E-MOBILITY ROADMAP FOR KAMPALA

This project has received funding from the European Union Horizon 2020 research and innovation Programme under grant agreement no. 875041

PROJECT PARTNERS

ABOUT

The roadmap to scale the adoption of e-mobility in Kampala

TITLE

E-mobility Roadmap for Kampala

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DISCLAIMER

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All the other pictures are provided by the SOL+ partners

June, 2024

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Purpose	The roadmap to scale the adoption of e-mobility in Kampala
Publication date	30 June 2024
Coordination	Kampala Capital City Authority (KCCA)
SOLUTIONS plus partners	Institute for Transportation and Development Policy (ITDP), Urban Electric Mobility Initiatives (UEMI), United Nations Environment Programme (UNEP), United Nations Human Settlements Program (UN-Habitat), Kampala Capital City Authority (KCCA)
Contributors	Dorica Mugusi, Shauri Shau
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Abbreviations

AC	Alternating Current
BRT	Bus Rapid Transit
CAPEX	Capital Expenditure
DC	Direct Current
EOL	End of Life
ESS	Energy Storage Systems
EURIST	European Institute for Sustainable Transport
EV	Electric Vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	German Development Agency
GKMA	Greater Kampala Metropolitan Area
ICE	Internal Combustion Engine
ITDP	Institute for Transportation & Development Policy
KCCA	Kampala Capital City Authority
KMC	Kiira Motors Corporation
kWh	Kilowatt Hour
LEV	Low Emission Vehicles
LRT	Light Rail Transit
MEMD	Ministry of Energy and Mineral Development
MFPED	Ministry of Finance, Planning and Economic Development
MoWT	Ministry of Works and Transport
MWE	Ministry of Water and Environment
MW	Megawatt
NDC	Nationally Determined Contribution
NMT	Non-Motorised Transit
STI	Science, Technology and Innovation Secretariat
TCO	Total Cost of Operation
TUMI	Transformative Urban Mobility Initiative
UBS	Uganda Bureau of Standards
UEDCL	Uganda Electricity Distribution Company Limited
UETCL	Uganda Electricity Transmission Company Limited
UN-Habitat	United Nations Human Settlements Program
UEMI	Urban Electric Mobility Initiative
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNRA	Uganda National Roads Authority
URA	Uganda Revenue Authority
USD	United States Dollar
VAT	Value Added Tax

Executive summary

Kampala, the capital city of Uganda, is grappling with severe air pollution, currently ranking as the 5th most polluted city in Africa and among the top 15 globally. In response, the Ugandan government is committed to transitioning to electric mobility (e-mobility) by 2030 as outlined in its Updated Nationally Determined Contribution (NDC) under the Paris Agreement. This report presents an e-mobility roadmap for Kampala, developed by the Kampala Capital City Authority (KCCA) and SOLUTIONSplus. The roadmap aims to enhance urban transport efficiency and reduce emissions by accelerating the adoption of electric vehicles (EVs).

At present, Kampala's transport system relies heavily on internal combustion engine (ICE) vehicles, exacerbating air pollution. However, initiatives are underway, including pilot projects for battery electric buses (BEBs), electric motorcycles, pedal-assist bicycles, and electric cars. The city is also advancing in developing charging infrastructure and local EV manufacturing.

Significant barriers to e-mobility include the following:

- High upfront costs: EVs have higher initial costs compared to ICE vehicles, mainly due to expensive batteries.
- Charging infrastructure: Lack of standardised connectors and voltage levels complicates the development of a cohesive charging network.
- Grid Instability: Frequent power outages and limited grid capacity pose challenges for reliable EV charging.
- Public Awareness: A significant gap in public knowledge about EV benefits affects adoption rates.

Uganda is supporting e-mobility and a broader agenda of supporting efficient urban mobility through various policies and strategies, including Uganda Vision 2040, the Updated NDC, and the Kampala Climate Change Action Strategy. Building on these initiatives, the roadmap recommends the following actions:

- Scale the deployment of electric buses: In line with the Updated NDC, deploy 200 BEBs by 2030, develop charging infrastructure at government-owned depots, and provide training for drivers and maintenance personnel. Offer subsidies and tax incentives.
- Advance electric bicycles: Expand pilot projects, develop safe cycle networks, encourage buildings to offer charging points, and offer incentives to promote adoption.
- Expand the use of electric motorcycles: Support battery-swapping networks and provide incentives for local manufacturing.
- Facilitate the use of electric cars: Encourage use through incentives, develop standardised charging infrastructure, integrate EVs into government and private fleets, and raise public awareness.
- Improve the electrical grid: Invest in transmission upgrades and explore sustainable energy sources for reliable charging solutions.
- Increase public awareness: Launch educational campaigns to raise awareness about e-mobility benefits and the use of e-vehicles.

The shift to e-mobility is essential for reducing air pollution, and the transition can catalyse actions to address Kampala's urban mobility challenges. This roadmap outlines the steps needed to accelerate EV adoption, develop infrastructure, and implement supportive policies, positioning Kampala as a leader in sustainable urban transport.

1 Introduction

The Kampala Capital City Authority (KCCA) recently reported that pollution levels in the city are five to seven times higher than the World Health Organization's recommended standards, and that vehicle emissions are one of the primary sources of air pollution (Nafula, 2023). According to KCCA, over 2.5 million people commute to the city centre every day (Oketch, 2021). This commuting could involve nearly 50,000 vehicles burning over 140,000 litres of fuel daily, as estimated by the Uganda National Environment Authority (Nafula, 2023).

To reduce transport sector emissions, Uganda's Nationally Determined Contribution (NDC) calls for a shift to cleaner fuels and vehicles (Ministry of Water and Environment, 2022). Planned mitigation actions in the transport sub-sector include introducing 200 battery electric buses (BEBs) in Kampala by 2030. A shift to electric vehicles could mitigate greenhouse gas emissions substantially, considering that 90 percent of electricity generated in the country comes from hydropower (International Energy Agency, 2021). The updated NDC projects that technology improvements and modal shift could have a combined effect of reducing emissions by 2.8 MtCO2e by 2030 (ibid).

The Ugandan government is committed to transitioning to e-mobility. In August 2022, the President of Uganda recommended shifting from petrol to electric vehicles, including cars, buses, motorcycles, and trains. The President envisions a full transition to electric vehicles (EVs) and clean energy within 20 years (STI, 2023).

To advance this goal, KCCA in partnership with the SOLUTIONSplus team has prepared an e-mobility roadmap for Kampala. This roadmap outlines a pathway for stakeholders to accelerate the transition to electric mobility in Kampala. The methodology involved a desktop review of existing studies and interviews with industry stakeholders. The team collected information on the current status of e-mobility initiatives for various vehicle types, including buses, motorcycles, bicycles, and cars. Based on this assessment, the study provides recommendations on steps the government can take to enhance readiness for e-mobility.

2 Methodology

The study team began by reviewing existing policy documents and transport plans, including the following

- Uganda Vision 2040
- Multi-Modal Urban Transport Master Plan for Greater Kampala Metropolitan
- Updated Nationally Determined Contribution
- National E-Mobility Strategy
- Kampala Climate Change Action Strategy
- Feasibility study on scaling up e-buses in Kampala.
- RFP for the procurement of BEBs under the gross cost contract in GKMA
- Fiscal policy on EV tax exemption

The team interviewed the following government and private sector stakeholders playing a role in e-mobility and conducted site visits to observe existing EVs fleets, map charging points, confirm operations and charging strategies, and obtain information on future plans. Following the stakeholder engagements and review of policies, SOLUTIONSplus analysed the existing situation and formulated scale-up strategies.

Table 1: Key informant interviews

Entity	Topics covered
KCCA	• Existing e-mobility initiatives in Kampala • Policies to support transition to e-mobility • Coordination among government bodies
Ministry of Works and Transport (MoWT)	• Uganda e-mobility policy • Land-use and structural plans to accommodate e-mobility infrastructure • Collaboration with entrepreneurs • Efforts to close the knowledge and awareness gap
Ministry of Energy and Mineral Development (MoEMD)	• Energy policy support to the e-mobility transition • Plans to develop electric vehicle charging infrastructure • Cost of charging infrastructure • Partnerships with the private sector to implement charging stations
Science, Technology and Innovations secretariate (STI)	• Status of the national e-mobility strategy • Actions to scale e-mobility • Efforts to close the knowledge and awareness gap
Total Energies	• Existing and planned charging facilities

Entity	Topics covered
E-mobility start-ups: FABIO, ZEMBO, SOLEIL power, Green Hub, WATU, GOGO Electric, Total Energies	• Number of electric vehicles imported/manufactured/assembled • Number of charging points • Financing models • Charging strategies • Battery technology

3 Where are we now?

3.1 Urban mobility context in Kampala

Kampala is the capital and the largest city in Uganda with a population of about 3.5 million and an annual growth rate of 3.9 percent (Ernston & Mukwaya, 2021). Kampala is the country's economic hub, accounting for 65 percent of the country's industrial and commercial activity (ibid). Out of daily trips in the city, 46 percent of residents walk, 22 percent use public transport, 17 percent use boda bodas (motorcycle taxis), 13 percent use private cars, and 2 percent use other means (Kampala Capital City Authority, 2018).

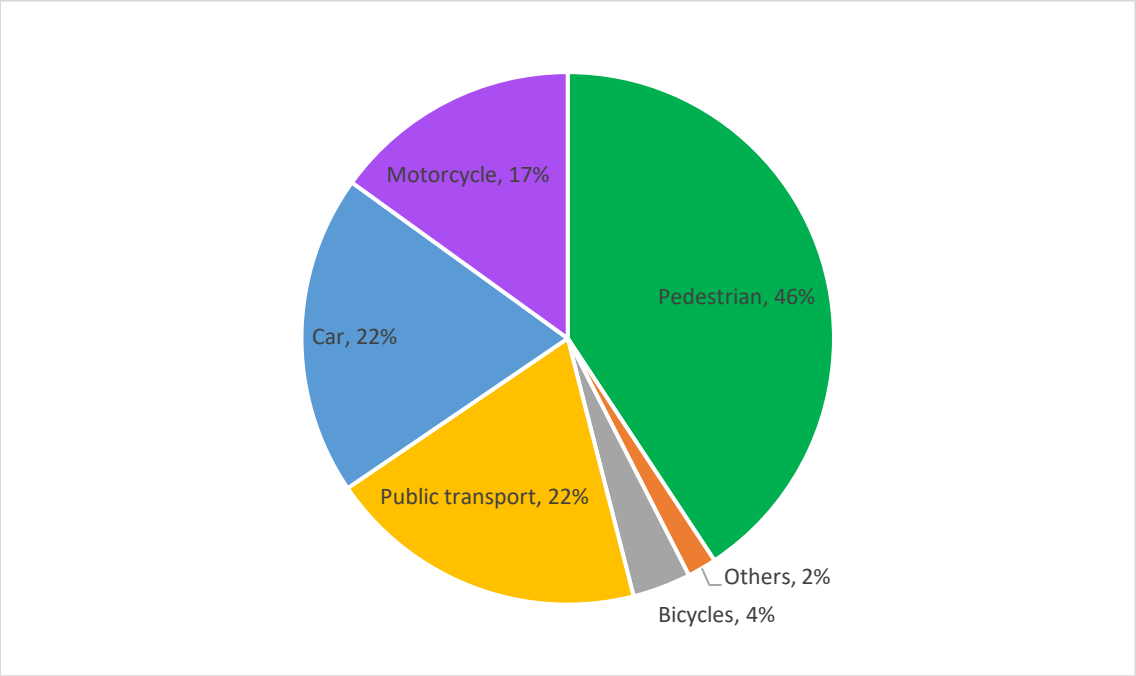

Figure *1*: Modal split (Kampala Capital City Authority, 2018)

Public transport in Kampala predominantly consists of 14-seat minibuses, locally called "taxis." As of 2018, there were 21,000 registered taxis in Kampala (Kampala Capital City Authority, 2018). The public transport system is characterised by overcrowding, unreliability, unsafe conditions, and reckless driving. Recent road infrastructure investments have prioritised private cars, neglecting public transport and non-motorised transport (NMT). Congestion is becoming more severe, especially during peak hours. Public transport is unregulated, with minibuses stopping wherever they want to pick up passengers. The poor quality of public transport has contributed to the proliferation of boda bodas as an alternative means of transport. KCCA estimates that over 200,000 boda bodas were operating in Kampala in 2018 (IGC, 2021).

To improve the mobility system, KCCA developed a transport master plan that calls for the introduction of bus rapid transit (BRT), metro, and light rail transit (LRT) (Kampala Capital City Authority, 2018).

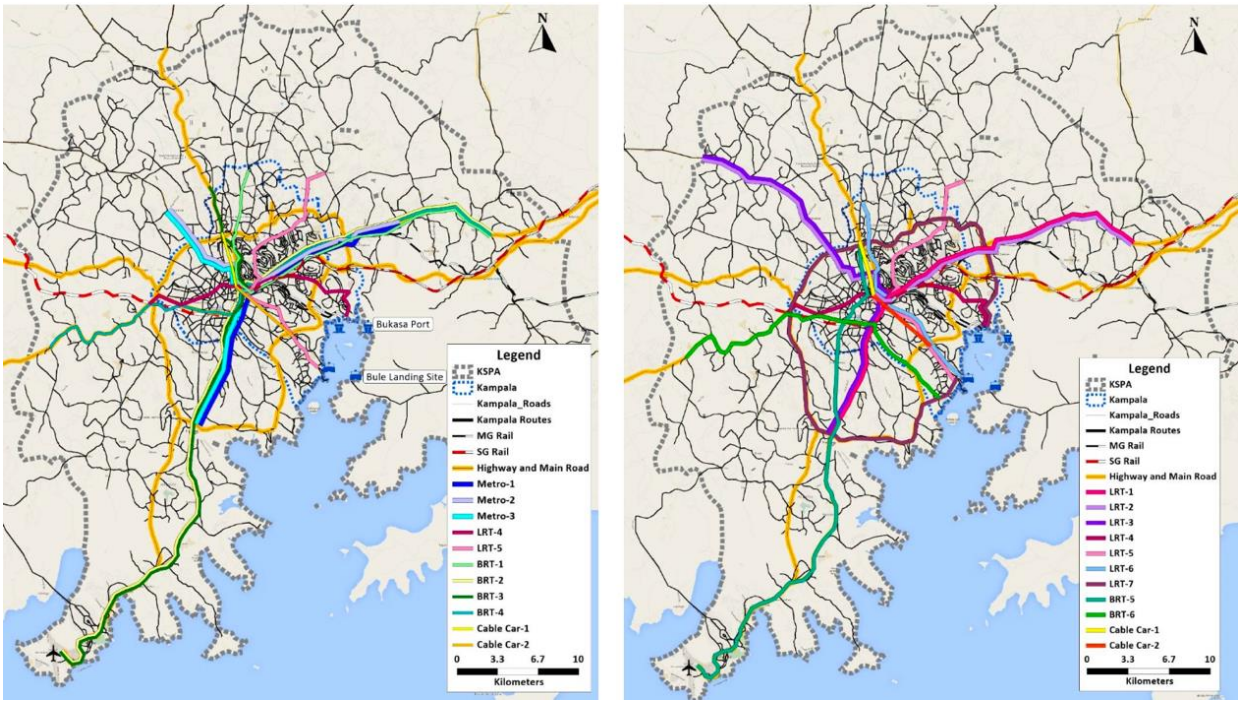

Figure 2: Proposed public transport systems: 2040

The government conducted a feasibility study for a first-phase BRT network in 2014. KCCA is currently reviewing the BRT designs and mobilising funds for implementation. The BRT network will include on three radial routes connecting Bwaise, Kireka, and Zana. The project will include dedicated BRT lanes, a fleet of high-capacity buses, station stops with level boarding, and junction modifications to maintain priority for buses.

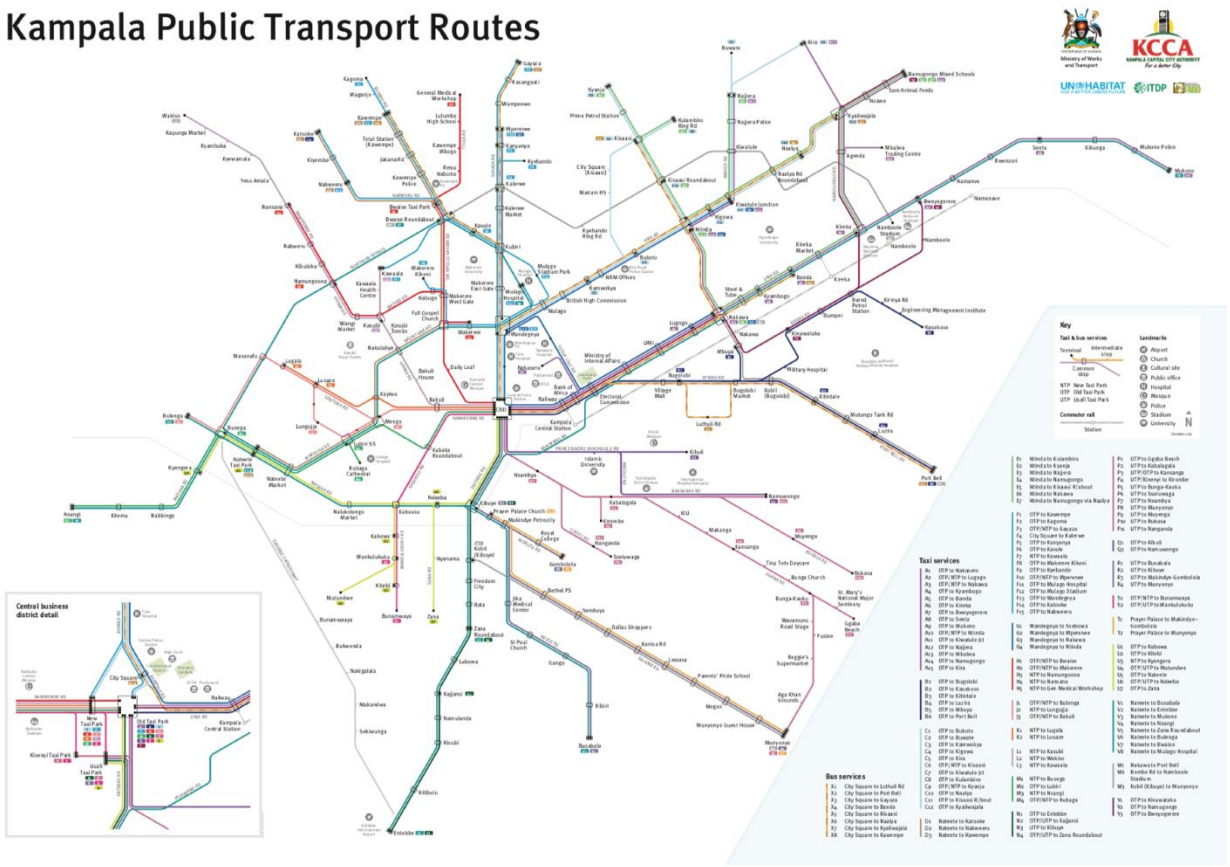

Figure 3: Kampala public transport network

The transport sector has a large number of stakeholders, as listed below.

Table 2: Agencies relevant to transport planning in Uganda (LEDS GP, 2018)

S/N	State agency	Overview
1	Ministry of Works and Transport	Plan, develop and maintain efficient and effective transport infrastructure.
2	National Planning Authority	Prepare developments plans for the country
3	Ministry of Kampala Capital City and Metropolitan Affairs	Coordinate the development and planning of Kampala City and the metropolitan area
4	Science, Technology and Innovation Secretariate (STI) – Office of the President	Spearheading technology and innovation in all sectors in Uganda. In Transport sector

S/N	State agency	Overview
		spearheading manufacturing and development of electric mobility.
5	Kampala Capital City Authority	Plans and implements public services and manages city development. Designated as the nodal entity for the BRT planning process.
6	Uganda National Roads Authority	Develops and operates the national road network.
7	Uganda Road Fund	Provides funding for road maintenance and facilitates supervision by relevant ministries.
8	Ministry of Finance Planning and Economic Development	Responsible for budgeting.
9	Ministry of Local Government	Establishes standards and regulations for local governments and monitors compliance.
10	Uganda Police Force	Enforces road transport laws and regulations and records traffic crash data.
11	Uganda Railways Corporation	Constructs and operates passenger and freight railway networks.
12	Civil Aviation Authority	Coordinates and promotes civil aviation.
13	Uganda Revenue Authority	Registers all vehicles and maintains a central registry.

3.2 Current policy frameworks

3.2.1 Uganda Vision 2040

The Government of Uganda developed the Uganda Vision 2040 to guide the transition to a competitive upper middle-income country. One of the objectives is to facilitate local production in the transport and automobile sectors. To support that, the vision emphasises the importance of generating and distributing adequate and reliable electricity to facilitate industrialisation. In 2010, the population in Uganda with access to electricity stood at 11 percent, and the government planned to increase access to 80 percent by 2040. Vision 2040 estimates that Uganda will require 41,738 MW by 2040. To improve access and availability, government plans to provide incentives to lower the cost of electricity infrastructure, facilities, and equipment (National Planning Authority, 2010).

3.2.2 Multi Modal Urban Transport Master Plan for GKMA

KCCA developed the Multi Modal Urban Transport Master Plan for GKMA with support from the World Bank under the second phase of the Kampala Institutional and Infrastructural Development Project (KIIDP). One of the goals of the Master Plan is to reduce greenhouse gas (GHG) emissions in the transport sector. The Plan proposed the following measures:

- Introduce one to two electric bus routes for immediate operation as part of the bus network.
- Promote pedal-assist electric bicycles.
- Allocate areas along the roads for electric charging stations and reserve parking spaces near these stations for electric vehicles.
- Allocate on-street parking spaces for electric vehicles.
- Introduce a low-emissions zone (LEZ) in the city centre, where every high-emissions vehicles will pay a fee to drive inside the zone while low-emissions vehicles will be exempted.

3.2.3 Updated Nationally Determined Contribution

The Updated Nationally Determined Contribution (NDC) for Uganda is aligned with Vision 2040. It sets out mitigation and adaptation actions to achieve the objectives of the Paris Agreement. If the country continues under the business as usual, GHG emissions will more than double to 9.6 MtCO2e by 2030. However, if all proposed mitigation actions are implemented, emissions could fall by 29 percent by 2030 (Ministry of Water and Environment, 2022). Some of the transport mitigation measures include introduction of at least 200 e-buses in GKMA, implementation of 101 km of BRT, and construction of at least 100 km of NMT infrastructure by 2030 (Ministry of Water and Environment, 2022).

3.2.4 National E-Mobility Strategy

The Science, Technology and Innovation Secretariate (STI) – Office of the President led the development of the National E-mobility Strategy, working with the Ministry of Energy and Mineral Development, Ministry of Works and Transport, and Ministry of Finance, Planning, and Economic Development amongst other bodies. The vision of the strategy is to have public transport vehicles and motorcycles transition to electric propulsion by 2030 and to have passenger vehicles transition by 2040. The strategy also aims to position Uganda as a net source rather than a consumer of e-mobility products (STI, 2023).

Therefore, the key priorities include the following:

- Electrify public transport systems.
- Increase local manufacturing and supply of the electric buses and motorcycles and their associated vehicle parts.
- Promote local manufacturing of EV batteries.
- Develop a network of EV charging infrastructure.
- Develop human capital to support the transition to e-mobility.

- Development of standards, regulations, guidelines, and a code of practice for the e-mobility industry.

3.2.5 Kampala Climate Change Action Strategy

In 2016, KCCA prepared the Kampala Climate Action Strategy to mainstream climate change activities and put the city on a path toward lower carbon emissions. KCCA estimated that if the city continues BAU, emissions will increase by 55 percent from 9.1 million tonnes CO_2e in 2020 to 14.6 million tonnes by 2030. The main contributing sectors to emissions are transport, household, freight, waste, tertiary, and industrial sectors. To reduce transport emissions, KCCA recommended the following targets (KCCA, 2016):

- Replace 40 percent of 14-passenger taxis with buses.
- Shift 50 percent of motorists to public transport.
- Construct 25 km of NMT facilities.
- Transition 15 percent of new vehicles to cleaner fuels.
- Establish alternative fuel dispensing/charging stations.
- Incentivise 200,000 motorists to use car sharing systems annually.

3.2.6 Feasibility study on Scaling Up E-buses in Kampala

KCCA and ITDP with support from the Transformative Urban Mobility Initiative (TUMI) conducted a study to explore the feasibility of scaling the public transport fleet with battery electric buses (BEBs) (ITDP, 2023). The study recommends starting the transition to BEBs with a small-scale demonstration project. The study included a review of the constraints to the adoption of BEBs, analysis of public transport routes, assessment of energy requirements, development of a charging strategy, and evaluation of total cost of ownership (TCO) of BEBs and conventional buses.

The study established that the TCO of BEBs would be 14 percent lower compared to ICE buses over the lifetime of both types of buses (ibid). The study identified seven routes to pilot BEBs and the necessary supporting infrastructure, including the number of chargers and energy requirement.

The study noted that the transition to BEBs is dependent on how well the city engages with the existing public transport industry. It emphasised that it is not feasible to simply add BEBs to the current operations. Instead, KCCA should work with the industry to consolidate and formalise existing operations. The government should also provide critical infrastructure, including depots with charging equipment and BRT infrastructure on high-demand corridors.

To improve the readiness of supply of BEBs, KCCA and ITDP prepared a request for proposals for the supply and operation of 134 e-buses on 7 corridors in GKMA. The RFP includes qualification criteria, scoring criteria, the scope of work for the operator, and detailed specifications for the electric buses to be operated (ITDP, 2023).

Figure 4: Routes selected for the pilot BEB operations in Kampala (ITDP, 2023)

3.2.7 Fiscal policies

In February 2024, Uganda Revenue Authority revised the taxes applicable to electric vehicles, equipment, and accessories (URA, 2024). This strategic move is expected to reduce the cost of EVs, giving them a 25 percent cost advantage over ICE vehicles (Nile Post, 2023). The new rates are listed in the appendix of this report.

4 Demonstration projects

This section highlights ongoing electric mobility initiatives in Kampala.

4.1 Battery electric buses

Kiira Motors Corporation (KMC), a state-owned enterprise, has begun assembling battery electric buses (BEBs) in Uganda (KMC, 2024). The company's Kayoola EVS is a 12 m low-entry BEB designed for urban use. The BEB has a capacity of 90 passengers (49 seated and 41 standing). With a battery capacity of 560 AH, the bus is expected to cover a range of approximately 300 km on a full charge (KMC, 2024). Currently, there are four Kayoola BEBs operating in Kampala. The company has established the Kiira Vehicle Plant at the Jinja Industrial and Business Park, which will have a capacity to produce 5,000 vehicles in a year. The company plans to scale from five BEBs to over 20 BEBs by the end of the 2023/2024 financial year (STI, 2023).

Figure 5: Kayoola EVS 12-meter BEB. Source: KMC.

4.2 Electric bicycles

Following are companies that assemble and sell pedal-assist electric bicycles in Kampala.

4.2.1 FABIO

Based in Jinja, the First African Bicycle Information Organization (FABIO) is a non-governmental organisation (NGO) established in 1997 to promote equitable and sustainable transport solutions through the use of bicycles. In 2017, FABIO partnered with the European Institute for Sustainable Transport (EURIST) to develop a pedal-assist electric bicycle for African conditions, known as the AfricroozE. The bicycle can travel up to 40 km on a charge with a load of 120 kg (FABIO, 2024). In Uganda, FABIO has

supplied about 200 pedal-assist electric bicycles, and the organisation expects to supply more than 120 units soon.

To expand the market for pedal-assist electric bicycles, FABIO and EURIST have identified delivery companies, boda-boda operators, and hotels interested in shifting to the use of e-bicycles. In addition, FABIO is working with Makerere University in Kampala to deploy the e-bicycles at the University. FABIO is currently engaging the University to secure space for a solar-powered charging station.

Figure 6: The AfricroozE bicycle designed by FABIO and EURIST

4.2.2 KARAA

KARAA is a start-up established with a mission to build electric bicycles to make last-mile transport faster, cheaper, and cleaner in Africa. The Karaa pedal-assist e-bicycle is powered by a 250 W motor and can travel up to 100 km with a 14.5 AH battery (Karaa, 2023).

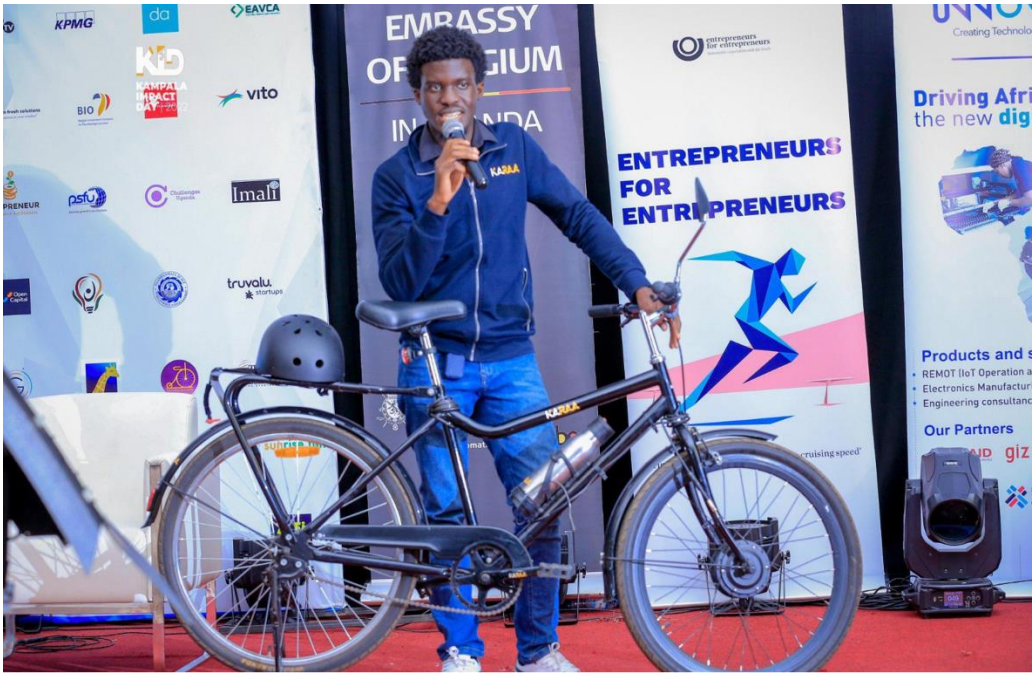

Figure 7: Karaa e-bicycle (The CEO Magazine East Africa, 2023)

4.2.3 eBee

eBee is an e-mobility company focusing on the sale of pedal-assist electric bicycles. The company was founded in Kenya in 2021 and has entered the Rwanda and Uganda markets. eBee sells and rents e-bicycles. The company has entered into agreements with delivery companies to use pedal-assist electric bicycles for deliveries, with a focus on employment of women and youth (eBee, 2024). To date eBee has sold over 12 pedal-assist electric bicycles in Uganda.

Figure 8: eBee e-bicycle. Source: eBee

4.3 Electric motorcycles

Motorcycles are widely used in Uganda for taxi and courier service. Reports show that there are over one million boda bodas across the country, with about 200,000 registered in Kampala alone (Nnamani, 2023). Several companies are developing electric motorcycles in Uganda.

4.3.1 GOGO Electric

GOGO Electric (formerly Bodawerk) is an e-mobility company that started out converting ICE motorcycles to electric motorcycles. The company now assembles e-motorcycles. The e-motorcycles are powered by locally developed lithium-ion phosphate (LFP) batteries which have an estimated range of 100 km on a single charge. The e-motorcycles are increasingly popular due to the long-term savings on fuel, oil, and maintenance, amounting to a 40 percent reduction in operating costs (GOGO Electric, 2024).

Figure 9: GOGO e-motorcycle

4.3.2 Spiro

Spiro is a mobility start-up that imports electric motorcycles. The company has supplied 12,000 e-motorcycles across six countries in the region, including Benin, Nigeria, Rwanda, Togo, Kenya, and Uganda. Recently venturing operations in Kampala, the company has tested seven e-motorcycles. The company plans to import about 500 e-motorcycles. The e-motorcycles are manufactured in China, assembled in West Africa, and imported fully assembled. The e-motorcycles will have a range of about 35-40 km per charge, and each e-motorcycle is fitted with two LFP batteries. It takes around 2 hours to charge the battery. Due to Kampala's hilly terrain, a mid-drive motor will be used in the vehicles.

The company has plans to install 22 swapping stations in the GKMA, with an average distance between swapping stations of 3-4 km. Most of the swapping stations will be located at filling stations because the locations are known to drivers. The company plans to scale to 3,000 swapping stations across the country by 2026-2027.

4.3.3 Zembo

Zembo is an e-mobility solutions company assembling e-motorcycles in Uganda. The company launched pilot operations in August 2018 and commercialised the solution in October 2019. The company has sold over 300 e-motorcycles. The e-motorcycles use 2.2 kWh LFP batteries that are charged to cover a range of approximately 65 km. The company uses the swapping method. The company has 29 charging stations, 24 of which are in GKMA. They have also deployed four outside the city along Masaka Road. At swapping stations, a rider pays UGX 4,000 shillings (USD 1.05) for a fully charged battery, and UGX 2,000 (USD 0.52) for a half-charged battery (Uganda Investment Authority, 2023).

Zembo is currently undertaking projects to enhance women's involvement in e-mobility. The "women on wheels" project has seen 25 women start riding e-motorcycles. The project subsidised the price of the motorcycles, enabling participants to own the vehicles in two years compared to the typical span of three years. The company employs over 50 people from different technical backgrounds including solar, electrical, and mechanical engineers, artisans, marketers, and administrators.

Figure 10: Zembo e-motorcycle

4.3.4 Motorcare

Motorcare imports and sells private electric scooters in Uganda. The company has sold 15 small scooters with one battery and four large scooters with two batteries.

4.4 Electric cars

4.4.1 Motorcare

Motorcare sells electric cars (e-cars) in Uganda. The company started in 1992 as an authorised dealer of Toyota cars and has pioneered the sale of e-cars in the country. The company sells different models of the e-cars as shown in

Table 3. So far, the company has sold seven electric Nissan Leaf vehicles and five Nissan Ariyas. Large companies such as commercial banks have been the main buyers.

Table 3: E-cars offered by Motorcare

Company	Outright purchase (excluding VAT) (USD)	Monthly lease rate (USD)	Battery size (kWh)	Range (km)	Electricity (units)	Number of sold units
Nissan Ariya	89,600	2,807	87.0 (2WD & 4WD); 63 (2WD)	500	47*	5
Nissan Leaf	58,800	1,554	40.0, 62.0	270	32**	7
Ford Mustang	72,620	2,362	75.7	480	45	-
Hyundai IoniQ5	63,570	1,970	58.0	350	40	-
Hyundai KONA	62,310	1,811	48.4	320	35	-

* Approximately UGX 52,000; ** Approximately UGX 37,000

4.5 EV battery production

Some companies are involved in the development and sale of batteries.

4.5.1 GOGO Electric

GOGO Electric produces LFP batteries. The company deploys LFP batteries in agriculture, domestic, commercial, and mobility applications. Currently, the company produces 1,500 batteries yearly, and it aims to increase production to 50,000 by 2024 and 150,000 by 2026. The company plans to establish a production facility at Namanve Industrial Park (STI, 2023).

4.5.2 Soleil Power

The start-up was established in early 2022. Soleil imports raw materials for battery packs and assembles LFP batteries in Uganda. The batteries are not yet available on the open market, but the company has been working with several partners to test and deploy battery prototypes. The company expects to commence production and supply during Q3/Q4 2024 (STI, 2023).

4.6 Charging infrastructure

As part of the shift to electric mobility in Kampala, several companies have started deploying charging infrastructure for EVs. WATU and Zembo have deployed 24 and 36 swapping stations respectively for

electric motorcycles in GKMA. Total Energies and Motor care have also deployed charging points for electric cars. Most of the BEBs currently charge from the Kiira Motors charging facility in Industrial Area in Kampala.

Table 4: Ownership and the number of charging points in GKMA

S/N	Company	Number of charging/swapping points	Targeted vehicles
1	Kiira Motors	16	Bus
2	Zembo	24	Electric motorcycles
3	WATU	36	Electric motorcycles
4	Total Energies	3	Electric cars
5	Motorcare	1	Electric cars

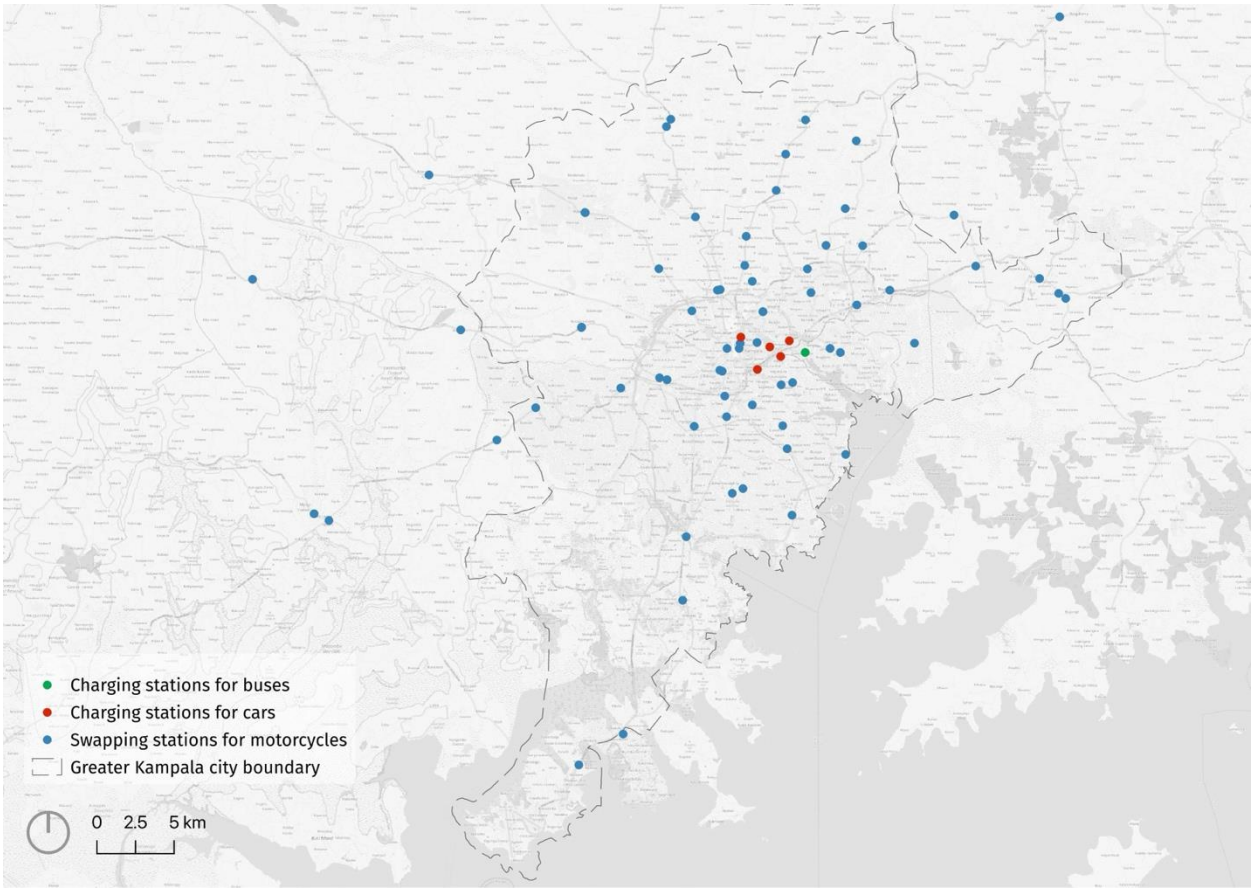

Figure 11: EV charging facilities in GKMA

4.7 Existing financing arrangements

The financing options differ across e-mobility companies. Some companies allow customers to pay in installments and to acquire the vehicle after completion of the payments while, others have adopted the lease to own model.

Table 5. Financing options of various companies

Company	Type of EV	Financing option
Zembo	E-motorcycles	Recently, Zembo partnered with Mogo Uganda to finance e-bikes. Mogo lets customers to purchase e-motorcycles with a down payment of UGX 500,000 and pay the remaining amount on a weekly basis.
GOGO Electric	E-motorcycles	GOGO Electric has partnered with WATU, one of the main financing companies in Uganda. WATU started financing ICE motorcycles and has now ventured into e-motorcycles. The company charges a down payment of UGX 300,000 (USD 79), compared to UGX 900,000 (USD 236) for ICE motorcycles. Customers make monthly payments and pay a small fee to swap the batteries at WATU charging and swapping stations. WATU currently has 80 swapping stations, 36 of which are deployed with in the GKMA.
Spiro	E-motorcycles	Spiro partnered with Mogo Uganda to finance procurement pf e-motorcycles. Mogo charges a down payment of UGX 500,000, and customers pay the remaining amount on a weekly basis.

5 Analysis of e-mobility barriers

E-mobility is gaining momentum in Kampala, as shown in the various demonstration projects. However, the deployment of EVs still faces several challenges.

5.1 High upfront capital cost of EVs

One of the challenges to scaling up operation of EVs in Kampala is the initial vehicle cost. In the case of buses, the cost of an e-bus can be double that of a diesel bus (ITDP, 2023). For any type of EV, the batteries are usually the contributing factor for the high upfront cost. However, over the long term, the total cost of ownership (TCO) is lower for EVs than for ICE vehicles. The estimated TCO for an e-bus in Kampala is 14 percent lower than that of a diesel bus over the respective bus life span (ibid). This difference stems mainly from energy cost savings: the cost of electricity is almost half the cost of diesel fuel.

To address the high upfront cost, companies are introducing new business models to increase EV access. E-motorcycle companies are lowering the capital cost and offering long-term business arrangements of requiring the drivers to swap batteries at their swapping stations.

5.2 Lack of standards for EV charging infrastructure

Lack of uniform standards for EV charging stations is a barrier to adoption of EVs. E-mobility companies are deploying unique chargers and plugs that may not be compatible with other systems. Chargers differs in terms of the connector type and charging speed, as seen in the following table. Standardised EV charging infrastructure is necessary to ensure ease of use and reliability for charging of EVs (Wambi, 2022).

Table 6: Comparison of the charging technology

Company	Vehicle type	Charging specification	Image
Motorcare	Car	• Level 1 home charging kit is suitable for a standard home outlet	
		• Level 2 kit uses a J1772 connection known as “J Plug” or “adapters”.	

Company	Vehicle type	Charging specification	Image
		• Level 3: CCS (Europe), CHAdeMO (Japan), or SAE combo (CCS1). The plugs are not interchangeable, a car using SAE Combo port cannot charge using a CHAdeMO plug	
Kiira Motors	E-bus	120 kW E-Bus charger • Input voltage is AC215V (3P+N+PE) • Output voltage ranges from DC 250-750 V (continuously adjustable) • Port standard is national standard 9 core DC charging gun, GB/T20234.3-2015	
		200 kW e-bus charger • Input voltage is AC215V (3P+N+PE) • The output voltage ranges from DC 250-750 V (continuously adjustable) • Port standard is national standard 9 core DC charging gun, GB/T20234.3-2015	

5.3 Electric grid instability

Generally, there is sufficient supply of electricity from renewable energy sources and hydropower in Uganda (International Energy Agency, 2010). However, limited access, high costs, and frequent outages are still prevalent and will likely remain the biggest barrier to e-mobility transition (Maya, 2022) (STI, 2023).

5.4 Limited awareness and knowledge

E-mobility is a new phenomenon and there is therefore a need to create public awareness programs to increase knowledge and understanding of the benefits of transitioning to EVs (CECIC, 2023).

6 Implementation plan

The following section discuses policy actions to accelerate the transition to e-mobility.

6.1 Buses

Table 7: Roadmap for e-buses.

Area	Measure	Responsibility
Technical measures	• Conduct a study on grid stability to supply enough power to e-bus depots. • Prepare a detailed e-bus infrastructure master plan. The study should focus on examine the suitable charging technology for each bus route, energy requirements, battery capacity, charging schedules, and depot layouts. • Update the BRT designs to incorporate charging facilities for e-buses.	• KCCA • UETCL • NGOs • MFPED • MEMD • MoWT
Financial measures	• Develop financing mechanisms to enable bus operators to invest in e-buses and scrap ICE taxis. • Provide a lower electricity tariff for e-bus depots.	• URA • MFPED • KCCA
Regulatory measures	• Develop a roadmap for the formalisation of the taxi industry and a transition to formal bus operating contracts. • Adopt standards for battery safety. • Prepare regulations for end-of-life battery management and disposal.	• KCCA • UETCL • MEMD
Capacity building & awareness	• Organise peer-to-peer exchanges with cities with e-buses in operation. • Organise trainings and incorporate e-mobility into the curriculum in universities and trade schools.	• KCCA • NGOs • Academic institutions

6.2 Electric bicycles

Table 8: Roadmap for e-bicycles

Area	Measure	Responsibility
Technical measures	• Develop a complete cycle network. Ensure that new road projects incorporate cycle tracks. • Conduct a feasibility study for an e-bikeshare system in Kampala.	• KCCA • Municipal Councils • UNRA
Financial measures	• Private financial incentives for the purchase of electric cars, including reduced VAT, reduced import duty, reduced withholding tax, and reduced electricity tariff for charging facilities, especially during off-peak times.	• MFPED • URA • KCCA
Regulatory measures	• Adopt standards for provision of bicycle charging facilities in buildings. • Adopt standards for battery safety. • Adopt regulations for end-of-life battery management and disposal.	• UBS • MoWT • Municipal Councils
Capacity building & awareness	• Organise trainings and incorporate e-mobility into the curriculum in universities and trade schools.	• NGOs • Academic institutions

6.3 Electric motorcycles

Table 9: Roadmap for e-motorcycles

Area	Measure	Responsibility
Financial measures	• Private financial incentives for the purchase of electric cars, including reduced VAT, reduced import duty, reduced withholding tax, and reduced electricity tariff for charging facilities, especially during off-peak times.	• URA • MFPED
Regulatory measures	• Adopt standards for battery safety. • Adopt regulations for end-of-life battery management and disposal.	• UBS • UETCL
Capacity building & awareness	• Organise trainings and incorporate e-mobility into the curriculum in universities and trade schools.	• NGOs • Academic institutions

6.4 Electric cars

Table 10: Roadmap for e-cars

Area	Measure	Responsibility
Technical measures	• Conduct a city-wide study to identify potential locations for public charging facilities.	• KCCA • UETCL • MEMD
Financial measures	• Private financial incentives for the purchase of electric cars, including reduced VAT, reduced import duty, reduced withholding tax, and reduced electricity tariff for charging facilities, especially during off-peak times.	• URA • MFPED
Regulatory measures	• Establish a uniform charging standard for electric cars. • For public on- and off-street parking facilities, designate spots for e-vehicle charging. Create enabling environment to encourage the private sector to deploy chargers at locations approved by government. • Adopt standards for provision of charging facilities in buildings. • Adopt standards for battery safety. • Adopt regulations for end-of-life battery management and disposal.	• UBS • KCCA • Municipalities
Capacity building & awareness	• Organise trainings and incorporate e-mobility into the curriculum in universities and trade schools.	• NGOs • Academic institutions

7 Conclusion

This roadmap contributes to achieving the objectives set out in the Government in Uganda's E-Mobility Strategy to scale up electric vehicles (EVs) in the coming years. This document outlines the current state of urban mobility in Kampala, identifies key barriers to the adoption of electric vehicles, and provides actionable steps for scaling up e-mobility solutions. Key focus areas include the development of charging infrastructure, strengthening of the electrical grid, and the creation of supportive policies and incentives to accelerate the introduction of electric buses, motorcycles, bicycles, and cars.

The e-mobility transition should take place alongside measures to encourage the use of efficient transport modes. The government should invest in public transport, facilitating the formalisation and consolidation of the taxi industry, the introduction of formal bus operating contracts, the provision of depots with charging facilities, and the implementation of the first phase of the BRT system. With regard to e-bicycles, the government should develop a complete cycle network to ensure that cyclists of all ages and abilities can cycle safely and comfortably. Cycle infrastructure will boost the viability of e-bikes as an alternative to private cars and motorcycles.

Collaboration among city authorities, residents, businesses, and other stakeholders is essential for implementing the policies, programs, and projects outlined in this roadmap. By doing so, Kampala can transform into a liveable, sustainable, and equitable city, serving as a model for other cities in the region and beyond. The successful implementation of this roadmap will not only reduce air pollution and greenhouse gas emissions but also enhance urban mobility, contributing to the overall well-being of Kampala residents.

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9 Appendix: Fiscal incentives for e-vehicles and parts

Table 11: EVS, spare parts and equipment that are entitled to tax reduction and exemption

No	Item Description	Image	Tax Treatment	Relevant Provisions of the law
1.	Deep Cycle Batteries - Lead Acid - Sealed Gel Cells - Others – excluding lithium ION		Import duty is 35% Value added Tax (VAT) is exempted 6% With Holding Tax is applicable	East African Community Common External Tariff (EAC CET) VAT Act
2.	Lithium ion deep cycle batteries		Import Duty stayed to 0% for Uganda for the Financial year 2023/2024 Value Added Tax (VAT) Exempted for deep cycle batteries. 6% WHT	EAC Gazette FY 2023/2024 VAT Act
3.	Raw materials for the manufacture of Deep Cycle Batteries		Import Duty remitted to 0% for all raw materials used in the manufacture of Deep cycle batteries. VAT Exempted under the VAT Act 6% WHT	Section 114 – EAC CMA VAT Act

4.	100% Electric Vehicles (EV)		Import duty reduced from 25% to 0% for one Year VAT is at the rate of 18% WHT – 6%	East African Community Gazette Notice Dated 30th June 2023.
5.	Hybrid Vehicles		Import duty reduced from 25% to 0% for one Year VAT is at the rate of 18% WHT – 6%	East African Community Gazette Notice Dated 30th June 2023.
6.	Solar motor vehicle charging stations		Exempted from all taxes under the 5th schedule of the EAC CMA as a solar Generator.	East African Community Customs Management Act (EAC CMA)
7.	Wind powered motor vehicle charging stations		Exempted from all taxes under the 5th schedule of the EAC CMA as a wind Power Generator.	East African Community Customs Management Act (EAC CMA)
8.	Solar energy generators		Exempted from all taxes under the 5th schedule of the EAC CMA as a solar Generator.	East African Community Customs Management Act (EAC CMA)

9.	Wind Energy Generators		Exempted from all taxes under the 5th schedule of the EAC CMA as a wind Power Generator.	East African Community Customs Management Act (EAC CMA)
10.	Grid Power Charging Station		Import Duty at 0% VAT 18% WHT 6% For VAT registered Companies VAT Can be deferred	East African Community Common External Tariff (EAC CET) VAT deferment regulations 2018
11.	Charging Cables		25% - Import Duty 18% - VAT 6% - WHT 1.5% IDL	East African Community Common External Tariff (EAC CET)
12.	E-vehicle tool kit		10% - Import Duty 18% - VAT 6% - WHT 1.5% IDL	East African Community Common External Tariff (EAC CET)

13.	E-axles typically involve the coupling of an oil-lubricated gearbox to an electrical machine that runs with minimal lubrication or even dry at very high rpm		10% - Import Duty 18% - VAT 6% - WHT 1.5% IDL	East African Community Common External Tariff (EAC CET)
14.	Electric Vehicles – Passenger vehicles		0% - Import Duty 18% - VAT 6% - WHT 1.5% IDL	0% granted under the EAC Gazette dated 30th June 2023 for one year. East African Community Common External Tariff (EAC CET)
15.	Electric Vehicles – Goods Carrying vehicles		25% - Import Duty 18% - VAT 6% - WHT 1.5% IDL	East African Community Common External Tariff (EAC CET)
16.	Battery Operated Forklifts		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)

17.	Self-balancing hoverboard powered by a lithium rechargeable battery.		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
18.	Electric Scooter		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
19.	4-wheeled Personal electric vehicle		0% - Import Duty 18% - VAT 6% - WHT	0% granted under the EAC Gazette dated 30th June 2023 for one year. East African Community Common External Tariff (EAC CET)
20.	Commercial electric vehicle charging station		Import Duty at 0% VAT 18% WHT 6% For VAT registered Companies VAT Can be deferred	East African Community Common External Tariff (EAC CET) VAT deferment regulations 2018

21.	Electric bicycle		East African Community Common External Tariff (EAC CET)	0% - Import Duty 18% - VAT 6% - WHT 1.5% IDL
22.	Electric completely knocked down (CKD) motorcycle		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
23.	Electric semi knocked down (SKD) and completely built-up (CBU) motorcycle		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
24.	TVS iQube motorcycle		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)

25.	E-vehicle analyser		0% - Import Duty 18% - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
26.	Electric bus		25% - Import Duty 18% - VAT 6% - WHT 1.5% IDL Above 9 years of Age they attract an additional 50% environmental Levy	East African Community Common External Tariff (EAC CET)
27.	Electric pickup truck		25% - Import Duty 18% - VAT 6% - WHT 1.5% IDL Above 9 years of Age they attract an additional 20% environmental Levy	East African Community Common External Tariff (EAC CET)
28.	Electric refrigerated truck		Exempted from all taxes under the fifth schedule of the East African Community Customs Management Act, 2004	East African Community Customs Management Act, 2004

29.	Electric tractor head		0% - Import Duty 18% - VAT 6% - WHT Above 9 years of Age they attract an additional 20% environmental Levy	East African Community Common External Tariff (EAC CET)
30.	Electric truck GVW below 20 tons.		10% - Import Duty 18% - VAT 6% - WHT 1.5% IDL Above 9 years of Age they attract an additional 20% environmental Levy	East African Community Common External Tariff (EAC CET)
31.	Electric agricultural tractor		0% - Import Duty Exempted from - VAT 6% - WHT	East African Community Common External Tariff (EAC CET)
32.	Electric Powered Golf Carts		Exempted from all taxes under the fifth schedule of the East African Community Customs Management Act, 2004 For use by Hospitals, Airports and Hotels	East African Community Customs Management Act, 2004

33.	Hyper Quad Dirt ATV is an electric 4wheeler		0% - Import Duty 18% - VAT 6% - WHT	East African Community Gazette dated 30th June 2023 East African Community Common External Tariff (EAC CET)

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