPORT SECTOR (2023)
[30] GreenCape, EV Opportunities in the ASEZ, (2022)
[31] Michael Taylor, Electric taxis for South Africa – This is the plan (2023)

to R13 000 per month on fuel costs and maintenance, which equates to R2.4 million over the average 15-year lifetime of a minibus taxi.

### 2.2.3 Technology development: Stellenbosch University

Stellenbosch University (SU) joined forces with Rham Equipment to convert a Toyota Hiace *Ses'fikile* minibus taxi into a battery electric vehicle (EV). The South African National Energy Development Institute (Sanedi) provided funding for the project and the Transport Services division at SU donated the minibus.

Booysen says the conversion costs about R750 000 in hardware and took 500 hours to complete. He believes, however, that the price tag can be reduced to R470 000 if working at a scale of 1 000 vehicles at a time. The converted taxi can still accommodate 15 passengers, plus the driver, despite the added weight of the lithium-iron-phosphate (LFP) battery. The LFP batteries are viewed as more thermally stable. The range on the electric vehicle is between 100 km and 120 km and the maximum speed 120 km/h. The minibus' electric motor offers 90 kW of power, with battery capacity at 53.76 kWh.

## 2.3 Electrification of public transport: Case studies in Africa

There have been several NEV-related developments in Africa in recent years, with significant developments in the policy sphere. A policy overview for selected African countries are provided in Table 6 below.

***Table 6: NEV policy overview for select African countries[32]***

| Country | Bus tech |
|---|---|
| **Ghana** | The Ghanian government's Ministries of Finance and Energy are collaborating to develop a national e-mobility policy to support the objective of reducing Ghana's GHG emissions by 15% by 2030. The Ministry of Transport has convened the Energy Commission to develop technical regulations and the Public Utilities Regulatory Commission (PURC) to focus on the policy framework and related tariff structures. It is expected that the policy will drive the large-scale adoption of zero emissions vehicles in the country. Between 2017 and 2021, Ghana has imported 17 660 personal EVs into the country- which include 16 159 hybrid EVs; 901 BEVs; and 583 plug-in hybrids[33]<br><br>Whilst the formal e-mobility is being finalised, there have been some policy-related developments, as recently as November 2023[34]:<br><br>• Ghana's Minister of Finance, in a budget reading to Parliament on 15th November 2023, announced that the import duties for EVs used for public transport, would be waived for a period of 8 years.<br><br>• In addition, local assemblers of EVs in Ghana, will also be granted an import duty waiver for parts required to assemble EVs. |

[32] Cliffe Dekker Hofmeyr, E-MOBILITY IN AFRICA (2023)
[33] Tech Labari, Government Of Ghana Waives Import Duties On Electric Vehicles For Public Transportation (2023)
[34] Tech Labari, Government Of Ghana Waives Import Duties On Electric Vehicles For Public Transportation (2023)

| Country | Bus tech |
|---|---|
| **Rwanda** | **Prevailing context:**<br>• The Rwandan government's e-mobility programme includes the phased adoption of electric vehicles to replace new ICE vehicle sales; reduce GHG emissions; and reduce reliance on imported fuel. This will relate to buses, motorbikes (which operate as taxis) and passenger cars.<br>• The attraction of foreign investment into the e-mobility sector is a priority, with the Rwandan Development Board offering a corporate income tax rate of 15% for investments in the e-mobility sector.<br>**Fiscal incentives:**<br>• Electricity tariffs for charging stations are capped at the industrial tariff. This will half the rate billed to charge point operators from USD 20 cents/kWh to USD 10 cents/kWh.<br>• When EVs are charged during off-peak periods, a reduced tariff is applied.<br>• EVs, their spare parts, batteries and charging infrastructure are zero-rated VAT products and are exempt from withholding tax. In addition, they are exempt from all import and excise duties.<br>**Non-fiscal incentives:**<br>• Charging stations which operate on land owned by government, are exempt from rent.<br>• Government when considering vehicle hiring, preference is given to electric vehicles.<br>• Building and city planning codes make appropriate provisions for charging stations.<br>• Imported used ICE vehicles are subjected to an age limit.<br>• Restricted zones are established to only allow access to electric vehicles.<br>• Green number plates allow electric vehicles preferential parking and free entry into future 'congestion zones' |

| Country | Bus tech |
|---|---|
| **Egypt** | **Prevailing context:**<br>Egypt's Ministries of Transport, Electricity and Renewable Energy have already collaborated to implement an e-mobility strategy and related incentives activities. The European Bank for Reconstruction and Development (EBRD) is supporting Egypt to undertake an investigation into the potential market for the acquisition of EVs for public fleets and to consider additional incentives:<br>• Subsidies for the first 100 000 EVs which are produced locally.<br>• Setting a target for public sector fleets to increase their percentage of EVs by 5% every year.<br>• Specific programme to support the procurement of EV taxis.<br>**Fiscal incentives:**<br>• Reduction in the local content requirement to 10%, to qualify for customs breaks on locally assembled cars.<br>• Implementation of discounting on components requires either to assemble EV charging stations.<br>• Provision of import duty exemptions on components and equipment used to manufacture EVs.<br>• Imposition of customs duties of 30% on EVs which carry more than 10 people, to promote local assembly.<br>**Non-fiscal incentives:**<br>Amendments to the standards and procedures for vehicle licensing which now grant permanent licences to EV owners |

### 2.3.1 Case study 1: Kenya (Buses)

BasiGo has supported bus operators to transition from ICE buses to BEV buses in Kenya since 2021[35]. At present, it has 19 BEVs buses being operated in Kenya and by 2025, expects this number to increase to 1 000. In the last year, the company has commenced the assembly of buses and makes use of parts from BYD China. The electric motor has an output of up to 100 kW and the battery is a lithium iron phosphate battery from BYD. The e-bus can be charged with 30 kW of nominal power (60 kW maximum), which means the battery is fully charged in less than four hours.

In 2022, BasiGo raised US$ 6.6 million[36] in a consortium led by Mobility54, the corporate venture capital arm of Toyota Tsusho, Trucks VC, a transportation-focused venture capital fund in Silicon Valley and Novastar Ventures, a global VC supporting entrepreneurs in Africa.

To counter the challenge of the high upfront investment cost of purchasing a BEV bus, BasiGo offers a two-fold "Pay-As-You-Drive" model, which allows operators to pay for the vehicle based on kilometres driven per day, versus the total cost upfront. The "Pay-As-You-Drive" model includes two modalities:

[35] Basi Go, Creating the future of clean, public transit in Africa (2023)
[36] Electrive, BasiGo gets over $6M for electric bus roll out in Kenya (2022)

#### 2.3.1.1 Purchase option

- As the battery is the most significant cost component of a new BEV bus and often makes it significantly more expensive compared to an ICE bus, BasiGo allows the operator to purchase the BEV bus "without" the battery, so that the upfront purchase price is on par with an ICE diesel bus.
- The operator enters an arrangement with BasiGo to lease the battery on a Pay-As-You-Drive basis which includes free charging and vehicle maintenance. This cost of this lease is lower than the costs associated with fuel and maintenance on an ICE diesel bus.

#### 2.3.1.2 Lease option

For bus operators who prefer to avoid the upfront costs associated with the purchase option, the lease option allows an operator to lease the full BEV bus, with a small upfront deposit and pay a Pay-As-You-Drive lease fee for the full BEV bus.

BasiGo notes the following advantages of the Pay-As-You-Drive model:

- Simplified payment structure related to kilometres driven per day
- Utilisation of post-payment billing, which allows operators to collect bus fare revenues first, before paying BasiGo
- Provision of night-time charging along major routes
- Free battery replacement and all standard service and maintenance support
- Real-time route information and GPS tracking
- Operational uptime of 90% per month

In 2023 BasiGo will partner with Rwanda's AC Mobility, a company which specialises in the electronic collection of travel fares for public transport systems and deliver 200 e-buses to Rwanda. It is expected that the bus operations will commence by the end of 2024[37]. The project involves participation of Vivo Energy and the Rwanda Social Security Board (RSSB).

### 2.3.2 Case study 2: Ghana (Buses)

The Government of Ghana published its National Electric Mobility Roadmap in 2022 with the purpose of proving an explicit implementation plan to scale-up electric mobility in Ghana, illustrated in Figure 6 below.

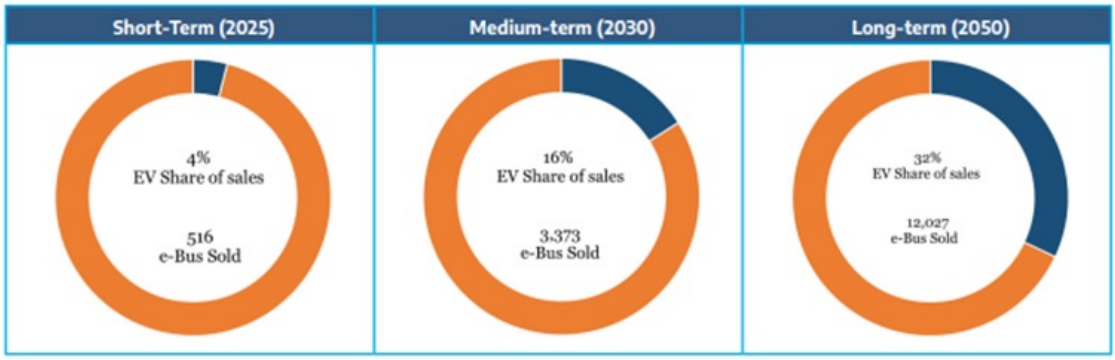



*Figure 6: Ghanian government's national e-bus targets[38]*

[37] ESI-Africa, Rwanda Kenya Partnership to see electric buses piloted in Kigali (2023)
[38] UNO Environment Programme, National Electric Mobility Roadmap in Ghana (2022)

The Ghanaian government committed to purchase 1 000 e-buses and their supporting infrastructure, to support both intra-city (40%) and inter-city (60%) transportation. Phase One includes the supply, operation and maintenance of 500 CBU e-buses (to be delivered in five batches), with Phase Two involving the supply of 500 SKD buses, which will be assembled in Ghana, in partnership with the local vehicle sector.

### 2.3.3 Case study 3: Rwanda (Minibus taxis)

Rwanda is a relatively small mobility market compared to South Africa, with about 221 000 registered vehicles on the road in 2020, with more than half of those being motorcycles and nearly 40% motorcycles. However, the IGC (202 ) indicates that the total number of registered vehicles in Rwanda is expected to increase 12% per annum.

Minibus taxis as they operate in South Africa, are quite unique globally and on the continent. In most developing countries, the predominant for of public transportation is usually buses or trains. One of the closest comparisons in Africa, is the use of e-motos in Rwanda, where motorbikes are used as moto-taxis . Of the roughly 100 000 motorbikes which are registered, nearly 46 000 operate as moto-taxis and it is estimated that 26 000 of the 46 000 utilise an internal combustion engine.

The IGC (2020) estimates that whilst the cost of purchasing a new e-moto is higher than an ICE version mainly due to the cost of the BEV battery, the operating costs of an e-moto are noticeably lower. A lifecycle cost analysis was undertaken and determined that the higher initial cost of the battery is fully mitigated via savings in maintenance and operational costs, if the e-moto had an average operating range of between 170 and 190 kilometres per day. It must be noted that electricity costs in Rwanda are high, with a tariff of US$ 27.7 per kWh.[39]

### 2.3.4 Case study 4: Zimbabwe (Minibus taxis)

Zimbabwe, like South Africa has a large informal transport sector, characterised by using 'kombis' which seat 15 – 18 passengers and operate on fixed routes, much like South African taxis[40]. As of 2020, there were an estimated 66 866 kombis in operation in Zimbabwe, representing 5.75% of the national vehicle parc (the national vehicle parc in Zimbabwe is dominated by personal vehicles at 87% of the total vehicle parc). Mobility for Africa (2022) prioritised kombis as vehicle segment with a high likelihood of successfully transitioning to full EVs and the national government has set new EV kombi targets, as illustrated in Table 7.

***Table 7: Zimbabwe's EV targets for minibus taxis (kombis): percentage of total minibus taxi (kombi) sales and number of units.[41]***

| Minibus taxis (kombis) | Short-term target (2022 – 2025) | Medium-term target (2026 – 2030) | Long-term target (2031 – 2035) |
|---|---|---|---|
| **Percentage of total minibus taxi (kombi) sales** | 15% | 70% | 90% |
| **Number of minibus taxi (kombi) units** | 2 444 | 13 705 | 24 586 |

[39] Correct pricing at time of writing.
[40] UNEP Copenhagen Climate Centre, National Policy Roadmap for Electric Mobility in Zimbabwe (2022)
[41] Mobility for Africa, National Policy Roadmap for Electric Mobility in Zimbabwe (2022)

In total, Zimbabwe seeks to pivot a total of 263 000 ICE vehicles to BEVs by 2023 and to support this national transition, has set additional targets for the building of public charging points. Table 8 illustrates the number of charging points, by charging type, over the short, medium and long-term.

*Table 8: Zimbabwe's proposed EV public charging point targets: Number of charging points per charger type.*[42]

| Minibus taxis (kombis) | Short-term target (2022 – 2025) | Medium-term target (2026 – 2030) | Long-term target (2031 – 2035) |
|---|---|---|---|
| **Slow chargers** | 798 | 5 115 | 11 896 |
| **Fast chargers** | 1 622 | 10 385 | 2 452 |

## 2.4 Identification of potential markets for exports of NEVs

Having considered key trends in each vehicle segment and unpacking the dominant OEMs and role players, due to the niche markets for agriculture and mining vehicles, it is unlikely that large export markets will be available to South African manufacturers and assemblers, considering that these are nascent vehicle categories in South Africa.

For trucks, total annual zero emissions truck sales for 2022, totalled 163 927 units, of which 114 898 units (70.1%) were manufactured and sold in China – leaving a 'rest of the world' annual sales volume of only 49 029 units[43]. Of these sales in 2023, it is only expected that total global FCEV truck sales will total 11 040 units[44], indicating an incredibly small global market, with China likely to retain over 70% of the total market for both BEV and FCEV trucks. Additionally, from previous analysis, there are only instances of small-scale FCEV truck pilots in select countries, many of which are private sector led. It is for this reason, that it is unlikely that FCEV trucks represent a viable export opportunity for South African manufacturers and assemblers.

However, the electric bus sector, owing to the prevailing legislative environment, as well as the modality of fleet ownership and management, presents a significant opportunity for exports, if manufactured locally.

The dominance of China as seen in Figure 7 cannot be ignored in these vehicle categories. Whilst total global electric vehicle sales of 10 million vehicles were recorded in 2022, 99% of these vehicles were light commercial vehicles and passenger vehicles, with 56% of them being sold in China.[45] Annual electric bus sales for 2022, totalled 115 000 units, of which 99 000 (or 92%) were manufactured and sold in China – leaving a 'rest of the world' annual sales volume of only 16 000 units[46].

[42] Mobility for Africa, National Policy Roadmap for Electric Mobility in Zimbabwe (2022)
[43] Calstart, Global Drive to Zero, ZERO-EMISSION TRUCK AND BUS MARKET UPDATE (2023)
[44] Statista, Projected fuel cell electric commercial vehicle deployment between 2020 and 2030 (2023)
[45] The International Council of Clean Transport, ANNUAL UPDATE ON THE GLOBAL TRANSITION TO ELECTRIC VEHICLES (2022)
[46] Ibid

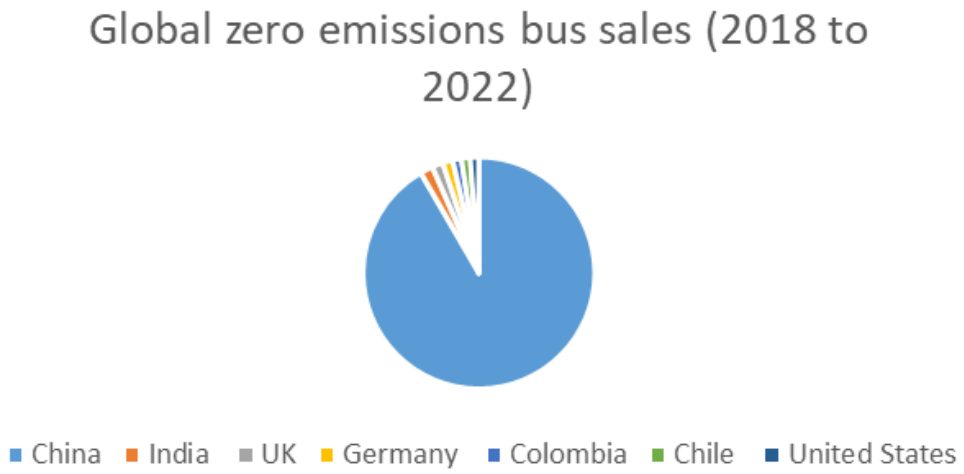



*Figure 7: Combined global zero emissions bus sales (2018 to 2022)*[47]

As seen in previous sections, the dominance of China is linked to its local OEM presence for the manufacture of NEVs. It is unlikely that South African companies will be able to compete directly with Chinese OEMs for the Chinese market, primarily due to differencing production cost baselines, the cost of capital and domestic technical infrastructure to support testing, validation and homologation.

Excluding China from the analysis, there are six main international markets for zero emission buses. Figure 8 below illustrates the combined sales between 2018 and 2022 for these regions. The Indian market is the largest and represents 388 buses a year, followed by the UK and Germany with 330 and 304 buses per year, respectively. Colombia and Chile represent 266 and 264 buses annually and the United States represents 260 buses per year.

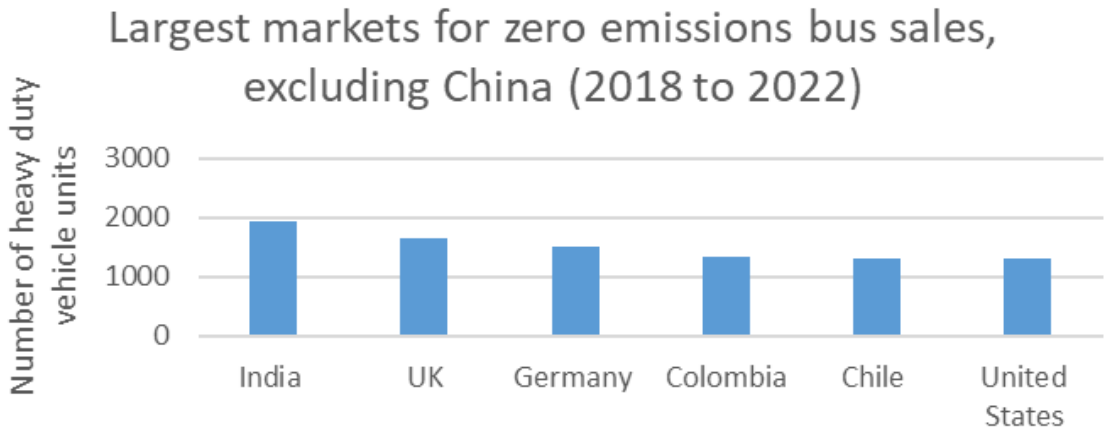



*Figure 8: Largest markets for zero emission buses excluding China (2018- 2022)*[48]

As seen in previous sections, South Africa's domestic sales for new ICE buses has indicated a slight decline, as seen in Figure 9 below, however, this represents an average of 898 buses per annum.

[47] Chu and Cui, Global Transition Electric vehicles (2023)
[48] Ibid

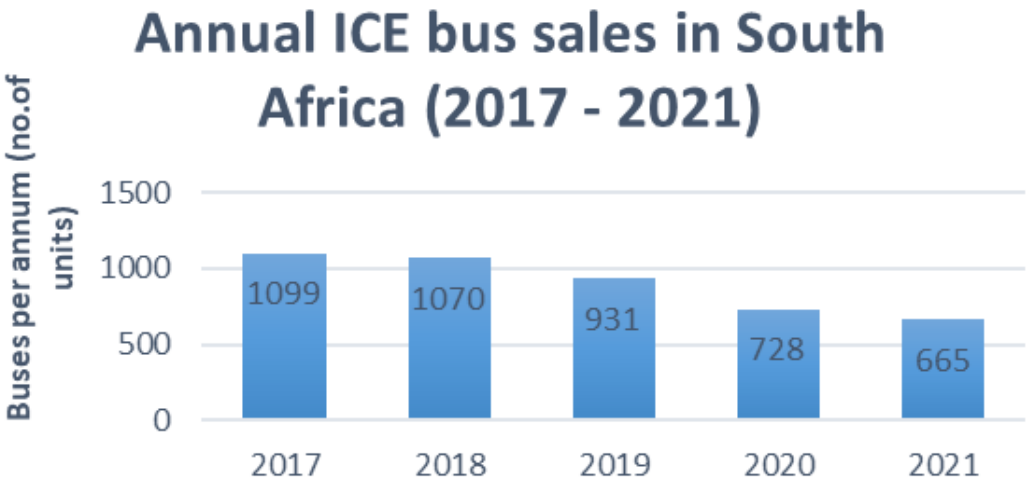



***Figure 9: Annual ICE bus sales in South Africa (2017 to 2021)[49]***

In the context of the relatively small global market for EV buses due to China's dominance, for South African manufacturers and assemblers to be well-positioned to export, an approach of non-Chinese exports supported by local market optimisation, is required. This would entail a pivoting of the South African market to the adoption of EV buses to build a credible domestic volume, thereafter, exports into the above-mentioned markets may be leveraged. The supporting legislative framework of local content designation for South African buses and bus bodies, plus the centrality of fleet ownership and management across the private and public sectors, presents a framework for the bus vehicle segment in South Africa to pivot to the greater adoption of EV buses.

[49] AIEC, Automotive Export Manual (2022)

## 2.5 Map EV components value chain and identify opportunities at a Bill of Materials (BOM) level

### 2.5.1 Legacy BEV and FCEV components value chain and opportunities at a BOM-Level

BEV and FCEV components for the Bill Of Materials (BOM) are increasingly of a critical nature and for the manufacture of batteries, as indicated in the Figure 10 below:

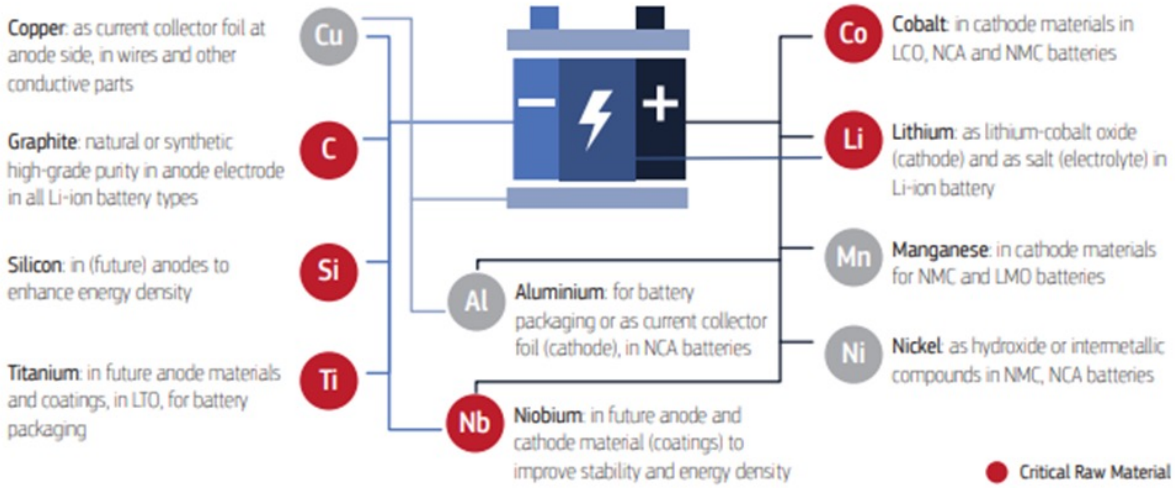



***Figure 10: Relevant raw materials used in batteries for EVs, with items in red indicating critical raw materials[50, 51].***

Africa is a key role player in the production of raw materials for lithium-ion batteries, with 54% of cobalt production originating from the Democratic Republic of Congo, 8% from China, 6% from Canada and 4% from Australia. In terms of refined cobalt production, China is responsible for 46% of global production, followed by Finland at 13% and Canada and Belgium each supplying 6%. Lithium is another critical raw material and the supply of which is likely to have a significant impact on the mass adoption of EVs, with South American countries Chile (32%) and Argentina (20%) being the dominate suppliers.

Figure 11 illustrates that both Africa and Latin America contribute 21% of EV raw materials, whilst 32% originate from China. In terms of processed raw materials and components, China and Japan are the dominate suppliers and are cumulatively responsible for 83% of all supply, whilst China is the dominate player in assemblies; responsible for 66% of global assemblies (Bobba et al, 2020).[52]

[50] Bobba et al (2020) define "critical raw material" as those which are "essential prerequisites for the development of strategic sectors such as renewable energy, electric mobility, defence and aerospace and digital technologies" (2020)
[51] European Commission, Critical Raw Materials for Strategic Technologies and Sectors in the EU (2020)
[52] Bobba et al (2020) define "critical raw material" as those which are "essential prerequisites for the development of strategic sectors such as renewable energy, electric mobility, defence and aerospace and digital technologies" (2020)

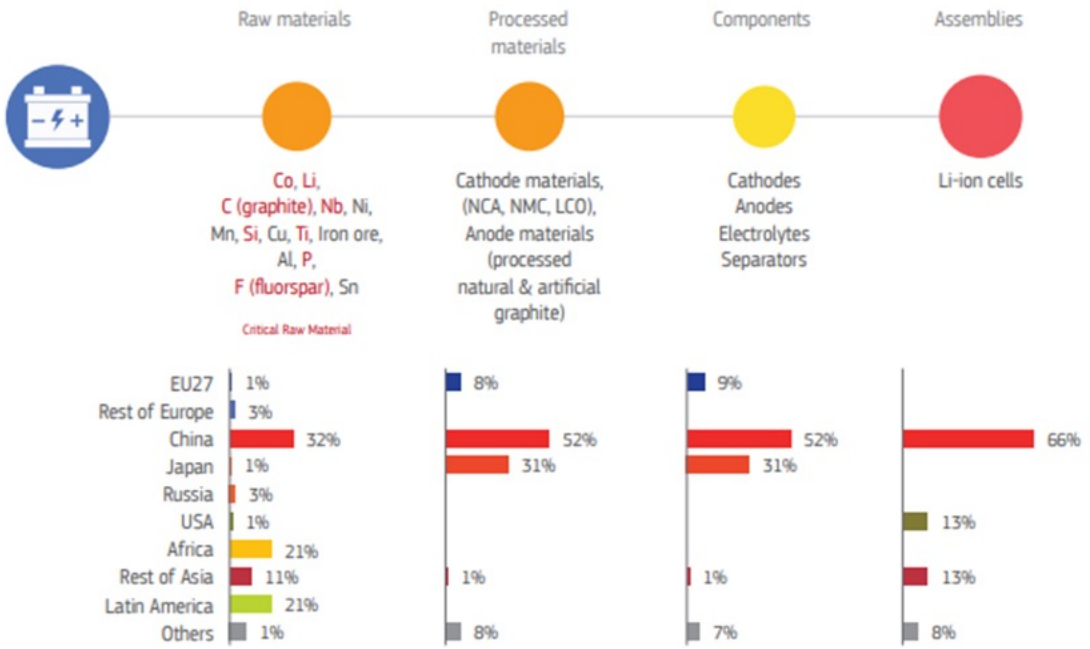



***Figure 11: EVs: Overview of key suppliers along the value chain.[53]***

Table 9 below provides an overview of the key components in a BEV or FCEV and provides an overview of the legacy components which will still be required and an indication of whether domestic manufacturing capacity and capacity exists. Prospective, existing automotive suppliers are suggested and those with at least 51% black ownership, are highlighted. Battery components and the related value chain are covered elsewhere in the study[54].

[53] European Commission, Critical Raw Materials for Strategic Technologies and Sectors in the EU (2020)
[54] To note, FCEV also require BEV battery technologies, in addition to the on-board hydrogen storage system

*Table 9: BEV and FCEV legacy components; existing manufacturing capability and capacity; and list of prospective domestic suppliers*

| Legacy component system | Legacy component sub-system | Existing local manufacturing capability and capacity | Prospective existing automotive suppliers in South Africa<br>Companies with at least 51% Black ownership bold and underlined |
|---|---|---|---|
| **Seat system** | Cut and sew components (including fabric, leather parts, sewn covers) | Yes | • ADIENT South Africa (Pty) Ltd<br>• Dask Distributors<br>• Expert Automotive Trim<br>• Feltex Automotive<br>• Isringhausen of SA (Pty) Ltd<br>• Lear Corporation<br>• Maxe Premium Automotive Accessories<br>• Ramsay Engineering (Pty) Ltd<br>• Expert Automotive Trim<br>• TNV Plastics |
| | Seat backings and plates | Yes | • Feltex Automotive<br>• Naicker Toolmakers (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd<br>• Technique Manufacturing Corporation cc<br>• Widney Transport Components (Pty) Ltd<br>• WRC Automotive Components (Pty) Ltd |
| | Seat fixtures and components | Yes | • Brace Able Manufacturing cc<br>• Dynafoam Converters (Pty) Ltd<br>• Expert Automotive Trim<br>• Feltex Automotive<br>• Naicker Toolmakers (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Technique Manufacturing Corporation cc<br>• Thekwini Wire & Fasteners (Pty) Ltd<br>• Weidplas South Africa (Pty) Ltd<br>• Wekaba Engineering<br>• WRC Automotive Components (Pty) Ltd |

| Legacy component system | Legacy component sub-system | Existing local manufacturing capability and capacity | Prospective existing automotive suppliers in South Africa<br><br>Companies with at least 51% Black ownership bold and underlined |
|---|---|---|---|
| **Seat system** | Frames and assemblies | Yes | • ADIENT South Africa (Pty) Ltd<br>• Brace Able Manufacturing cc<br>• Feltex Automotive<br>• Linde and Wiemann RSA (Pty) Ltd<br>• RG Brose Automotive Components (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd<br>• Technique Manufacturing Corporation cc<br>• Widney Transport Components (Pty) Ltd<br>• WRC Automotive Components (Pty) Ltd |
| | Height adjustors and components | Yes | • ADIENT South Africa (Pty) Ltd<br>• Isringhausen of SA (Pty) Ltd<br>• WRC Automotive Components (Pty) Ltd |
| | Foam, pads and squabs | Yes | • Dynafoam Converters (Pty) Ltd<br>• Feltex Automotive<br>• Lear Corporation |
| | Recliner mechanisms and slides | Yes | • CRH-Africa Automotive (Pty) Ltd<br>• Isringhausen of SA (Pty) Ltd<br>• Sintered Metal Products (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd<br>• Technique Manufacturing Corporation cc |
| | Seat assemblies | Yes | • ADIENT South Africa (Pty) Ltd<br>• Lear Corporation<br>• RG Brose Automotive Components (Pty) Ltd<br>• Toyota Boshoku |
| **Window system** | Window sliding systems | Yes | • Widney Transport Components (Pty) Ltd |
| | Window seals | Yes | • Dynafoam Converters (Pty) Ltd<br>• Hudson Rubber<br>• Widney Transport Components (Pty) Ltd |
| | Static or dynamic window guiding seals | Yes | • Hudson Rubber<br>• SP Automotive Profile Sealing Systems S.A. (Pty) Ltd |

| Legacy component system | Legacy component sub-system | Existing local manufacturing capability and capacity | Prospective existing automotive suppliers in South Africa<br><br>Companies with at least 51% Black ownership bold and underlined |
|---|---|---|---|
| **Window system** | Window regulators and winders | Yes | • RG Brose Automotive Components (Pty) Ltd |
| **Wheel system** | Flywheels (housings and assemblies) | Yes | • Auto Industrial Group |
| | Wheel arch | Yes | • Automould (Pty) Ltd<br>• Ebor Automotive Systems (Pty) Ltd<br>• Feltex Automotive<br>• Venture Otto South Africa (Pty) Ltd |
| | Wheel carriers (knuckles) | Yes | • Auto Industrial Group<br>• MCR Manufacturing Company (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd |
| | Aluminium alloy | Yes | • Borbet South Africa<br>• Maxion Wheels South Africa (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd |
| | Steel wheels | Yes | • MW Wheels SA (Pty) Ltd<br>• C & J Services<br>• Ramsay Engineering (Pty) Ltd |
| **Brake system** | Airbrake components | Yes | • MCR Manufacturing Company (Pty) Ltd<br>• Robert Bosch (Pty) Ltd<br>• Wekaba Engineering |
| | Brake system components | Yes | • Advics South Africa<br>• Alfred Teves Brake Systems (Pty) Ltd<br>• Auto Industrial Group<br>• C & J Services<br>• G.U.D. Holdings (Pty) Ltd<br>• MCR Manufacturing Company (Pty) Ltd<br>• Naicker Toolmakers (Pty) Ltd<br>• Robert Bosch (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Wabco South Africa (Pty) Ltd<br>• Wekaba Engineering<br>• ZF Passive Safety South Africa Inc. |

| Legacy component system | Legacy component sub-system | Existing local manufacturing capability and capacity | Prospective existing automotive suppliers in South Africa<br><br>Companies with at least 51% Black ownership bold and underlined |
|---|---|---|---|
| **Brake system** | Handbrake components | Yes | • Naicker Toolmakers (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Wekaba Engineering |
| **Chassis** | Chassis assembly | Yes | • Benteler South Africa (Pty) Ltd<br>• Brace Able Manufacturing cc<br>• KLT Automotive and Tubular Products (SA)(Pty) Ltd<br>• MA Automotive Tool and Die (Pty) Ltd |
| **Body system** | Body mouldings | Yes | • Automould (Pty) Ltd<br>• Faurecia Clean Mobility |
| | Body panel/skin | Yes | • Formex Industries (Pty) Ltd<br>• MA Automotive Tool and Die (Pty) Ltd |
| | Structural body components (including body-in-white) | Yes | • Benteler South Africa (Pty) Ltd<br>• George Stott Automotive (Pty) Ltd<br>• Linde and Wiemann RSA (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd<br>• Technique Manufacturing Corporation cc |
| | Carpets and mats (includes overlay and vaccu-formed) | Yes | • Acoustex Trim<br>• Auria South Africa (Pty) Ltd<br>• Feltex Automotive<br>• Caravelle Automotive Carpets<br>• Dask Distributors<br>• Expert Automotive Trim<br>• Faurecia Clean Mobility<br>• Feltex Automotive<br>• Hudson Rubber<br>• John Moffat Prolock (Pty) Ltd<br>• Natal Gaskets (Pty) Ltd |
| | Bumpers | Yes | • Automould (Pty) Ltd<br>• Venture Otto South Africa (Pty) Ltd |

| Legacy component system | Legacy component sub-system | Existing local manufacturing capability and capacity | Prospective existing automotive suppliers in South Africa<br><br>Companies with at least 51% Black ownership bold and underlined |
|---|---|---|---|
| **Body system** | Dashboards and instrument panels | Yes | • Auria South Africa (Pty) Ltd<br>• Benteler South Africa (Pty) Ltd<br>• Linde and Wiemann RSA (Pty) Ltd<br>• Ramsay Engineering (Pty) Ltd<br>• Technique Manufacturing Corporation cc<br>• Yanfeng South Africa Automotive Interiors Systems (Pty) Ltd |
| | Door handles and mechanisms | Yes | • Brace Able Manufacturing cc<br>• CRH-Africa Automotive (Pty) Ltd<br>• George Stott Automotive (Pty) Ltd<br>• Ramsay Engineering (Pty) Ltd<br>• Sodecia Automotive Pretoria (Pty) Ltd<br>• Steel Best Manufacturing Services (Pty) Ltd<br>• Wekaba Engineering |
| | Head (roof) liner | Yes | • Grupo Antolin South Africa (Pty) Ltd |
| | Interior door/roof components | Yes | • ADIENT South Africa (Pty) Ltd<br>• Automould (Pty) Ltd<br>• Dynafoam Converters (Pty) Ltd<br>• Toyota Boshoku South Africa<br>• Yanfeng South Africa Automotive Interiors Systems (Pty) Ltd |

# 3. PROJECT TEAM

## 3.1 Project lead

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| INTERNAL | EXTERNAL |
|---|---|
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*Left the IDC in November 2023 to join Toyota South Africa.

## 3.2 Contributing Authors for the Study Phase 1

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