Total cost of ownership comparison of EVs and ICE vehicles in South Africa

This document provides the results of a total cost of ownership comparison between internal combustion engine vehicles and their equivalent electric counterparts, based on locally relevant data.

Informing the transition of local municipal fleets

December 2022

Table of contents

Document overview

This document was funded by the UK PACT (Partnering for Accelerated Climate Transitions) programme in South Africa, and produced by Sustainable Energy Africa, as part of its City of Johannesburg Electric Vehicle (EV) Readiness Support Programme, in partnership with the City of Johannesburg and City Power.

This document aims to provide guidance to City Power specifically, and South African local municipalities more generally, on the resources available to inform decisions and actions on the transition of municipal fleets from internal combustion engine (ICE) vehicles to electric vehicles (EVs). It provides first-estimate findings as to the comparison of the total cost of ownership of ICE vehicles and EVs by vehicle type, using locally relevant data, and links to a simple Excel-based model that can be used to undertake such analyses in the future.

Executive summary

A number of local resources are available to guide the transition to EVs in municipal fleets in South Africa. These highlight total cost of ownership as a key financial consideration when comparing ICE vehicles with EVs. Total cost of ownership considers both operational and capital expenditure over a vehicle's lifespan. It can also include the estimation of environmental impacts/costs, such as total greenhouse gas or air pollutant emissions produced.

Tools currently available for undertaking a total cost of ownership analysis are based on international data, focuses on one vehicle type and/or have relatively onerous data input requirements. In response, a simple Excel-based tool[1] was built to allow for an initial analysis, based on locally relevant default data that can be overridden by user-specified inputs. Results include capital, energy/fuel, maintenance and insurance costs, as well as greenhouse gas and key air pollutant emissions over a vehicle's lifespan for all major vehicle types.

The results indicate that the total cost of ownership of an EV is higher than that of an ICE vehicle, across all vehicle types, given the current context and prices. This is overwhelmingly driven by an EV's higher capital cost, as a result of the higher cost of new and innovative technology, as well as the lack of local manufacture and resultant import duties and taxes. EV insurance costs are higher due to the higher value of the vehicle and potential higher repair costs. In contrast, maintenance and energy costs of an EV are significantly lower than that of an ICE vehicle. Total lifetime greenhouse gas emissions of an EV may be lower or higher than that of an ICE vehicle, dependent on electricity source (grid or supplemented by rooftop PV), initial fuel source (crude oil or coal-to-liquids), vehicle type, and assumptions on the change in the national electricity grid mix.

Total cost of ownership analyses should be undertaken regularly, since results are likely to change rapidly and drastically, in particular as a result of changes in vehicle capital cost, driven by technology development, and changes in local manufacture and/or tax regimes.

[1] Available here: https://www.cityenergy.org.za/total-cost-of-ownership-comparison-of-evs-and-ice-vehicles-in-south-africa-tool/

Acronyms, abbreviations and terms

CBA	Cost Benefit Analysis
CNG	Compressed Natural Gas
CPI	Consumer Price Index
DoT	Department of Transport
EV	Electric Vehicle
GABS	Golden Arrow Bus Services
ICE	Internal Combustion Engine
OEM	Original Equipment Manufacturer
MPV	Multi-Purpose Vehicle
NOx	Nitrogen oxides
PV	Photo-voltaic
SO_2	Sulphur dioxide
SUV	Sport Utility Vehicle
VOC	Volatile Organic Compound

1. Resources guiding EV transition in municipal fleets

There are a small number of key locally-relevant guiding resources that inform the transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs) within local government fleets in South Africa, and – specifically – within City Power, the energy service company of the City of Johannesburg. These resources are listed in Table 1, along with descriptions as to the guidance or analyses they provide that is relevant to municipal fleets.

Table 1. Resources to guide and inform action on the transition of municipal fleets to EVs

Document	***Description***
LTE Consulting (2020), CITY POWER Electric Vehicles Feasibility Report (not public)	Assessed emissions and cost impacts of leasing available hybrid hatchback and sedan vehicles instead of their ICE vehicle counterparts. Compared cost and emissions metrics (based on international costs and emissions factors) of electric, diesel and biofuel buses. Covered charger options, ownership models, indicative costs (quotes) and possible placement.
SEA (2022), Electric vehicle procurement options for local government	Provides broad recommendations for local governments on transitioning fleets from ICE vehicles to EVs, based on policy, regulatory, cost, capacity, skills, practical and behavioural challenges and opportunities, as captured within international and local case studies. Available here: https://www.cityenergy.org.za/electric-vehicle-procurement-options-for-local-government/.
The Green House (2018), Municipal Fleet Costs and Environmental Impacts Calculator	Simple Excel-based tool allowing for comparison of costs and emissions of electric, CNG, diesel, biodiesel and biogas bus fleet conversion projects. Available here: https://www.cityenergy.org.za/municipal-fleet-costs-and-emissions-calculator/.
Department of Transport, Guideline for Procurement of Green Vehicles in the Public Sector (not yet published)	Provides detailed guidance as to green procurement processes, as it relates to EVs, including relevant legislation, government procurement options (transversal contracting, joint procurement, framework agreements, etc.), setting specifications, market assessment and consultation and sourcing strategies, among much else.

2. Motivation for focus on total cost of ownership

The available resources highlight that an important and common approach or recommendation when considering the procurement of EVs for municipal fleets, is to undertake a total cost of ownership comparison between ICE vehicles and equivalent EVs, which looks at both capital and operational costs of a vehicle over its lifespan, and can include environmental impacts / costs, such as greenhouse gas and air pollutant emissions.

This recommendation stems from the fact that the up-front capital cost of an electric vehicle (EV) is currently higher than its internal combustion engine (ICE) equivalent, due to lack of local manufacture (resulting in high import duties) and the fact that the technology is relatively new (prices will decrease as the technology matures). Yet maintenance costs of EVs are lower, since they have fewer moving parts, and energy / fuel costs are usually lower, although this depends on charging tariffs. Overall, the total cost of ownership of an EV may be lower than an equivalent ICE vehicle over its lifespan, yet a focus on up-front capital cost alone can skew purchasing decisions in favour of ICE vehicles.

Currently, available total cost of ownership comparison resources are either based on international data, which is indicative, but not always relevant (emissions factors and costs can vary greatly), or is specific to a particular vehicle type.

3. Total cost of ownership model approach

A simple Excel-based tool was built that allows for the comparison of capital and operational costs, as well as greenhouse gas and air pollutant emissions, of a variety of vehicle types (sedan, bakkie, bus, truck, etc.). The model is aimed at local municipal officials involved in fleet procurement, who wish to compare total cost of ownership of ICE vehicles and EVs.

Similar to an already-available bus cost benefit analysis tool (noted in Table 1), the model is based on default data that can be overridden by user inputs, reducing user input requirements and improving ease-of-use. All default assumptions and their sources can be found in the appendices.

> The ICE vs. EV total cost of ownership comparison model can be downloaded here:
>
> https://www.cityenergy.org.za/total-cost-of-ownership-comparison-of-evs-and-ice-vehicles-in-south-africa-tool/

Globally, the trend is towards pure battery EVs (IEA, 2022; Gómez Vilchez et al, 2022). Therefore, the model focuses only on the replacement of ICE vehicles with that of battery EVs; not considering other vehicle types such as hybrids, biofuels, CNG or hydrogen. In addition, where plug-in hybrid vehicles are used, there could be a tendency to continue using it as a conventional ICE vehicle (refuelling, but not recharging), negating most of the potential benefits of switching to an EV (LTE, 2020).

Government fleets consists largely of light trucks, bakkies and light vehicles (DoT). City Power's fleet reflects this (Figure 1). The majority (80%) of City Power's trucks are cherry pickers; fitted with cranes for lifting/lowering people to work on overhead cables[2]. Very little data was available on electric trucks and model results for these vehicles should therefore be interpreted with caution. The model allows for the input of improved data as it becomes available.

[2] Personal communication, Itumeleng Gamede, City Power, and data received from Jacques Rabie, City Power.

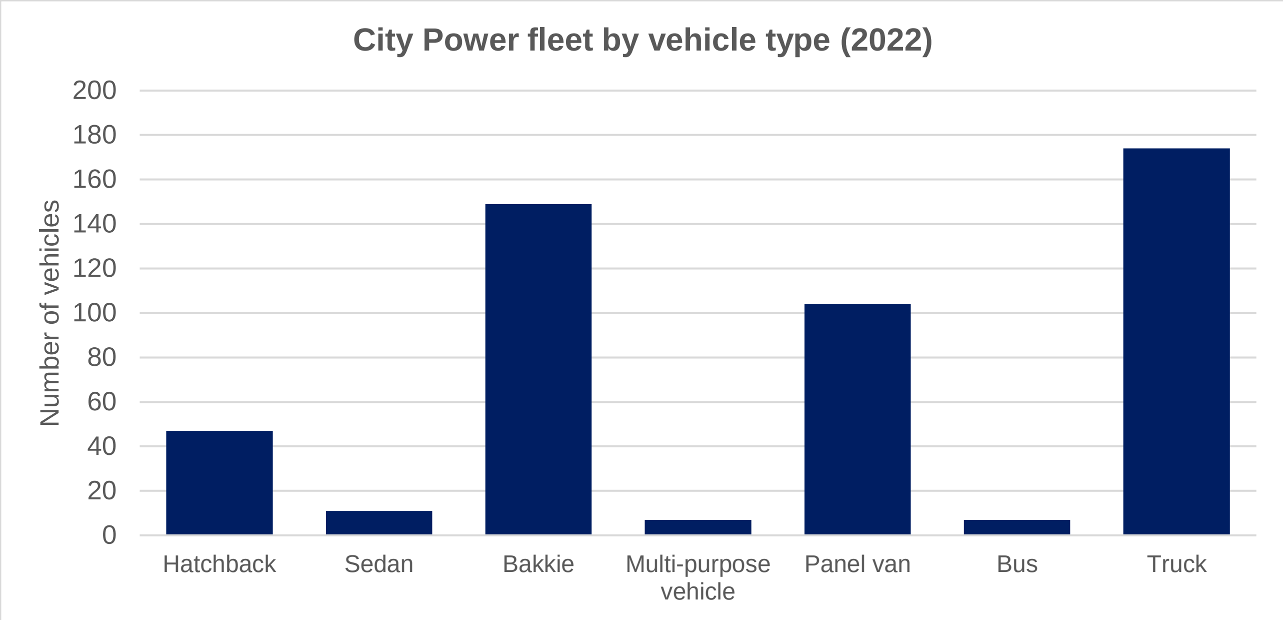

Figure 1. City Power fleet by vehicle type

The total cost of ownership calculation is based on guidance provided within the Department of Transport 's Guideline for Procurement of Green Vehicles in the Public Sector (unpublished at the time of writing):

Capital cost + ((Maintenance cost + Energy cost) / (1 + Discount Rate) ^ Number of years).

The model results include greenhouse gas emissions from operations (energy use) only, due to the wide variation in embodied emissions (related to vehicle manufacture) because of differences across countries of production and manufacturers' energy source(s).

Greenhouse gas emission related to EV electricity use is calculated based on the current South African national grid emissions factor, as well as assumptions as to how this may change in future, based on scenarios within the country's Integrated Resource Plan (IRP). The model allows for the ability to specify charging using renewables rather than the grid mix.

The model estimates air pollutants ($PM_{2.5}$, PM_{10}, SO_2, NOx and VOCs) related to the use of diesel and petrol by ICE vehicles, but not that related to the generation of grid electricity, since electricity generation plants may be outside municipal boundaries and not impacting local air quality.

4. Total cost of ownership results and recommendations

A summary of the model's findings is below. Detailed results are contained within the appendices. These results are relevant as at 2022, and may change rapidly and drastically, in particular as a result of future changes in vehicle capital cost, driven by technology development, and changes in local manufacture and/or tax regimes.

The total cost of ownership of an EV is higher than that of a mid-market ICE vehicle across all vehicle types, given the current context and prices. This is in line with findings by Eskom, which has undertaken its own fleet analysis modelling[3]. The only exceptions are when an EV is compared to the luxury end of the market for some vehicle types, in particular SUVs. For example, comparing an electric SUV to the higher-priced (not mid-market) internal combustion engine SUVs results in a lower total cost of ownership after 5-6 years (Figure 2). Yet these results are not relevant, since the luxury and SUV segments are not of interest to City Power fleet (and the majority of municipal fleets), given the current fleet composition (Figure 1).

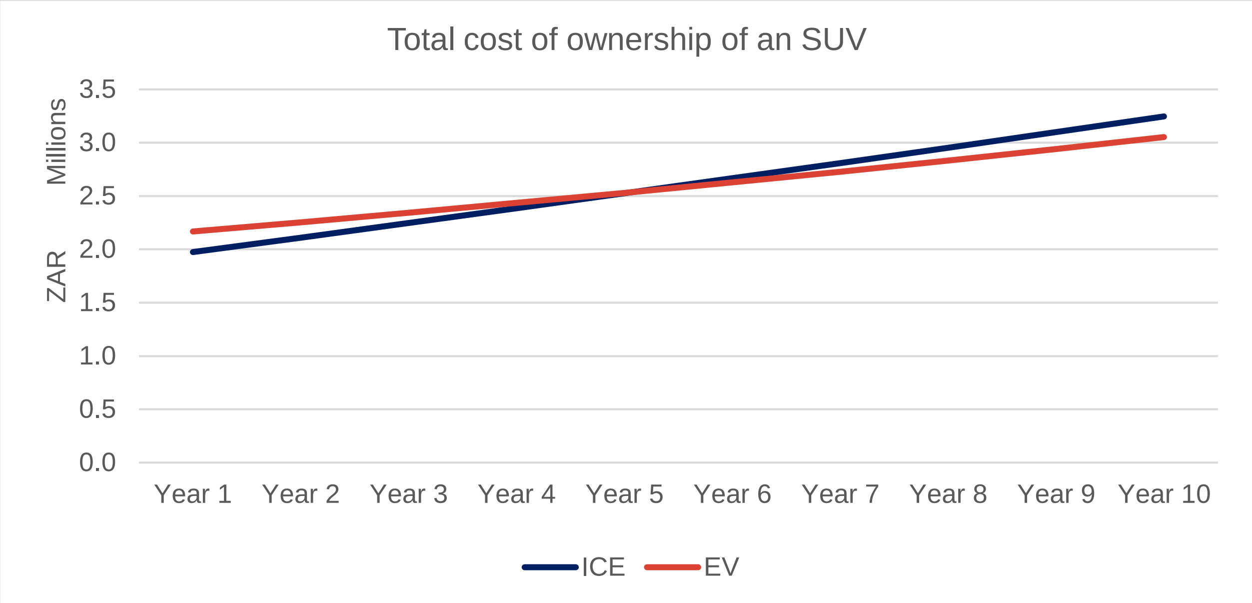

Figure 2. Comparison of total cost of ownership of an EV SUV with a luxury-end ICE SUV[4]

The higher total cost of ownership of an EV is overwhelmingly driven by the higher capital cost. This higher cost is due to two major factors: (1) the higher cost of new / innovative technology, in particular the battery, which forms a large share of vehicle cost; and (2) the lack of local manufacture, with the resultant need to import these vehicles.

Vehicles (excluding trucks[5]) are subject to ad valorem duties, essentially a "luxury tax", which is applied on a sliding scale, based on vehicle value. This tax can be as high as 30%. Since EVs have higher value than an equivalent ICE vehicle, mainly due to the expensive battery, they tend to attract higher ad valorem excise duties.

Imported vehicles attract high import duties and taxes, to protect the local manufacturing industry (see appendices for rates, which can be as high as 25%). In some cases, import duties and taxes may be higher than that of an equivalent ICE vehicle.

The Department of Trade, Industry and Competition is considering adjusting the imbalance between EV and ICE vehicle import duties, as well as restructuring the ad valorem excise duty (potentially excluding vehicle batteries from vehicle valuation) in its draft Auto Green Paper. In addition, any

[3] Personal communication, Nalini Pillay, Research Testing & Development, Eskom
[4] Comparing total cost of ownership of an Audi e-tron 55 Quattro Advanced with an Audi Q8 45TDI Quattro
[5] Does not seem to be applied to ICE goods vehicles with gross vehicle mass (GVM) above 5 tonnes or EV goods vehicles with a GVM above 3.5 tonnes.

future local manufacture of EVs will result in substantive price reductions of new EVs, which will substantively impact the total cost of ownership results in an EV's favour (Figure 3).

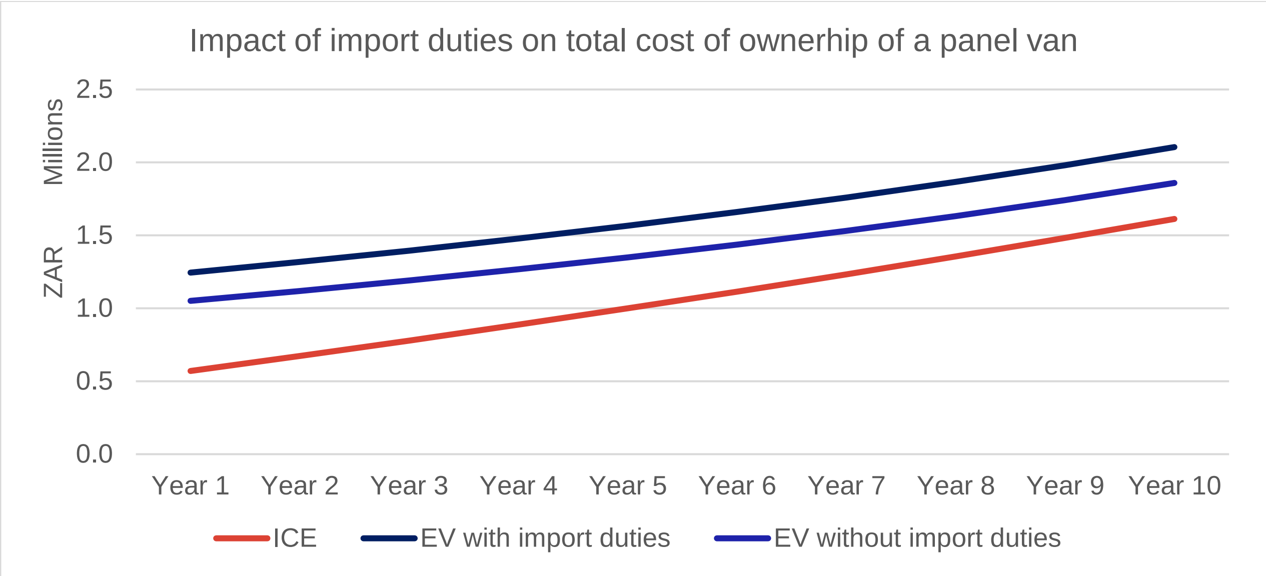

Figure 3. Impact of import duties on the total cost of ownership of an electric panel van

The higher capital cost of an EV in turn drives higher insurance costs, since premiums are higher for higher-value vehicles. As a result, insurance costs are the second-largest cost item in an EV's total cost of ownership (Figure 4). EVs tend to suffer extreme damage more easily than ICE vehicles; for example, damaging a battery, which is a high share of the vehicle's value. EVs are also more expensive to repair due to new and innovative technology and parts, although these costs should decrease as EVs become more mainstream.

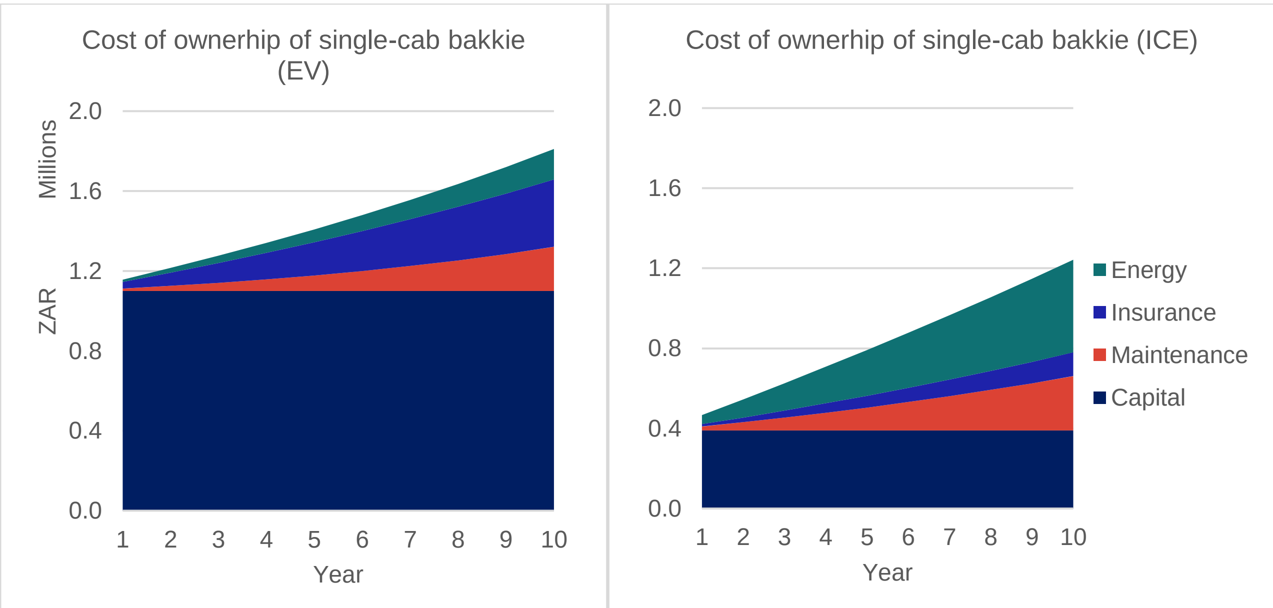

Figure 4. Cost breakdown of total cost of ownership of EV and ICE single-cab bakkie over a 10-year lifespan

In contrast, both maintenance and energy/fuel costs for EVs are lower than their ICE vehicle counterparts (Figure 4). EVs cost less to maintain due to the lower number of moving parts. The cost reduction ranges from 30% in the light vehicle market to as high as 60-70% for buses and trucks[6] (illustrated in Figure 5 and Figure 6).

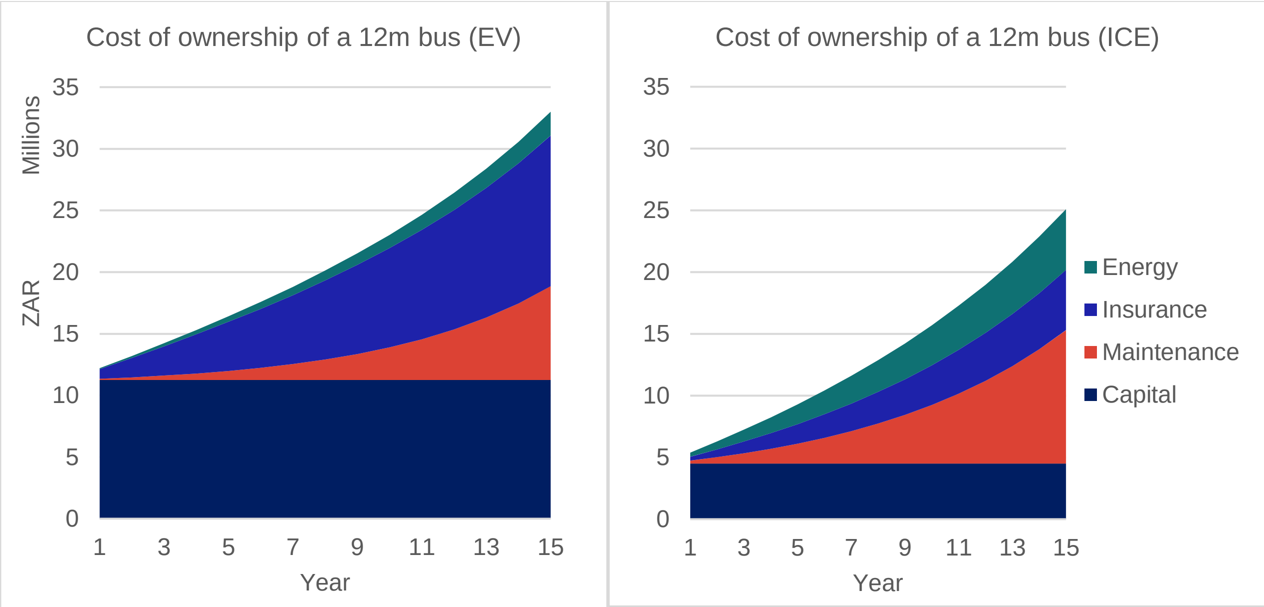

Figure 5. Cost breakdown of total cost of ownership of EV and ICE 12m bus over a 15-year lifespan

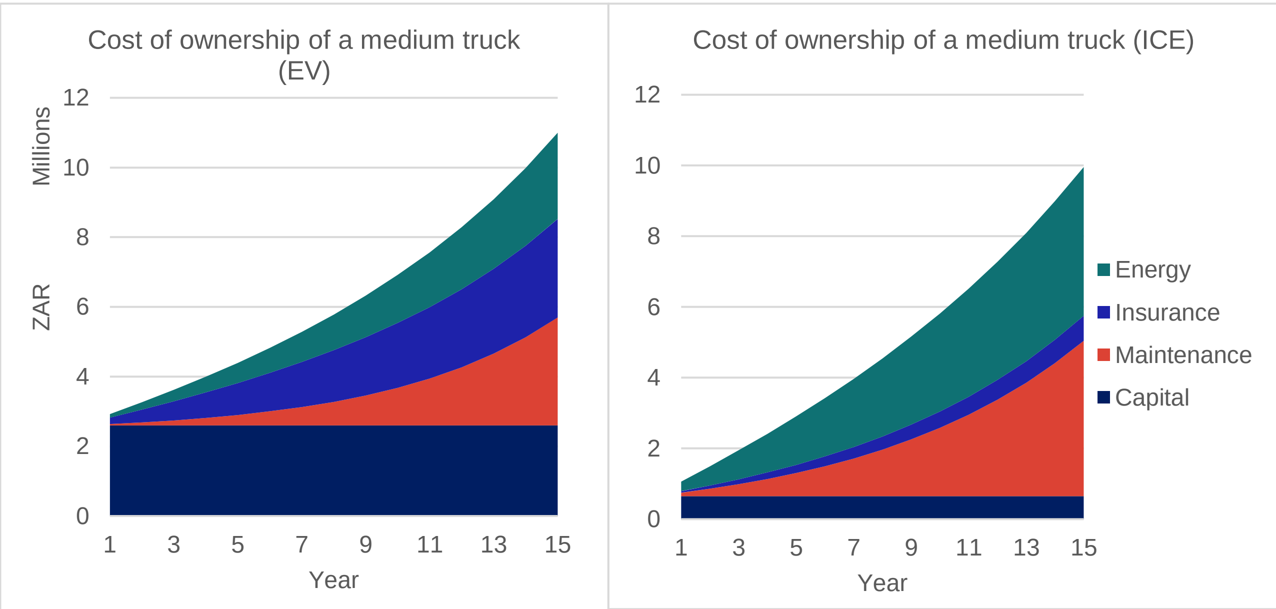

Figure 6. Cost breakdown of total cost of ownership of EV and ICE medium truck[7] over a 15-year lifespan

Energy costs for an EV are usually lower, since EVs use very little energy per kilometre travelled when compared to an equivalent ICE (Figure 7 and Figure 8). Some caveats that should be noted is that energy costs exclude the initial installation cost of EV fleet chargers and assumes an electricity tariff based on what City Power pays Eskom for electricity – roughly R1.80/kWh[8]. If fleet vehicles

[6] See appendix 6.9. Maintenance assumptions for detail and sources.
[7] ICE truck used for reference is the Isuzu NQR 500, which has a gross vehicle mass of 8.5 tonnes and a payload of 5 tonnes.
[8] Based on the relevant Megaflex tariff.

were to charge at public chargers instead, the costs are much higher, due to the high average rate at public chargers – roughly R5.88/kWh in 2022. This can result in energy costs that are higher than that of an equivalent ICE vehicle (Figure 9). Therefore, installation of municipal-owned chargers for municipal fleets is strongly recommended. It should be noted that the rate for public charging is very likely to decrease as EV uptake accelerates, since the business case for public charger operators improves with increased charging frequency (SEA, 2022a).

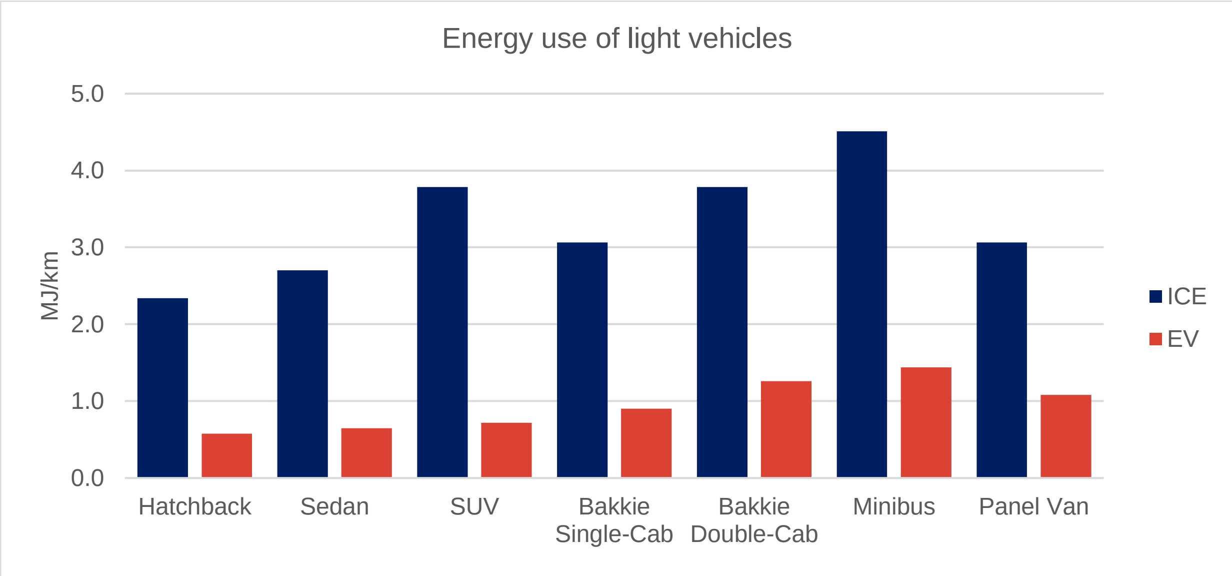

Figure 7. Energy use of EV vs ICE for light vehicles

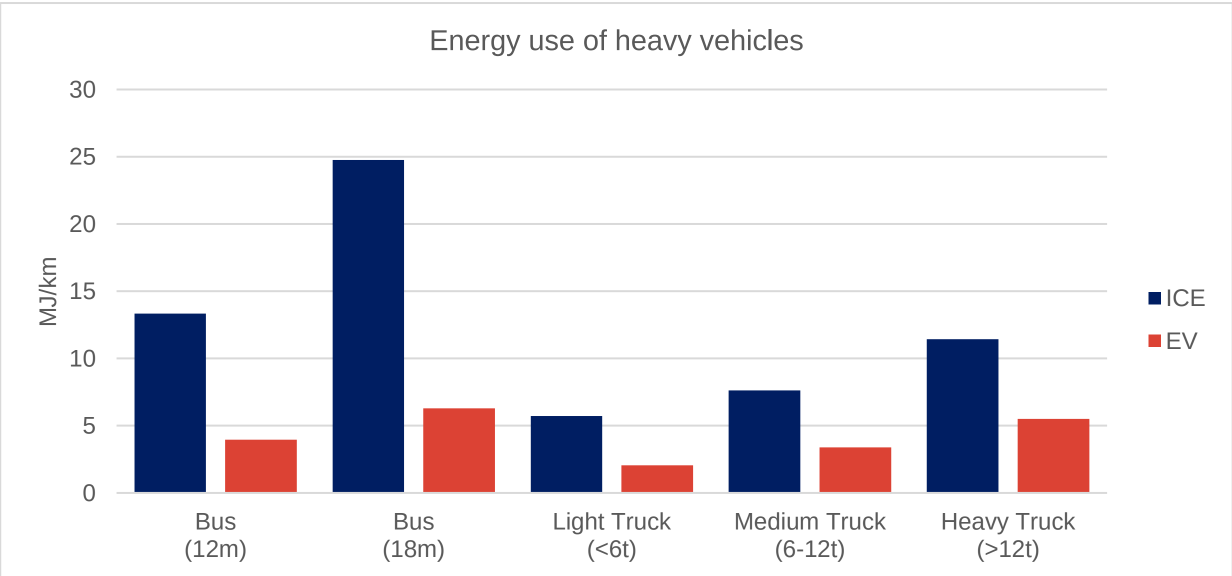

Figure 8. Energy use of EV vs ICE for heavy vehicles

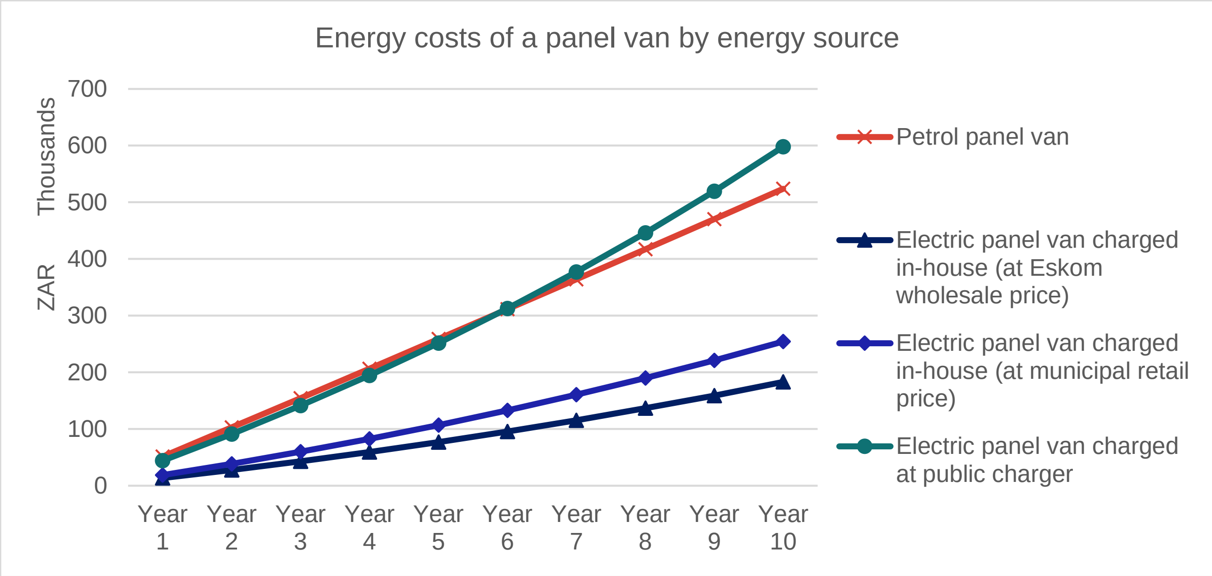

Figure 9. Impact of charging cost on EV energy / fuel costs[9]

The potential high share of reduction in energy and maintenance costs of an EV means that total cost of ownership is very sensitive to distance driven by a vehicle over its lifetime: the higher the distance, the higher the lifetime savings. This results in the total cost of ownership of an EV approaching that of an equivalent ICE vehicle at a faster rate, in essence bringing the "breakeven" year between the two vehicle types closer (Figure 10). Therefore, EVs are more suited to applications where high distances are covered per year, with the caveats that these trips are urban and/or on relatively predictable routes, to allow for easier access to, and planning around the installation of, charging facilities.

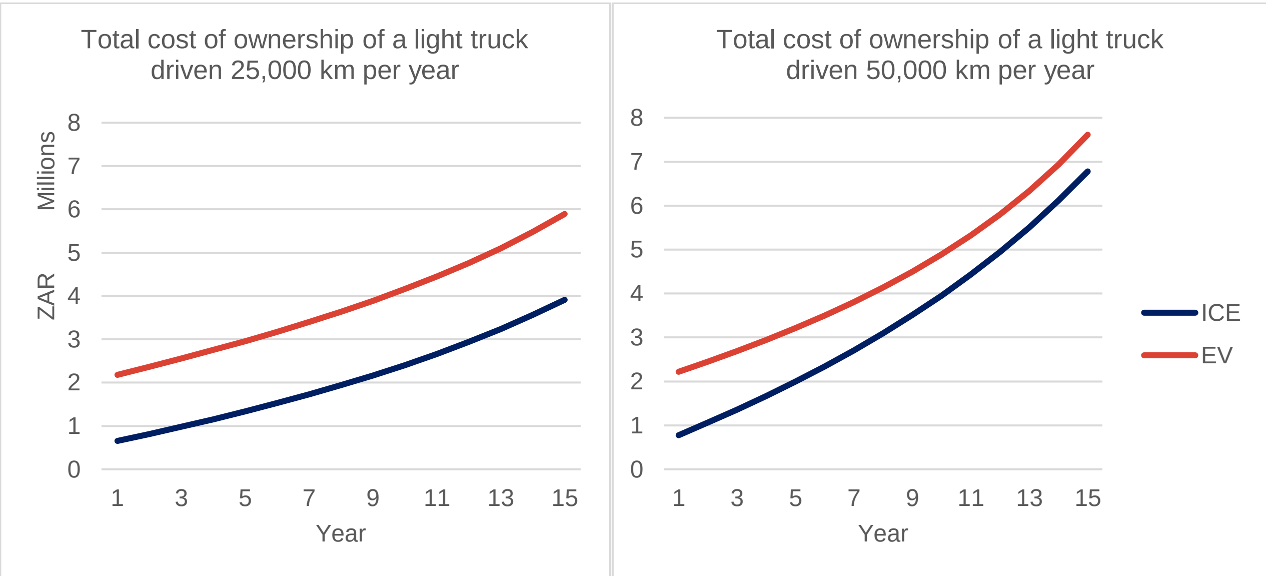

Figure 10. Impact of annual mileage on the difference in total cost of ownership of an EV and equivalent ICE vehicle

[9] Note that the assumptions include a higher tariff escalation for electricity than for petrol.

The comparison of greenhouse gas emissions between an EV and equivalent ICE vehicle over a vehicle's lifespan is sensitive to assumed energy use intensity (litres or Watt-hours per kilometre), the emissions factors related to the use of the energy sources, as well as the source of electricity. While greenhouse gas emissions per unit of electricity is very high, due to a national grid sourcing most of its electricity from coal, the energy use intensity of an EV is much lower than an equivalent ICE vehicle (Figure 7 and Figure 8).

Table 2 indicates that in some cases an EV may generate more greenhouse gas emissions over its lifespan than an equivalent ICE vehicle, even in a context of decreasing national grid emissions intensity in line with national government's electricity generation build plan[10]. Yet there are important caveats. Firstly, the emissions factors for petrol and diesel excludes the impact of any fuel sourced from Sasol's coal-to-liquid process, which would increase ICE vehicle emissions, tipping the scales between an EV and ICE vehicle in favour of EVs (SEA, 2016). Secondly, the energy intensity of some electric vehicle types is very uncertain (e.g. trucks, bakkies, panel vans), since very little to no data is available. In these cases, the assumed energy intensity errs on the side of conservative (on the higher end), which will result in higher emissions for an EV. Thirdly, it assumed that all electricity is sourced from the national grid, whereas rooftop PV could supplement charging[11].

Table 2. Savings in greenhouse gas emissions over an EV's lifespan when compared to an ICE vehicle

Change in greenhouse gas emissions as a result of using an EV[12]	tCO_2e
Hatchback	-8
Sedan	-10
SUV	-22
Bakkie Single-Cab	-5
Bakkie Double-Cab	1
Multi-Purpose Vehicle[13]	5
Panel Van	8
Bus 12m	-89
Bus 18m	-295
Light Truck (<6t)	-5
Medium Truck (6-12t)	98
Heavy Truck (>12t)	259

A switch from an ICE vehicle to an EV will result in the total removal of all air pollutants (e.g. SO_2, NOx, VOCs and particulates) related to tail-pipe emissions over that vehicle's lifespan (Table 3). There is the potential for substantial local air quality improvements as EV uptake across the city increases, since most of the brown haze across South Africa cities is related to the burning of fossil fuels by vehicles (Wicking-Baird et al, 1997).

[10] The national grid emissions assumptions can be found in the appendices.
[11] The total cost of ownership model allows for the setting of the share of renewable electricity not sourced from the grid (e.g. rooftop PV or purchases from an independent power producer) that is used for charging.
[12] A positive value means that the EV is generating more emissions over its lifespan than an ICE vehicle.
[13] A large car typically seating 6 or more. Minibuses fall into this category.

Table 3. Air pollutants over an ICE vehicle's lifespan

Air pollutants over a vehicle's lifespan (kg)	SO_2	NOx	VOCs	PM_{10}	$PM_{2.5}$
Hatchback (petrol)	29	302	605	10	8
Sedan (petrol)	33	346	691	12	10
SUV (petrol)	45	475	950	16	13
Bakkie Single-Cab (diesel)	186	122	100	132	122
Bakkie Double-Cab (diesel)	233	153	125	165	153
Multi-Purpose Vehicle (petrol)	55	585	1,170	20	16
Panel Van (petrol)	38	405	810	14	11
Bus 12m (diesel)	1,953	1,281	1,050	1,386	1,281
Bus 18m (diesel)	3,627	2,379	1,950	2,574	2,379
Light Truck (<6t) (diesel)	1,046	686	563	743	686
Medium Truck (6-12t) (diesel)	1,674	1,098	900	1,188	1,098
Heavy Truck (>12t) (diesel)	2,930	1,922	1,575	2,079	1,922

Total cost of ownership analyses should take place regularly, due to the rapidly evolving EV space, where technology improvements and learning curves, along with local manufacture, will continue to decrease capital costs and therefore improve the business case for EVs.

The total cost of ownership model[14] can be used as an aid in undertaking total cost of ownership analyses. Model defaults should be replaced with more relevant data, where available, to improve the relevance of results. The most critical defaults to replace with user-specified inputs are the actual annual mileage travelled by fleet vehicles and vehicle capital costs, especially for EVs. The model includes a calculator tool to help estimate the cost of an imported EV, in cases where a specific vehicle type is not yet available on the local market.

In cases where vehicles are leased by a municipality, rather than purchased, a model result indicating a similar or lower cost of ownership for an EV when compared to an equivalent ICE vehicle may translate into similar or lower monthly lease costs, where such fleet service suppliers are available.[15] This will avoid the high up-front capital cost associated with EVs.

[14] Available here: https://www.cityenergy.org.za/total-cost-of-ownership-comparison-of-evs-and-ice-vehicles-in-south-africa-tool/

[15] Woolworth is converting 70% of their delivery fleet to EVs, which will be leased (SEA, 2022b).

5. References

DoT	*Department of Transport, Guideline for Procurement of Green Vehicles in the Public Sector (draft). Unpublished at the time of writing.*
DoT, 2019	*Department of Transport, Green Transport Strategy 2018-2050*
IEA, 2022	*International Energy Agency (2022), Global EV Outlook 2022. Available at: https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf.*
Gómez Vilchez et al, 2022	*Gómez Vilchez, J. J., Julea, A., Lodi, C. & Marotta, A. (2022), An analysis of trends and policies supporting alternative fuels for road freight transport in Europe. Available at: https://doi.org/10.3389/fenrg.2022.897916.*
LTE, 2020	*LTE Consulting (2020), CITY POWER Electric Vehicles Feasibility Report. Unpublished.*
TGH, 2018	*The Green House (2018), Municipal Fleet Costs and Environmental Impacts Calculator, available here: https://www.cityenergy.org.za/municipal-fleet-costs-and-emissions-calculator/*
SEA, 2016	*Sustainable Energy Africa (2016), Well-to-Wheels Greenhouse Gas Emissions and Energy Comparison between Battery Electric Vehicles, non-Plug in Hybrids and Conventional Passenger Cars for South Africa. Available at: https://www.cityenergy.org.za/battery-electric-vehicles-vs-non-plug-in-hybrids-vs-conventional-passenger-cars-technical-brief/*
SEA, 2022a	*Sustainable Energy Africa (2022), Local response options to enable electric vehicle uptake in Johannesburg, available here: https://www.cityenergy.org.za/local-response-options-to-enable-electric-vehicle-uptake-in-johannesburg/*
SEA, 2022b	*Sustainable Energy Africa (2022), Electric vehicle procurement options for local government, available here: https://www.cityenergy.org.za/electric-vehicle-procurement-options-for-local-government/*
Wicking-Baird et al, 1997	*Wicking-Baird, M.C., De Villiers, M.G. & Dutkiewicz, R.K. (1997), Cape Town Brown Haze Study, Report No. Gen. 182. Energy Research Institute, University of Cape Town.*

Note: Detailed references related to model assumptions are captured within the appendices rather than in the above table.

6. Appendices

6.1. Model results by vehicle type

Table 4. Total cost of ownership of an ICE and EV hatchback over a 10-year lifespan

Variable	ICE (petrol)	EV
Total cost of ownership (ZAR)	**794,356**	**1,323,084**
Capital cost	265,000	900,000
Maintenance cost	57,028	53,550
Insurance cost	81,209	275,804
Energy cost	391,119	93,731

Variable	ICE (petrol)	EV
Greenhouse gases (tonnes)	**38**	**30**
CO_2e (tonnes)	38	30
Air pollutants (kg)	**954**	**0**
SO_2	29	0
NOx	302	0
VOCs	605	0
PM_{10}	10	0
$PM_{2.5}$	8	0

Table 5. Total cost of ownership of an ICE and EV sedan over a 10-year lifespan

Variable	ICE (petrol)	EV
Total cost of ownership (ZAR)	**941,682**	**1,596,090**
Capital cost	335,000	1,100,000
Maintenance cost	57,028	53,550
Insurance cost	102,660	337,094
Energy cost	446,993	105,447
Greenhouse gases (tonnes)	**44**	**34**
CO_2e (tonnes)	44	34
Local air pollutants (kg)	**1,091**	**0**
SO_2	33	0
NOx	346	0
VOCs	691	0
PM_{10}	12	0
$PM_{2.5}$	10	0

Table 6. Total cost of ownership of an ICE and EV SUV over a 10-year lifespan

Variable	ICE (petrol)	EV
Total cost of ownership (ZAR)	**1,365,307**	**2,029,746**
Capital cost	400,000	1,300,000
Maintenance cost	228,111	214,199
Insurance cost	122,579	398,383
Energy cost	614,616	117,163
Greenhouse gases (tonnes)	**60**	**38**
CO_2e (tonnes)	60	38
Local air pollutants (kg)	**1,500**	**0**
SO_2	45	0
NOx	475	0
VOCs	950	0
PM_{10}	16	0
$PM_{2.5}$	13	0

Table 7. Total cost of ownership of an ICE and EV panel van over a 10-year lifespan

Variable	ICE (petrol)	EV
Total cost of ownership (ZAR)	**1,612,471**	**2,104,960**
Capital cost	470,000	1,175,000
Maintenance cost	474,620	386,815
Insurance cost	144,031	360,077
Energy cost	523,820	183,068
Greenhouse gases (tonnes)	**51**	**59**
CO_2e (tonnes)	51	59
Local air pollutants (kg)	**1,278**	**0**

Variable	ICE (petrol)	EV
SO_2	38	0
NOx	405	0
VOCs	810	0
PM_{10}	14	0
$PM_{2.5}$	11	0

Table 8. Total cost of ownership of an ICE and EV multi-purpose vehicle over a 10-year lifespan

Variable	ICE (petrol)	EV
Total cost of ownership (ZAR)	**1,681,065**	**2,098,188**
Capital cost	500,000	1,250,000
Maintenance cost	271,211	221,037
Insurance cost	153,224	383,061
Energy cost	756,629	244,090
Greenhouse gases (tonnes)	**74**	**79**
CO_2e (tonnes)	74	79
Local air pollutants (kg)	**1,846**	**0**
SO_2	55	0
NOx	585	0
VOCs	1,170	0
PM_{10}	20	0
$PM_{2.5}$	16	0

Table 9. Total cost of ownership of an ICE and EV bakkie (single-cab) over a 10-year lifespan

Variable	ICE (diesel)	EV
Total cost of ownership (ZAR)	**1,242,645**	**1,810,687**
Capital cost	390,000	1,100,000
Maintenance cost	271,211	221,037
Insurance cost	119,515	337,094
Energy cost	461,919	152,556
Greenhouse gases (tonnes)	**55**	**49**
CO_2e (tonnes)	55	49
Local air pollutants (kg)	**662**	**0**
SO_2	186	0
NOx	122	0
VOCs	100	0
PM_{10}	132	0
$PM_{2.5}$	122	0

Table 10. Total cost of ownership of an ICE and EV bakkie (double-cab) over a 10-year lifespan

Variable	ICE (diesel)	EV
Total cost of ownership (ZAR)	**1,632,480**	**2,002,354**
Capital cost	600,000	1,200,000
Maintenance cost	271,211	221,037
Insurance cost	183,869	367,738
Energy cost	577,399	213,579
Greenhouse gases (tonnes)	**68**	**69**
CO_2e (tonnes)	68	69
Local air pollutants (kg)	**828**	**0**
SO_2	233	0
NOx	153	0
VOCs	125	0

Variable	ICE (diesel)	EV
PM_{10}	165	0
$PM_{2.5}$	153	0

Table 11. Total cost of ownership of an ICE and EV bus (12m) over a 15-year lifespan

Variable	ICE (diesel)	EV
Total cost of ownership (ZAR)	**25,087,020**	**33,004,868**
Capital cost	4,500,000	11,250,000
Maintenance cost	10,794,655	7,613,723
Insurance cost	4,884,249	12,210,622
Energy cost	4,908,116	1,930,522
Greenhouse gases (tonnes)	**573**	**484**
CO_2e (tonnes)	573	484
Local air pollutants (kg)	**6,951**	**0**
SO_2	1,953	0
NOx	1,281	0
VOCs	1,050	0
PM_{10}	1,386	0
$PM_{2.5}$	1,281	0

Table 12. Total cost of ownership of an ICE and EV bus (18m) over a 15-year lifespan

Variable	ICE (diesel)	EV
Total cost of ownership (ZAR)	**34,224,878**	**39,509,600**
Capital cost	5,000,000	12,500,000
Maintenance cost	14,682,861	10,370,956
Insurance cost	5,426,944	13,567,358
Energy cost	9,115,073	3,071,286
Greenhouse gases (tonnes)	**1,065**	**770**
CO_2e (tonnes)	1,065	770
Local air pollutants (kg)	**12,909**	**0**
SO_2	3,627	0
NOx	2,379	0
VOCs	1,950	0
PM_{10}	2,574	0
$PM_{2.5}$	2,379	0

Table 13. Total cost of ownership of an ICE and EV light truck (<6t) over a 15-year lifespan

Variable	ICE (diesel)	EV
Total cost of ownership (ZAR)	**6,779,057**	**7,570,608**
Capital cost	500,000	2,000,000
Maintenance cost	3,107,014	2,193,254
Insurance cost	542,695	2,170,778
Energy cost	2,629,348	1,206,577
Greenhouse gases (tonnes)	**307**	**303**
CO_2e (tonnes)	307	303
Local air pollutants (kg)	**3,724**	**0**
SO_2	1,046	0
NOx	686	0
VOCs	563	0
PM_{10}	743	0
$PM_{2.5}$	686	0

Table 14. Total cost of ownership of an ICE and EV medium truck (6-12t) over a 15-year lifespan

Variable	ICE	EV
Total cost of ownership (ZAR)	**9,956,666**	**10,998,477**
Capital cost	650,000	2,600,000
Maintenance cost	4,394,206	3,101,887
Insurance cost	705,503	2,822,011
Energy cost	4,206,957	2,474,579
Greenhouse gases (tonnes)	**491**	**590**
CO_2e (tonnes)	491	590
Local air pollutants (kg)	**5,958**	**0**
SO_2	1,674	0
NOx	1,098	0
VOCs	900	0
PM_{10}	1,188	0
$PM_{2.5}$	1,098	0

Table 15. Total cost of ownership of an ICE and EV heavy truck (>12t) over a 15-year lifespan

Variable	ICE	EV
Total cost of ownership (ZAR)	**15,350,889**	**17,207,803**
Capital cost	1,000,000	4,000,000
Maintenance cost	5,903,327	4,167,182
Insurance cost	1,085,388	4,341,554
Energy cost	7,362,175	4,699,067
Greenhouse gases (tonnes)	**860**	**1,119**
CO_2e (tonnes)	860	1,119
Local air pollutants (kg)	**10,427**	**0**
SO_2	2,930	0
NOx	1,922	0
VOCs	1,575	0
PM_{10}	2,079	0
$PM_{2.5}$	1,922	0

6.2. Price and financial assumptions

Table 16. Price assumptions

Variable	Value	Unit	Notes
Petrol price	21.40	ZAR/lit	Price in January 2023.
Diesel price	21.23	ZAR/lit	Price in January 2023.
Petrol / diesel increase	6.5%	% p.a. (nominal)	Roughly tracked inflation between 2011 & 2021, but can be volatile.
Electricity (fleet charger)	2	ZAR/kWh	Average cost of electricity provided by in-house fleet charger, where applicable. Rates will differ, based on municipality.
Electricity (public charger)	6	ZAR/kWh	Average price payable at public chargers. Was R5.88/kWh in 2022. Source: https://www.chargestations.co.za/ChargeMap.aspx.
Electricity increase	13.0%	% p.a. (nominal)	Average 13% p.a. between 2008/09 & 2020/21. Source: Eskom (https://www.eskom.co.za/distribution/tariffs-and-charges/tariff-history/).
Carbon price	0	ZAR/tCO_2e	Default as zero unless entity is paying carbon tax.

Variable	Value	Unit	Notes
Carbon price increase	6.5%	% p.a. (nominal)	Carbon Tax Act indicates increase at CPI (inflation).

Table 17. Financial assumptions

Variable	Value	Unit	Notes
Discount rate	6.0%	% p.a.	Determines present value of future money. 6% usually used for government (private sector is higher).
CPI (inflation)	6.5%	% p.a.	See Stats SA CPI history for latest. Averaged 6.7% in Jan - Sep 2022.

6.3. Emissions assumptions

Table 18. Emissions assumptions

Variable	Value	Unit	Notes
Electricity grid emissions	0.9	kg CO_2e/kWh	Consumption-based scope 2 factor, excluding losses, including impacts of hydro import and REIPPPP, ranged between 0.89 & 0.96 over past 5 years. Source: SEA (https://www.cityenergy.org.za/local-electricity-emissions-factor-calculator/).
Grid emissions change	-0.03	% p.a.	Estimated reduction rates, based on range of IRP 2019 scenarios, from -2.1% p.a. (IRP5) to -4.1% p.a. (IRP1). Source: SEA.
Share of electricity from on-site / IPP renewables	0	%	Includes renewables purchased / generated that is not sourced through national grid electricity, e.g. rooftop PV, IPP purchased, etc.
Petrol CO_2e emissions	2.28	kg/lit	IPCC 2006 tier 1 default emissions factors of 2.28 for petrol, 2.73 for diesel. Fuel in SA may have slightly higher factor due to share of petrol & diesel produced from coal-to-liquids.
Diesel CO_2e emissions	2.73	kg/lit	
Petrol SO_2 emissions	1.7	g/lit	Cape Town State of Energy & Carbon 2021 Table A58 provides value of 1.7 g/lit for petrol, 9.3 g/lit for diesel
Diesel SO_2 emissions	9.3	g/lit	
Petrol NOx emissions	18	g/lit	Cape Town State of Energy & Carbon 2021 Table A58 provides value of 18.0 g/lit for petrol, 6.1 g/lit for diesel
Diesel NOx emissions	6.1	g/lit	
Petrol VOCs	36	g/lit	Cape Town State of Energy & Carbon 2021 Table A58 provides value of 36 g/lit for petrol, 5 g/lit for diesel
Diesel VOCs	5	g/lit	
Petrol PM_{10}	0.6	g/lit	Cape Town State of Energy & Carbon 2021 Table A58 provides value of 0.6 g/lit for petrol, 6.6 g/lit for diesel
Diesel PM_{10}	6.6	g/lit	
Petrol $PM_{2.5}$	0.5	g/lit	Cape Town State of Energy & Carbon 2021 Table A58 provides value of 0.5 g/lit for petrol, 6.1 g/lit for diesel
Diesel $PM_{2.5}$	6.1	g/lit	

6.4. Capital cost assumptions

Table 19. Capital cost assumptions

Capital costs (2022)	ZAR	Reference vehicle
Hatchback Petrol	R 265,000	VW Polo Vivo
Hatchback Diesel	R 360,000	N/A
Hatchback Electricity	R 900,000	BMW i3
Sedan Petrol	R 335,000	VW Polo 1.6
Sedan Diesel	R 450,000	N/A
Sedan Electricity	R 1,100,000	N/A
SUV Petrol	R 400,000	Toyota Corolla Cross
SUV Diesel	R 720,000	Toyota Fortuner
SUV Electricity	R 1,300,000	2022 BMW iX3
Bakkie Single-Cab Petrol	R 330,000	Toyota Hilux 2.0
Bakkie Single-Cab Diesel	R 390,000	Toyota Hilux 2.4 GD
Bakkie Single-Cab Electricity	R 1,100,000	N/A
Bakkie Double-Cab Petrol	R 510,000	N/A
Bakkie Double-Cab Diesel	R 600,000	Toyota Hilux 2.4 GD-6
Bakkie Double-Cab Electricity	R 1,200,000	Chevrolet Silverado
Multi-Purpose Vehicle Petrol	R 500,000	VW Caddy Kombi
Multi-Purpose Vehicle Diesel	R 700,000	Toyota Quantum
Multi-Purpose Vehicle Electricity	R 1,250,000	N/A
Panel Van Petrol	R 470,000	VW Caddy Cargo
Panel Van Diesel	R 630,000	VW Transporter
Panel Van Electricity	R 1,175,000	N/A
Bus 12m Diesel	R 4,500,000	N/A
Bus 12m Electricity	R 11,250,000	N/A
Bus 18m Diesel	R 5,000,000	N/A
Bus 18m Electricity	R 12,500,000	N/A
Light Truck (<6t) Diesel	R 500,000	Isuzu NMR 250 (5.5t)
Light Truck (<6t) Electricity	R 4,000,000	N/A
Medium Truck (6-12t) Diesel	R 650,000	Isuzu NQR 500 (8.5t)
Medium Truck (6-12t) Electricity	R 2,600,000	N/A
Heavy Truck (>12t) Diesel	R 1,000,000	Isuzu FSR 800 (14t)
Heavy Truck (>12t) Electricity	R 4,000,000	N/A

Notes

- *For vehicles purchased in a year beyond 2022, capital costs are increased according to CPI.*
- *Reference vehicle column notes the vehicle used as reference for capital costs in 2022. Generally this is based on a locally-manufactured/assembled vehicle, where possible.*
- *Tonnage for reference trucks is for gross vehicle mass, which excludes payload. Payload for reference vehicles is 2.5, 5 and 8 tonnes for light, medium and heavy trucks respectively.*

Sources/assumptions (general):

- *Vehicle capex:*
  - *https://www.autotrader.co.za/*
  - *https://www.engineeringnews.co.za/article/ev-revolution-to-be-felt-in-sa-in-2022-but-affordability-concerns-linger-2021-10-29/rep_id:4136*
  - *https://www.dailymaverick.co.za/article/2021-12-29-the-electric-vehicles-coming-to-south-africa-in-2022/*
  - *OEM websites*
- *Cars manufactured / assembled in SA:*
  - *https://www.hippo.co.za/blog/motor/the-best-cars-made-in-south-africa/*

Sources/assumptions (hatchback):

- *BMW i3 EV no longer available. Assumed price estimated off highest 2nd-hand value.*
- *No price for diesel hatchback. Assume price is 35% higher than petrol equivalent, based on petrol vs. diesel Toyota Hilux prices.*

Sources/assumptions (sedan):

- *No local value for electric sedan. Estimated as average of hatchback and SUV price.*
- *No price for mid-market diesel sedan. Assume price is 35% higher than petrol equivalent, based on petrol vs diesel Toyota Hilux prices.*

Sources/assumptions (bakkie):

- *No value for electric single-cab bakkie. Assume same as sedan EV.*
- *Double-cab petrol bakkie price estimated based on petrol vs diesel price for single-cabs.*
- *EV bakkie capex (incl. import duties, etc.):*
  - *https://mybroadband.co.za/news/motoring/433150-what-it-costs-to-import-an-electric-bakkie-to-south-africa.html*

Sources/assumptions (minibus/bus/panel van):

- *E-bus cost is 2 to 3 times that of ICE bus cost, as per communication with GABS (Golden Arrow Bus Services). Used a factor of 2.5 times, which is in line with findings as to the cost of an electric minibus taxi when compared to an ICE version (SEA, 2021). Used this factor for MPVs (multi-purpose vehicles, which will include minibuses), panel vans and buses.*
- *ICE bus prices extrapolated from 2017 CoJ Bus CBA model, increased by 5.5% (historic CPI average). Model:*
  - *https://www.cityenergy.org.za/municipal-fleet-costs-and-emissions-calculator/*

Sources/assumptions (trucks):

- *EV truck is 2.8 times cost of ICE truck in US market:*
  - *https://theicct.org/cost-electric-semi-feb22/*
- *Adding local taxes (VAT & import tax), results in costs 3.6 to 3.8 x higher, depending on import taxes. Therefore assume electric truck currently costs 4x ICE equivalent.*

Calculating the cost of an EV

A calculator to estimate the local price for an imported electric vehicle can be found in the total cost of comparison model. It is based on the following:

=EV Capex x (1 + Import Duties + Ad Valorem) + (EV Capex + EV Capex x Customs Mark-Up + EV Capex x Ad Valorem) x VAT

Where:

Table 20. Notes on variables used to calculate local cost of imported EV

Variable	Notes
EV capex (without local duties and taxes)	A good resource is the EV database (https://ev-database.org/). Look at retail prices that do not include country incentives, i.e. rather use prices from Germany & Netherlands, than those from UK. Convert this price into ZAR using the relevant exchange rate.
Mark-up for customs value of goods (%)	VAT on goods imported from countries other than Botswana, Lesotho, Namibia or Swaziland is calculated after the addition of a 10% mark-up, i.e. [(Customs Value + 10% thereof) + (any non-rebated duties levied on the goods)] x VAT rate = VAT payable. EVs unlikely to be imported from the countries mentioned, therefore most will have this mark-up.

Variable	Notes
Import duties (%)	**6.5. Ranges from free to 25% based on vehicle type, size and country of origin. See SARS vehicle import duties** Table 21 on SARS import duties further below for relevant rate. In general: cars, bakkies and panel vans at maximum 25%; buses, minibuses and trucks at maximum 20%. Lower rates for EU/UK or EFTA imports, free from SADC.
VAT	Standard VAT rate is 15%.
Ad valorem excise duty	"Luxury tax" on high-value items. Works on sliding scale with cars, based on value, up to a maximum of 30%. Set as 0% for trucks or use this calculation for other vehicles: *((0.00003 x vehicle capital cost without import duties and taxes)-0.75)/100* For any result above 30%, use 30%.

6.6. SARS vehicle import duties

Table 21. South African Revenue Service vehicle import duties as at December 2022

87.02.40 Motor vehicles for the transport of ten or more persons, including the driver, with only electric motor for propulsion	
Vehicle mass <2000 kg	
SADC[16]	Free
EU/UK & EFTA[17]	20%
Other	25%
>2000 kg (minibuses & buses will be in this category)	
SADC	Free
EU/UK & EFTA	15%
Other	20%
87.03.80 Motor cars and other motor vehicles principally designed for the transport of persons (excluding those of heading 87.02), including station wagons and racing cars, with only electric motor for propulsion:	
Ambulances	
UK/EU, SADC, EFTA	Free
Other	20%
Other passenger vehicles (cars & MPVs will be included here)	
SADC	Free
Other	25%
87.04.60 Motor vehicles for the transport of goods, with only electric motor for propulsion:	
Mass <2000 kg or GVM <3500 kg, or mass <1600 kg or a GVM <3500 kg per chassis fitted with cab (bakkies and panel vans will likely fall within this category)	
SADC	Free
EU/UK	18%
EFTA	20%
Other	25%
Other (will include trucks)	
SADC	Free

[16] Southern African Development Community: Angola, Botswana, Comoros, DRC, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Tanzania, Zambia, Zimbabwe

[17] European Free Trade Association: Iceland, Liechtenstein, Norway and Switzerland

EU/UK	12%
EFTA	15%
Other	20%
87.05 Special purpose motor vehicles (for example, breakdown lorries, crane lorries, fire fighting vehicles, concrete-mixer lorries, road sweeper lorries, spraying lorries, mobile workshops, mobile radiological units)	
All regions	Free

6.7. Vehicle mileage and lifespan assumptions

Table 22. Vehicle mileage and lifespan assumptions

Vehicle type	km p.a.	Lifespan
Hatchback	24,000	10
Sedan	24,000	10
SUV	24,000	10
Bakkie Single-Cab	25,000	10
Bakkie Double-Cab	25,000	10
Multi-Purpose Vehicle	25,000	10
Panel Van	25,000	10
Bus 12m	40,000	15
Bus 18m	40,000	15
Light Truck (<6t)	50,000	15
Medium Truck (6-12t)	60,000	15
Heavy Truck (>12t)	70,000	15

Sources:

- *Merven, B., Stone, A., Hughes, A. (2012), Quantifying the energy needs of the transport sector for South Africa: A bottom-up model. Available at: https://open.uct.ac.za/bitstream/handle/11427/16905/Merven_Quantifying_energy_needs_2012.pdf?sequence=1&isAllowed=y.*
- *Braun, M. (2019), Truck Operating Benchmarks 2019. Available at: https://fleetwatch.co.za/wp-content/uploads/2019/09/pg-61-65.pdf.*

6.8. Energy use assumptions

Table 23. Energy use assumptions

Energy use	lit/100km or Wh/km
Hatchback Petrol	7.0
Hatchback Diesel	6.0
Hatchback Electricity	160.0
Sedan Petrol	8.0
Sedan Diesel	7.0
Sedan Electricity	180.0
SUV Petrol	11.0
SUV Diesel	10.0
SUV Electricity	200.0
Bakkie Single-Cab Petrol	9.0
Bakkie Single-Cab Diesel	8.0

Energy use	lit/100km or Wh/km
Bakkie Single-Cab Electricity	250.0
Bakkie Double-Cab Petrol	11.0
Bakkie Double-Cab Diesel	10.0
Bakkie Double-Cab Electricity	350.0
Multi-Purpose Vehicle Petrol	13.0
Multi-Purpose Vehicle Diesel	12.0
Multi-Purpose Vehicle Electricity	400.0
Panel Van Petrol	9.0
Panel Van Diesel	8.0
Panel Van Electricity	300.0
Bus 12m Diesel	35.0
Bus 12m Electricity	1,100.0
Bus 18m Diesel	65.0
Bus 18m Electricity	1,750.0
Light Truck (<6t) Diesel	15.0
Light Truck (<6t) Electricity	570.0
Medium Truck (6-12t) Diesel	20.0
Medium Truck (6-12t) Electricity	940.0
Heavy Truck (>12t) Diesel	30.0
Heavy Truck (>12t) Electricity	1,530.0

Sources/assumptions:

- *Real-world (not stated) usage for most ICE vehicles from Fuelly. Link:*
  - *https://www.fuelly.com/*
- *EV electricity usage from EV Database:*
  - *https://ev-database.org/*
- *EV bakkie (D/C) based on Ford F-150 Lightning specs (320 Wh/km). Assume real-world is higher. Assume S/C lower, somewhere between SUV and D/C.*
- *ICE bus values from report: Business Parameters for MyCiTi Trunk Vehicles:*
  - *https://www.salga.org.za/Documents/Knowledge-products-per-theme/Built%20Environment/PEER%20LRNING%20BRT%20MANG%206%20JUN%2018%20CoCT%20Business%20Parameters%20inform%20trunk%20vehicle%20selection%20Nov%202015.pdf*
- *12m e-bus real-world value from GABS: 1100 Wh/km.*
- *18m e-bus usage real-world findings, with air-con: 1650-1840 Wh/km. Source:*
  - *https://www.sustainable-bus.com/news/electric-bus-range-focus-on-electricity-consumption-a-sum-up/*
- *ICE heavy truck fuel use based on FleetWatch benchmark for vehicle of similar payload (8 tonnes). Source:*
  - *https://fleetwatch.co.za/wp-content/uploads/2019/09/pg-61-65.pdf*
- *ICE light and medium truck based on reference vehicle (Isuzu NMR/NPR and NQR) real-world fuel use on Fuelly:*
  - *https://www.fuelly.com/truck/isuzu/*
- *Electric truck energy use based on: each 100 kg vehicle mass increases the energy consumption by some 0.4–1.3 kWh/100 km (source in below link) & assumptions of 5.5t, 8.5t & 14t GVM & half of max 2.5t, 5t & 8t payloads for light, medium, heavy trucks respectively.*
  - *https://enveurope.springeropen.com/articles/10.1186/s12302-020-00307-8#Sec9*

6.9. Maintenance assumptions

Table 24. Maintenance cost assumptions

Maintenance costs (2022)	ZAR/km
Hatchback Petrol / Diesel	R 0.20
Hatchback Electricity	R 0.14
Sedan Petrol / Diesel	R 0.20
Sedan Electricity	R 0.14
SUV Petrol / Diesel	R 0.80
SUV Electricity	R 0.56
Bakkie Single-Cab Petrol / Diesel	R 0.80
Bakkie Single-Cab Electricity	R 0.48
Bakkie Double-Cab Petrol / Diesel	R 0.80
Bakkie Double-Cab Electricity	R 0.48
Multi-Purpose Vehicle Petrol / Diesel	R 0.80
Multi-Purpose Vehicle Electricity	R 0.48
Panel Van Petrol / Diesel	R 1.40
Panel Van Electricity	R 0.84
Bus 12m Diesel	R 6.08
Bus 12m Electricity	R 2.43
Bus 18m Diesel	R 8.27
Bus 18m Electricity	R 3.31
Light Truck (<6t) Diesel	R 1.40
Light Truck (<6t) Electricity	R 0.56
Medium Truck (6-12t) Diesel	R 1.65
Medium Truck (6-12t) Electricity	R 0.66
Heavy Truck (>12t) Diesel	R 1.90
Heavy Truck (>12t) Electricity	R 0.76

Notes:

- *Represents costs in first year after new vehicle purchased. For maintenance costs in the first year of a new vehicle purchased in a year beyond 2022, maintenance costs are increased according to CPI.*

Sources/assumptions (ICE):

- *Service costs for hatchback & sedan:*
  - *https://www.mechanicbuddy.co.za/*
  - *https://www.michanic.co.za/*
- *Panel van and trucks source: Fleetwatch benchmarks:*
  - *https://fleetwatch.co.za/wp-content/uploads/2019/09/pg-61-65.pdf*
- *Assume ICE SUV, MPV & bakkie service costs as an average of panel van and hatchback/sedan.*
- *Bus maintenance values from 2017 CoJ Bus CBA model, increased using average historic inflation (5.5%). Model:*
  - *https://www.cityenergy.org.za/municipal-fleet-costs-and-emissions-calculator/*
  - *Note that Metrobus Integrated Annual Reports (2021/22 & 2017/18) provides a much higher maintenance figure for an 18m bus (R11.50/km).*

Sources/assumptions (EV):

- *EV car maintenance as 72% share of ICE. Source:*
  - *https://www.chargedfuture.com/typical-ev-maintenance-schedule/*
- *EV car maintenance is 25-30% lower than ICE; light duty vehicle as 40% lower, bus as 40-60% lower. Sources:*
  - *https://www.caranddriver.com/shopping-advice/a32494027/ev-vs-gas-cheaper-to-own/*
  - *https://publications.anl.gov/anlpubs/2021/05/167399.pdf*

- *GABS real-world findings to date indicates EV bus as 70% lower.*
- *First EV truck in KZN showing 70% reduction in maintenance costs. Source:*
    - *https://kznindustrialnews.co.za/electric-vehicles-are-cheaper-to-run/*
- *Used 30% lower maintenance assumption for hatchback, sedan and SUV; 40% lower for bakkies, panel vans and MPVs; 60% lower for buses and trucks.*

Table 25. Maintenance cost increase assumptions

Vehicle type	% p.a. (real, excluding CPI)
Hatchback, Sedan & SUV	10%
Bakkie, Multi-Purpose Vehicle, Panel Van	13%
Bus & Truck	21%

Notes:

- *CPI added to above figures to obtain nominal cost increase.*

Assumptions

- *ICE light duty fleet: 10-11% p.a. real.*
- *EV light duty fleet: 10% p.a. for first 9 years (before battery replacement). Average lifespan of SA govt fleet is 9 years, therefore assume battery won't be replaced during vehicle lifespan.*
- *Medium duty: 13% p.a. real. Assume EV same.*
- *ICE transit bus 21% p.a. real. Assume EV same. Assume trucks (ICE & EV) the same.*

Source:

- *Argonne (2021), Comprehensive Total Cost of Ownership Quantification for Vehicles with Different Size Classes and Powertrains. Link: https://publications.anl.gov/anlpubs/2021/05/167399.pdf.*

6.10. Insurance assumptions

Table 26. Annual insurance as a share of the capital cost value of a new vehicle

Annual insurance as a share of the capital cost value of a new vehicle	%
Hatchback, Sedan, SUV, Bakkie, Multi-Purpose Vehicle, Panel Van	3%
Bus, Truck	7%

Notes:

- *Above is used to calculate insurance value in first year of new vehicle ownership.*

Sources/assumptions:

- *Sum of annual insurance premiums for new ICE car (hatchback, sedan, SUV) roughly 4% of car value (source: Hippo).*
- *Sum of annual insurance premiums for EV car (hatchback, SUV) in SA roughly 2.5-4% for new or used, with low excess. Source: Naked Insurance (BusinessTech article):*
    - *https://businesstech.co.za/news/motoring/570842/how-much-it-costs-to-insure-an-electric-vehicle-in-south-africa/*
- *FleetWatch benchmarks for trucks indicates annual insurance as 7% of vehicle capex:*
    - *https://fleetwatch.co.za/wp-content/uploads/2019/09/pg-61-65.pdf*
- *Assumed 3% for hatchback, sedan, SUV, bakkie, MVP and 7% for bus and truck.*

Table 27. Monthly insurance cost assumptions

Insurance costs	R/month
Hatchback Petrol	R 662.50
Hatchback Diesel	R 900.00
Hatchback Electricity	R 2,250.00
Sedan Petrol	R 837.50
Sedan Diesel	R 1,125.00
Sedan Electricity	R 2,750.00
SUV Petrol	R 1,000.00
SUV Diesel	R 1,800.00
SUV Electricity	R 3,250.00
Bakkie Single-Cab Petrol	R 825.00
Bakkie Single-Cab Diesel	R 975.00
Bakkie Single-Cab Electricity	R 2,750.00

Insurance costs	R/month
Bakkie Double-Cab Petrol	R 1,275.00
Bakkie Double-Cab Diesel	R 1,500.00
Bakkie Double-Cab Electricity	R 3,000.00
Multi-Purpose Vehicle Petrol	R 1,250.00
Multi-Purpose Vehicle Diesel	R 1,750.00
Multi-Purpose Vehicle Electricity	R 3,125.00
Panel Van Petrol	R 1,175.00
Panel Van Diesel	R 1,575.00
Panel Van Electricity	R 2,937.50
Bus 12m Diesel	R 26,250.00
Bus 12m Electricity	R 65,625.00
Bus 18m Diesel	R 29,166.67
Bus 18m Electricity	R 72,916.67
Light Truck (<6t) Diesel	R 2,916.67
Light Truck (<6t) Electricity	R 11,666.67
Medium Truck (6-12t) Diesel	R 3,791.67
Medium Truck (6-12t) Electricity	R 15,166.67
Heavy Truck (>12t) Diesel	R 5,833.33
Heavy Truck (>12t) Electricity	R 23,333.33

Notes:

- *Calculated based on vehicle capital cost and annual insurance value as share of vehicle capital costs.*

Sources/assumptions:

- *Most claims are from accident damage. Parts / labour / paint costs increase over time. Therefore, reduced vehicle value has little bearing on premium price (source: MiWay). Defaults therefore assume insurance value grows with inflation (CPI).*

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For any enquiries, please get in touch via email at info@sustainable.org.za or communications@ukpact.co.uk