REPUBLIC OF UGANDA

NATIONAL E-MOBILITY STRATEGY

POSITIONING UGANDA AS A NET SOURCE OF E-MOBILITY TOOLS & SOLUTIONS TO REDUCE DEPENDENCE ON IMPORTS, AND IMPROVE THE WELLBEING OF UGANDANS

NOVEMBER 2023

SCIENCE, TECHNOLOGY & INNOVATION SECRETARIAT
REPUBLIC OF UGANDA

MAKING UGANDA THE BEST


Charge World with X
KIIRA MOTORS

This National e-Mobility Strategy has been developed through a multi-sectoral approach by: Science, Technology and Innovation Secretariat – Office of the President; Ministry of Energy and Mineral Development; Ministry of Works and Transport; Ministry of Finance, Planning and Economic Development; Ministry of Trade, Industry and Cooperatives; Ministry of Kampala Capital City Authority and Metropolitan Affairs; Ministry of Local Government; Ministry of Education and Sports; and National Planning Authority.

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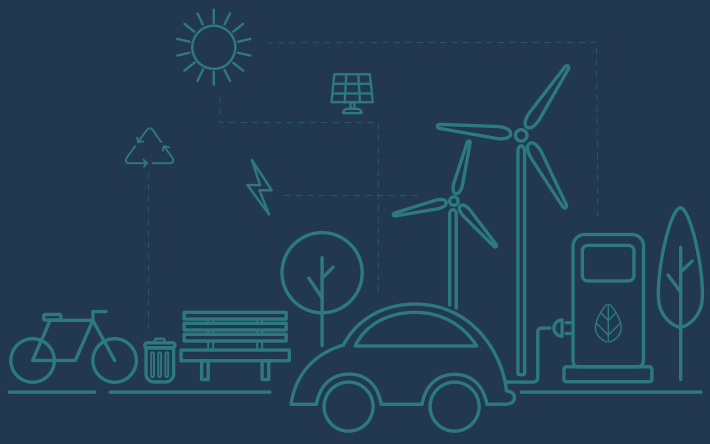
Kayoola EVS Buses at the Kiira Vehicle Plant, Jinja

LIST OF ACRONYMS

ARB	Architects Registration Board
BESS	Battery Energy Storage Systems
BRT	Bus Rapid Transit
CAGR	Compound Annual Growth Rate
CKD	Complete Knocked Down
COPD	Chronic Obstructive Pulmonary Disease
DC	Direct Current
DFI	Development Finance Institutions
ERA	Electricity Regulatory Authority
EV	Electric Vehicle
FY	Financial Year
GDP	Gross Domestic Product
GHG	Green House Gas
GKMA	Greater Kampala Metropolitan Area
GWh	Giga Watt Hour
HEI	Higher Education Institution
ICE	Internal Combustion Engine
ICT	Information and Communications Technology
KCCA	Kampala Capital City Authority
KMC	Kiira Motors Corporation
LIL	Luwero Industries Ltd
MDA	Ministry, Department and Agency
MEMD	Ministry of Energy and Mineral Development
MITP	Mobility Industrial & Technology Park
MoES	Ministry of Education and Sports
MoFPED	Ministry of Finance, Planning and Economic Development
MoICT	Ministry of ICT and National Guidance
MoJCA	Ministry of Justice and Constitutional Affairs
MoLG	Ministry of Local Government
MoLUD	Ministry of Lands and Urban Development

MoTIC	Ministry of Trade, Industry and Cooperatives
MoWE	Ministry of Water and Environment
MoWT	Ministry of Works and Transport
$MtCO_2e$	Metric tons of Carbon Dioxide Equivalent
MW	Mega Watt
MWh	Mega Watt Hour
NBRB	National Building Review Board
NEMA	National Environment Management Authority
NMT	Non-Motorized Transport
NPA	National Planning Authority
NPPB	National Physical Planning Board
NRM	National Resistance Movement
OEM	Original Equipment Manufacturer
OP	Office of the President
PPDA	Public Procurement and Disposal of Public Assets Authority
R&D	Research and Development
SDG	Sustainable Development Goal
SME	Small and Medium Enterprise
STI	Science, Technology and Innovation
SUV	Sports Utility Vehicle
UDB	Uganda Development Bank
UIPE	Uganda Institute of Professional Engineers
UNBS	Uganda National Bureau of Standards
UNRA	Uganda National Roads Authority
URA	Uganda Revenue Authority
URC	Uganda Railways Corporation
USD	United States Dollars
UTOF	Federation of Uganda Taxi Operators
VAT	Value Added Tax
VIN	Vehicle Identification Number



FOREWARD

Hon. Dr. Monica Musenero Masanza

Minister for Science, Technology and Innovation and Chairperson Interministerial Committee on e-Mobility

Let us spark innovation, ignite passion, and drive toward a sustainable future for Africa powered by African solutions using African resources.

The Automotive Industry and the world of mobility is undergoing a seismic shift from traditional fossil fuels to new technologies and electric mobility is taking the center stage. The transition from traditional internal combustion engines to electric vehicles (EVs) is no longer a distant dream but our present reality. The e-Mobility sector therefore holds immense promise and implication to the strategic development of our nation.

Sustainable industrialization of Uganda's economy forms the essence of the country's Vision 2040, the Third National Development Plan (NDP III) and the NRM Manifesto 2021 – 2026 which specifically emphasize (1) promotion of local manufacturing of motor vehicles; (2) establishment of an efficient, integrated, sustainable, safe, and inclusive public transport system; and (3) promotion of environmentally friendly transport solutions.

The transport sector today is responsible for around 25% of carbon dioxide emissions and its share of global emissions is on the rise. In Uganda, Road Transport accounts for 95% of passenger traffic and 96.5% of the freight cargo and contributes over 10% on the greenhouse carbon emissions. The sector is characterized by an inefficient public transport system utilizing imported end-of-life vehicles with an average age of over 16 years at first registration. Uganda's heavy reliance on imported obsolete petrol & diesel engine powered vehicles is not only a huge drain to the economy but poses significant risk to our socioeconomic transformation, public health, and the environment with Kampala being ranked 2nd most polluted city in Africa.

To alleviate the adverse impacts of the transport sector on climate and health, many nations are shifting to e-mobility and globally, the sector is projected to grow from USD 280 billion in 2021 to USD 1.5 Trillion by 2028 at a Compound Annual Growth Rate of 27.2%.

It is now obvious that Climate Change is driving the next industrial revolution – Climate Industrial Revolution. While Uganda missed out on all the previous revolutions, having been absent in the 1st two, and struggling for basic survival through the third and 1st part of the fourth, we have a real opportunity to attain our leap through this Climate Industrial Revolution.

Uganda's National e-Mobility Strategy represents a convergence of minds, expertise and unwavering commitment by government MDAs and private sector players to address the challenges in the mobility sector today. The Strategy is a call to action for sustainable, efficient, and inclusive homegrown mobility solutions contributing to sustainable socio-economic transformation. It puts Uganda's foot in the door, as we aim to be a net source rather than a consumer of e-Mobility Technology.

The National e-Mobility Strategy has a bold target of Uganda fully transitioned to e-Mobility in public transport and motorcycles by 2030 and passenger vehicle sales by 2040.

This will be realized by creating a robust, self-sustaining and competitive e-Mobility Ecosystem in Uganda guided by principles of Ecosystem Approach; Sustainability; Supply Chain Localization; Innovation; Equity & Inclusion; Integration; Adaptability; and Information & Public Awareness.

Driven by domestic R&D, technology development, innovation, manufacturing and smart ecosystem development, the National e-Mobility strategy is anticipated to catalyze value addition by promoting domestic manufacturing and localization of the value chain; increasing domestic contribution to our GDP; creation of over 500,000 green jobs; enabling the creation of sustainable and reliable public transport systems; and ultimately reducing transport-based carbon emissions by over 25% by 2040 leading to more productive, cleaner and healthier cities.

As you delve into this strategy document, I invite you to become a champion and key partner in our e-Mobility journey. Each decision, collaboration, and leap of faith shapes our e-Mobility destiny. Let us spark innovation, ignite passion, and drive toward a sustainable future for Africa powered by African solutions using African resources.

For God & My Country

The Kayoola EVS

The overall strategy is to position Uganda as net Source, rather than a consumer of e-Mobility tools and solutions.

The global mobility industry was valued at USD 15 Trillion in 2017 and is projected to exceed USD 26.6 trillion by 2030. Mobility currently makes up 10% of Africa's total greenhouse gas emissions, and this is expected to increase in a business-as-usual scenario as sub-Saharan Africa's vehicle market size grows from 25 million vehicles in 2021 to over 58 million by 2040 in South Africa, Kenya, Rwanda, Uganda, Ethiopia, and Nigeria combined.

To alleviate the adverse impacts of the mobility sector on the climate and health, many nations are shifting their mobility to green energy i.e., e-Mobility. e-Mobility refers to the use of electric vehicles powered by batteries or hydrogen fuel cells. Globally, market associated with e-Mobility is projected to grow from USD 280 billion in 2021 to USD 1.5 Trillion by 2028 at a Compound Annual Growth Rate of 27.2%.

In his addresses to the nation in July and August 2022, H.E. the President of Uganda guided that, "the correct way to sustainably address the current fuel crisis in Uganda is to move from petrol to electric cars, buses, motorcycles, and trains." He further highlighted that Uganda should have made a full transition to electric vehicles within 20 Years.

Under the coordination of the STI Secretariat, the e-Mobility ecosystem has been organized through the e-Mobility Consortium that currently comprises over 80 e-Mobility value chain actors in Uganda. Through a rigorous synthesis, 6 clusters have been defined to work in a well-coordinated manner to sustainably deliver e-Mobility in Uganda:

(i) Research and Development

(ii) Engineering and Manufacturing

(iii) Energy

(iv) Transport Planning, Management, Operations, Distribution and Support

(v) Value Chain Financing

(vi) Policy, Regulations and Standards

(vii) Digital Infrastructure

Government and Private Sector efforts have realised the production and deployment of **24 Kayoola Electric Buses** for mass transit in the Greater Kampala Metropolitan Area, supported by **16 Fast Chargers** and over **1,500 electric motorcycles** on the road supported by over **100 battery swapping stations**. There are other initiatives by Private Sector in the production of vehicle parts and components such as lithium-ion battery assembly, auxiliary batteries, electronics & semiconductors, wires & wiring harnesses, tyres & tubes, automotive paints, filters and automotive lubricants among others.

The vision is to see **"Uganda fully transitioned to e-Mobility in public transport and motorcycles by 2030 and passenger vehicle sales by 2040"**; the mission is to build **"a robust, self-sustaining and competitive e-Mobility ecosystem in Uganda"**. The key guiding principles that have informed the strategy include Ecosystem Approach; Sustainability; Supply Chain Localization; Innovation; Equity & Inclusion; Integration; Adaptability; and Information & Public Awareness.

These are the National e-Mobility priorities and objectives:

1) **Local EV Manufacturing & Supply:** to increase local manufacturing and supply of electric buses, motorcycles and vehicles with associated parts, components and systems.

2) **Local EV Battery Manufacturing:** to promote local manufacturing of EV batteries and battery energy storage systems for domestic, commercial, and industrial applications.

3) **Public Transport:** to electrify public transport systems based on electric buses, motorcycles and trains.

4) **Charging Network:** to establish Electric Vehicle Charging Infrastructure supporting battery swapping, contact charging, wireless charging, e-Trams, and any other emerging charging technologies.

5) **e-Mobility Human Capital Development:** to develop domestic skills and capabilities for the e-Mobility value chain.

6) **Electric Vehicle Uptake:** to increase EV Uptake including electrification of the Government Fleet.

7) **e-Mobility Standards Development:** to develop standards, regulations, guidelines, and a code of practice for the e-Mobility Industry.

The STI Secretariat will coordinate the Whole-Government Approach to create an enabling environment for the protection and growth of the domestic e-Mobility ecosystem. Government of Uganda commits to implementing these interventions and policy measures, prioritised based on recommendations from stakeholders, for the next 10 years after which they will be reviewed.

CATEGORY	PRIORITISED POLICY MEASURES
Targets and Mandates	EV Targets
	EV Mandates
Economic & Fiscal Measures	Fiscal Incentives to EV Users including subsidies and concessions
	Incentives to manufacturers including tax holidays, tax exemptions and concessions on EV Production
	Affordable and special electricity (energy) tariff for charging EVs
	Incentives for lowering EV operational costs such as parking and toll fee concessions
	Disincentives for internal combustion engine (ICE) vehicles, such as VAT increase, pollution, and environmental taxes
Infrastructural Measures	Installation of intra-city and inter-city charging points
	Licensing of garages, maintenance workshops and training centers
	Traffic Management: green routes; e-Bus lanes; NMT lanes
Institutional framework, policy, and regulatory measures	5-year periodic review of existing used vehicle import regulations
	Review of planning guidelines to include requirements and regulations for EV charging stations
	Standardisation, licensing, and certification of EVs and related components
	EV charging infrastructure standards & safety regulations
	EV scrapping guidelines and battery usage & recycling guidelines
	e-Mobility value chain downstream operations certification & accreditation
	Electricity grid management
R&D and capacity building measures	Technology transfer
	Battery technology development to increase range and capacity
	Skills development to develop, make, maintain and repair EVs
	EV Public transport pilot projects
Local EV development measures to accelerate the uptake of EVs	Domestic manufacture of buses, motorcycles, passenger cars, and related parts
	Domestic manufacture of EV Batteries and EV battery recycling
	Provide an enabling environment for domestic manufacturers, innovators, and start-ups
Social measures	EV awareness creation roadmap
	EV Promotional Measures such as incentives to early adopters

To engender success, Government with participation of private sector and development partners shall implement a range of supportive policy interventions including:

(i) Tax exemptions on expenditure on mobility research and development.

(ii) 0% Import Duty, 0% VAT and 0% Withholding Tax on Original Equipment Manufacturer vehicle parts, components (production parts), EV chargers, EV batteries, and materials imported for motor vehicle production by registered mobility industry value chain actors.

(iii) 0% Import Duty, 0% VAT, 0% Infrastructure Levy and 0% Withholding Tax on plant machinery, tools and equipment and all industrial replacement spare parts imported by registered mobility industry value chain actors.

(iv) Income Tax holidays for registered mobility industry value chain actors operating in dedicated industrial parks to enable reinvestment of profits for expansion and to encourage new investments of plant and machinery in the mobility industry value chain.

(v) 0% VAT and 0% Withholding Tax on sale of EVs produced in Uganda.

(vi) 0% Income Tax on expenditure on mobility research and development.

(vii) Increase in VAT, Import Duty and Environmental Levy for ICE Vehicles.

(viii) An e-Mobility energy tariff for public and commercial charging points like the tariff for City streetlights.

(ix) Requisite standards for e-Mobility in the areas of charging infrastructure, vehicle safety, energy efficiency and interoperability.

(x) Integrate requirements for charging stations at public spaces and buildings in the planning and building guidelines.

(xi) Exemption of electric vehicles from paying road tolls.

(xii) Exemption of electric vehicles from street parking fees.

Expected Outcomes

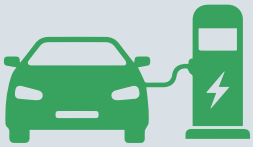
The Implementation of the e-Mobility Strategy is expected to generate these outcomes by 2040:

a) **12.5% contribution of the mobility sector to National GDP.**
b) **Creation of over 500,000 green jobs.**
c) **65% localization of the e-Mobility Value Chain.**
d) **Reduced transport-based emissions by over 25%.**

The strategy will require a total investment of up to USD 1.74 billion for the period FY2023/24 – FY2027/28. This investment will enable the generation of over USD 15 billion in annual revenues, over UGX 1 billion in income from jobs created, and reduction of transport-based emissions by over 2 $MtCO_2e$ by 2030.

INTRODUCTION

The Spiro Electric Bike



Plug-in station

Battery

Fuel cells

E-Mobility, also termed Electric or Electro Mobility, refers to clean and efficient transport using electric vehicles, powered by either batteries or hydrogen fuel cells, as well as full electric vehicles, plug-in hybrid electric vehicles, and hydrogen fuel cell vehicles that convert hydrogen into electricity. Electric mobility includes light-duty automobiles, medium- and heavy-duty electric vehicles, electric micro mobility devices, and transit vehicles.

Transition to e-Mobility is fundamentally changing the traditional interaction between technology, market dynamics, production capacity, government policy, supply chains, manufacturing, and complex political economy. As part of what is referred to as the Green Energy Revolution, it will be viewed as the biggest technology shift since the invention of the internal combustion engine.

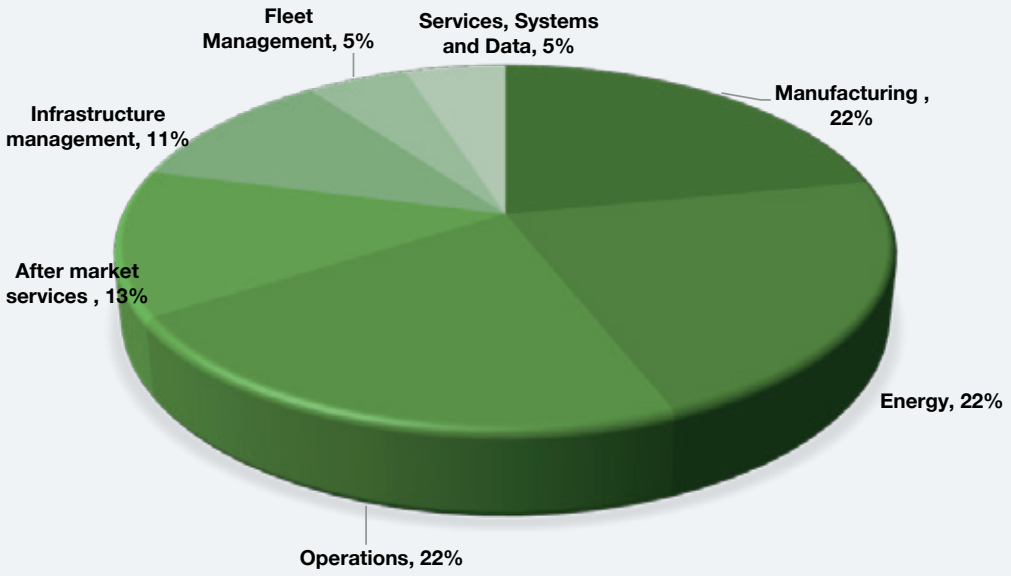
The National e-Mobility Strategy describes Uganda's vision, mission, goal objectives and action plan for transitioning the nation towards e-mobility in the transport sector, placing emphasis on positioning Uganda as a net source rather than a consumer of e-Mobility tools and solution, to reduce our dependance on imports and improve the wellbeing of Ugandans through green jobs.

e-Mobility, also termed Electric or Electro Mobility, refers to clean and efficient transport using electric vehicles, powered by either batteries or hydrogen fuel cells, as well as full electric vehicles, plug-in hybrid electric vehicles, and hydrogen fuel cell vehicles that convert hydrogen into electricity.

1.1 Background

Mobility is the largest single contributing sector to the global economy, valued at approximately USD 15 Trillion in 2017 and is projected to grow to over USD 26.6 Trillion by 2030. Additionally, the global mobility vehicle fleet is set to double by 2050, with more than 90% of future vehicle growth projected to take place in low and middle-income countries[1]. The key components contributing to the sector are summarized in Figure 1.1 below.[2]

Figure 1.1: Value Distribution in the Mobility Value Chain
(Source: Oliver Wyman Analysis)



The transport sector is the fastest-growing greenhouse gas (GHG) emitting sector, expected to reach a share of more than 30% of total GHG emissions in the future.

According to McKinsey & Company, transport currently makes up 10% of Africa's total greenhouse gas (GHG) emissions and this is expected to increase as sub-Saharan Africa's vehicle market size grows from 25 million vehicles in 2021 to over 58 Million by 2040 in South Africa, Kenya, Rwanda, Uganda, Ethiopia, and Nigeria combined[3]. It is estimated that 60% of global road transport emissions come from passenger travel (cars, motorcycles, and buses) and 40% from road freight (lorries and trucks).

The resultant adverse effects of transport-based emissions on climate change, air quality and public health as well as the international commitments to cut greenhouse gas emissions has catalyzed the global movement to transition from Internal Combustion Engine (ICE) Vehicles using Petrol and Diesel to Electric Vehicles (EVs) resulting in a world-wide growth of the e-Mobility Industry.

1 https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/supporting-global-shift-electric-mobility
2 Dissecting The Global Mobility Market, 2017 To 2030E (oliverwymanforum.com)
3 Power to move: Accelerating the electric transport transition in sub-Saharan Africa | McKinsey

Global efforts to transition have seen the e-Mobility market size grow

2020

230

Billion USD

2021

280

Billion USD

2028

1.5

Trillion USD

As e-Mobility adoption increases globally, existing EVs of all vehicle types in 2019 collectively avoided 53 Metric tons of carbon dioxide equivalent ($MtCO_2e$) of emissions[4]. Globally, the market associated with e-Mobility is projected to grow from USD 280 billion in 2021 to USD 1.5 Trillion by 2028 at a Compound Annual Growth Rate of 27.2%.

Achieving the objectives of the Paris Agreement of limiting average global temperature rise to less than 2^0C below pre-industrial levels will require rapid de-carbonization across all sectors including the transport sector. Electrification of transport could be one of the options to achieve emissions reductions at the scale necessary to decarbonize transport. Indeed, electrification of transport could significantly reduce vehicle emissions in cities while also reducing dependence on fossil fuel imports for transport.

1.2 Problem Statement

The transport sector today is responsible for around 25% of carbon dioxide emissions and its share of global emissions is on the rise. In Uganda, Road Transport accounts for 95% of passenger traffic and 96.5% of the freight cargo and contributes over 10% on the greenhouse carbon emissions. The sector is characterized by an inefficient public transport system utilizing imported used vehicles with an average age of over 16 years at first registration. Uganda's heavy reliance on imported obsolete petrol & diesel engine powered vehicles is not only a huge drain to the economy but poses significant threats to economic growth, public health, and the environment. This has resulted in the following major challenges.

1.2.1 Unreliable Public Transport System

The total daily passengers that require public transport in GKMA currently stands at over 2 million and is expected to grow by 4% per annum over the next decade. The existing transport model of 42% of daily trips by motorcycles (boda-bodas) transporting 9% of the passengers, 21% by minibus taxis (matatus) transporting 82% of the passengers and 37% for private cars transporting 9% of the passengers, is inadequate.

4 Global EV Outlook 2020 (iea.org)

Commuters spend over 24,000 man-hours lost in daily traffic jams amounting to over USD 800 Million annually. Government recognizes that the predominant used low volume vehicles has amplified the challenges of public transport in cities, exuberated congestion and traffic jams minimizing productivity and increasing pollution. This presents a dire need for sustainable mass public transport to improve mobility in cities, across the country and across borders for greater productivity in the economy.

1.2.2 Low Energy Efficiency

Uganda's average fuel efficiency in 2014 was 13.7 liters/100 kilometers against the United Nations Economic Commission for Europe's average of 5.1 liters/100 kilometers for passenger vehicles and 7.2 liters/100 kilometers for light commercial vehicles in 2016. It is estimated that over UGX 500 Million worth of imported fuel is wasted daily due to traffic congestion in Kampala City alone according to the National Environment Management Authority (NEMA) National State of the Environment Report for Uganda, 2014.

1.2.3 High Cost on the Economy

Uganda's vehicle and transport equipment imports in FY2022/23 were worth USD 795 Million, the second highest value on Uganda's import bill. Despite the high and growing demand, vehicles are imported predominantly fully built 85% used with an average age of 16 years at first registration on the backdrop on importation of auto-parts for maintenance and repair. The consumerism perspective in the vehicle market not only undermines the prospects of domestic value addition, but also contributes to the undesired growing trade deficit.

1.2.4 Air Pollution

Urban Centers in Uganda are increasingly faced with air pollution problems linked to transport-based emissions. In a 2022 report by the Business Insider Africa and IQAir, Kampala was ranked the 5th most polluted city in Africa and one of the most polluted in the world[5]. This is mainly resultant of inefficient end-of-life (average age of 16 years at first time registration) vehicles on the road[6].

Exposure to high concentrations of air pollutants increases the incidence of Chronic Obstructive Pulmonary Disease (COPD), asthma, lung disease, heart disease, and premature births & death, with consequent impacts on quality of life and the economy. Uganda has a high burden of respiratory diseases with a population level prevalence of asthma estimated at 11.02% and COPD at 16.2%, with over 13,000 deaths attributed to air pollution annually[7].

1.2.5 Climate Change

Studies show that the economic costs of climate change in Africa could equal an annual loss in GDP of 1.5% - 3.0% by 2030 under a business-as-usual scenario due to noncompliance[8]. Adoption of Electric Mobility is projected to reduce the carbon emissions from transport in Sub-Saharan Africa by up to 25% by 2040[9].

5 15 Most polluted cities in Africa 2021 | Business Insider Africa
6 Baseline Survey on Uganda's National Average Automotive Fuel Economy, August 2015 (globalfueleconomy.org)
7 Pollution and Health Metrics. Global, Regional, and Country Analysis, December 2019 (gahp.net)
8 The Economic Cost of Climate Change in Africa, November 2009 (preventionweb.net)
9 Power to move: Accelerating the electric transport transition in sub-Saharan Africa | McKinsey & Company

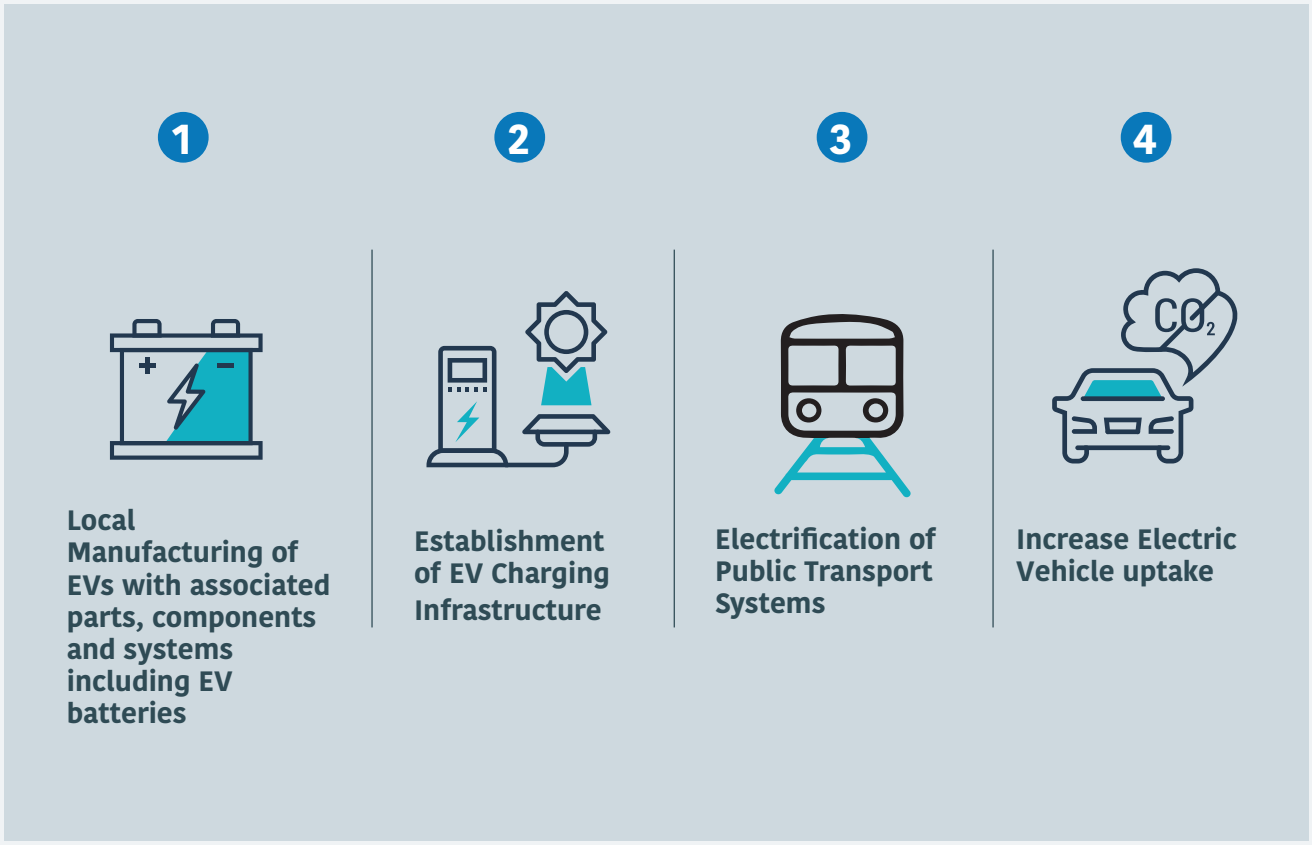
e-Mobility presents a critical strategy for achieving sustainable mobility, economic development, and provides an appropriate solution addressing current development issues such as decarbonizing transportation, reducing air and noise pollution, reducing reliance on imported fossil fuels, and creation of green jobs.

However, despite the potential benefits of e-Mobility, EVs represent little over 2% of global vehicle sales and a small share of the global vehicle fleet. In addition to reducing EV acquisition costs, accelerating the transition to e-Mobility at scale will require robust fiscal, regulatory and infrastructure policy frameworks that engage all relevant stakeholders in the development of an EV ecosystem. In this regard the electrification of public transport could provide rapid emissions reductions as these vehicles tend to represent a major share of miles travelled.

Adoption of Electric Mobility is projected to reduce the carbon emissions from transport in Sub-Saharan Africa by up to 25% by 2040

1.3 Uganda Government's Commitment

Uganda therefore seeks to adopt interventions to sustainably address these problems while contributing to sustainable socio-economic transformation. These interventions are in the following key priority areas:



Government of Uganda under the visionary leadership of H.E the President has taken definitive steps towards building a robust, competitive, and sustainable mobility industrial value chain in Uganda. The efforts are geared toward interventions drawing synergies between the State, Private Sector, Academia, and Development Partners.

In his Addresses to the nation on 20th, 27th July and 5th August 2022, H.E. the President of Uganda guided that, "the correct way to [sustainably] address the current fuel crisis in Uganda is to move from petrol to electric cars, buses, motorcycles, and trains." He further highlighted that Uganda should have made a full transition to EVs within 20 Years.

Cognizant of this, the government identified the need to streamline the e-Mobility sector in Uganda by providing strategic policy guidance and oversight through the Science, Technology, and Innovation Secretariat - Office of the President (STI-OP). Subsequently, an Inter-Ministerial Committee chaired by the Minister for Science, Technology and Innovation on Strategy for Catalyzing the Transition to e-Mobility in Uganda was constituted under the coordination of the Science, Technology and Innovation Secretariat.

" The correct way to address the current fuel crisis in Uganda is to move from petrol to electric cars, buses, motor cycles and trains."

H.E. Yoweri K. Museveni

1.4.1 Emissions Reduction and Global Trends

EVs present an opportunity to decarbonize the transport sector and reduce the reliance of fossil fuels. Secondary emissions from charging an EV from the electricity grid are already lower than emissions from equivalent ICE vehicles given that Uganda's national grid is predominantly served by renewable energy.

1.4.2 Evolving technology and lower operating costs

In public transport, several studies have shown that the total cost of ownership of an electric bus (purchase prince, maintenance, and operation costs) is 60% of that of the diesel equivalent. The cost of energy is 20-22% of the petrol or diesel equivalent. However, the initial purchase cost of acquisition is still much higher compared to the equivalent petrol and diesel vehicles. Table 1.1 shows some of the differences between cost of EVs Vs fuel cars.

EV technology is evolving however, and it is anticipated that as uptake increase and new technologies in batteries emerge, the purchase cost for EVs shall rapidly decline.

Table 1.1: Operation Costs and Emissions Comparison of Diesel and Electric Bus (Sources: VTT Technical Research Centre of Finland; Potkány M., et. al. (2018)

	Parameter	Diesel Bus	Electric Bus
1	Purchase Price (USD)	160,000	360,000
2	Maintenance Costs (USD per annum)	10,186	5,785
3	Fuel/Electricity Consumption per 100 km	45 Liters	100 kWh
4	Average Cost of Fuel/Electricity Unit (UGX)	5,100	386.3
5	Consumption Cost per 100 km (UGX)	229,500	38,630
6	CO_2 emissions (g/km)	1,213	-
7	CO emissions (g/km)	0.85	-
8	PM_{10} emissions (g/km)	0.209	-
9	NO_x emissions (g/km)	8.48	-

Notes: A Euro III Diesel Bus was used for this comparison. The Average Block 1 Large Industries Consumers End-User Electricity Tariff was used.

In households, EVs offer substantially lower operating costs and reduce exposure to volatile global fuel prices. On average, a petrol car consumes around 10 liters per 100 km and costs around $2,400 to fuel each year. The average EV consumes around $400 worth of electricity per year (EVC 2022a). EVs also tend to have lower maintenance costs, as there are only a few hundred parts in and electric car, compared to 2,000 plus moving parts in an ICE vehicle (Raftery 2018).

As well as using less energy, some EVs can provide energy storage for houses and the electricity grid. EVs could also play a key role in storing and later dispatching excess power generated from solar photovoltaic (PV) and other renewable energy systems, and potentially assist in electricity grid management (AEMO 2022). This and future technology advancements could give Ugandan households the flexibility to choose where their energy comes from, more control of their bills, and less reliance on imported fossil fuels.

1.4.3 Health and Safety Benefits

Greater adoption of EVs will help reduce air pollution and will have wide-ranging health and environmental benefits, via the reduction in nitrogen oxide and particulates. Research has shown that even at low penetration rates, EV uptake results in better air quality and reduced asthma-related emergency room visits (Garcia et al. 2023). The switch to EVs may also deliver health benefits from reduced noise pollution.

The total cost of ownership of an electric bus (purchase prince, maintenance, and operation costs) is 60% of that of the diesel equivalent.

1.4.4 Green R&D and Manufacturing Jobs

The transition to EVs presents a significant opportunity to develop new jobs and skills in Uganda. Across the supply chain, from manufacturing through to maintenance, new skills will be needed to support the rollout of EVs. We have the mineral resources, capital, and capability to maximize this opportunity.

The Kayoola EVS under production

The Future of Mobility is Here

Collaboration to achieve a better mobility industry.

2. SITUATION ANALYSIS OF THE E-MOBILITY INDUSTRY IN UGANDA

To effectively contextualize the transition to e-Mobility in Uganda, we adopted a value chain approach to develop comprehensive understanding and involvement of all relevant stakeholders. The STI Secretariat convened an inter-ministerial stakeholder meeting that established a National e-Mobility Technical Taskforce to work on the e-Mobility Strategy.

This was comprised of: Ministry of Energy and Mineral Development; Ministry of Works and Transport; STI Secretariat; Ministry of Kampala Capital City and Metropolitan Affairs; Ministry of Finance, Planning and Economic Development; Ministry of Local Government; Ministry of Education and Sports; Ministry of Trade, Industry and Cooperatives; and National Planning Authority. Through this approach, the e-Mobility Ecosystem in Uganda has been well defined and streamlined.

The team interrogated multiple aspects including economic, ecosystem networks, technical capacities, and gaps as well as human capital needs. The key findings are summarized below.

2.1 Economic Value Distribution

The e-Mobility value chain consists of multiple components whose current market value and trends are projects to grow differently. To be able to identify priorities, the team examined the current estimated market value, the CAGR of the different components and the projected growth.

A quick examination of the trends shown in Table 2.1 and Figure 2.1 quickly shows that to tap the economic opportunities for the country beyond manufacturing, Uganda should strategize for the operations and energy subsectors.

Table 2.1: The Mobility Market by Sector in USD Trillions, 2017 to 2030.
(Source: Oliver Wyman Analysis)

Sector	CAGR ▼	2017	2030E
Service, systems, data	12.5% →	0.8	3.4
Operations	5.0% →	3.3	6.2
Fleet Management	4.8% →	0.7	1.2
Infrastructure managment	4.3% →	1.6	2.7
MRO & aftermarket services	4.1% →	2.0	3.4
Energy	3.0% →	3.3	4.8

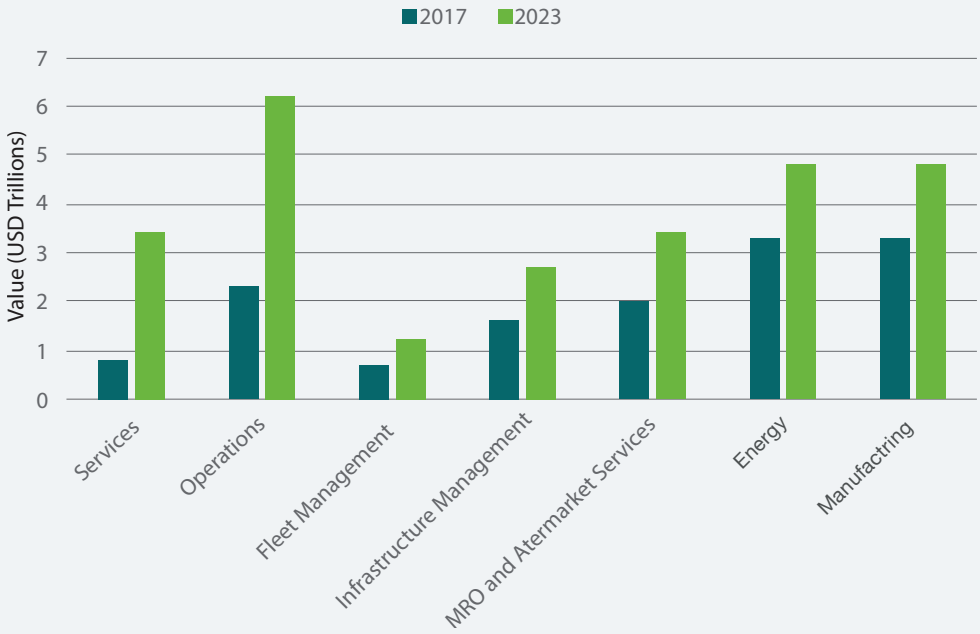


Figure 2.1: The Mobility Market Growth Trends by Sub-Sector 2017 to 2030 (Source: Oliver Wyman Analysis)

2.2 The e-Mobility Ecosystem

Under the coordination of the STI Secretariat, the e-Mobility ecosystem has been organized through the e-Mobility Consortium that currently comprises over eighty (80) e-Mobility value chain actors in Uganda. Through a rigorous synthesis, the following six (6) clusters which must work in a well-coordinated manner to sustainably deliver e-Mobility in Uganda, have been defined as highlighted in Figure 2.2.

(i) **R&D, Engineering and Manufacturing** comprises players in Research & Development, Computer Aided Design, Computer Aided Engineering, Battery Manufacturing, Vehicle Parts and Components Manufacturing, Testing, Validation, Raw Material Processing, Vehicle Production and Recycling among others.

(ii) **Energy** comprises actors in Electricity Generation, Transmission, Distribution, Charging Infrastructure and Energy Storage Systems.

(iii) **Transport Planning, Management, Operations, Distribution and Support** comprises actors in Urban Planning, Infrastructure Design, Integrated Transport Systems, Bus, and Truck Operation, Ride Hailing, Vehicle Distribution, Maintenance, Service and Repair.

(iv) **Value Chain Financing** comprises actors in Supplier Financing, Asset Financing, Debt Financing, Equity Investors and Insurance.

(v) **Policy, Regulations and Standards** composed of Government Ministries, Departments and Agencies, Policy Advocates and Advisors on issues of Laws, Regulations, Guidelines, Policy and Standards.

(vi) **Digital Infrastructure** includes players in Information Systems, Financial Technology, Data Storage and Management that augment the E-Mobility Products and Services.

Figure 2.2: Uganda's e-Mobility ecosystem players

2.3 R&D, Engineering and Manufacturing

The e-Mobility ecosystem is composed of several Government and Private Sector-led initiatives championing the local manufacture of electric buses and motorcycles in Uganda. These initiatives have in the past been uncoordinated making it difficult to achieve effective and efficient development of the e-Mobility ecosystem.

Zembo Electric Motorcycles

2.3.1 Electric Buses

The manufacture of electric buses is led by Kiira Motors Corporation (KMC), a state enterprise that is championing value addition in the nascent automotive industry in Uganda. KMC has brought to market the Kayoola EVS, a premium fully electric city bus, and the Kayoola Coach, an executive long-distance bus. Twenty Four (24) Electric Kayoola Buses are already operational, providing public transport in the Greater Kampala Metropolitan Area.

The Kiira Vehicle Plant at the Jinja Industrial and Business Park that is expected to be commissioned by KMC by end of 2024 will have an installed capacity of 2,500 vehicles per year and capabilities for frame and body fabrication, state-of-the-art paint shop, chassis integration, final assembly and integration, and Quality Inspection and Testing.

2.3.2 Electric Motorcycles

The production of electric motorcycles in Uganda is primarily Private Sector and Academia-led. They feature plug-in technology that enables charging at home, or battery swapping programs where the user exchanges a used battery for a fully charged one at a charging station.

1) **International University of East Africa** undertook R&D of Plug-in Electric Motorcycles and is currently undertaking a pilot in Kampala in preparation for mass production.

2) **Bodawerk/GOGO and Modjo Energies** are currently converting existing ICE motorcycles into electric powertrains.

These initiatives have brought over 1,500 electric motorcycles on the road being used in public transport and logistics.

3) **Zembo** is assembling new electric motorcycles off existing Petrol Motorcycle Platforms and has recently partnered with Simba Automotive, a motorcycle manufacturer based in Uganda, to provide the platform locally. Zembo utilizes the battery swapping model to charge its motorcycles and operates a network of swapping stations.

4) **M Auto Electric/Spiro** an Indian Start-Up with operations in Togo and Benin is exploring entry in Uganda offering 2-wheeler and 3-wheeler vehicles, battery swapping systems and energy storage systems.

5) **Green Hub Kampala** is a consortium between Nexus Green, Motorcare and TVS Motor that has been established to produce electric motorcycles and deploy charging and swapping stations in Kampala.

2.3.3 Manufacturing Supply Chain Localization

To maximally benefit from e-Mobility, Uganda must produce a critical number of inputs locally. Uganda is endowed with a wealth of natural resources that can be harnessed to enhance domestic value addition in the e-Mobility sector and promote supply chain localization. Uganda's minerals can be used to manufacture electric vehicle parts including iron ore for automotive steel; silica sand for glass; rare earth elements for glass glazing, catalytic converters, batteries, electronics; graphite for brake pads; oil for plastics; cobalt & lithium for batteries; kaolin, marble and vermiculite for paint; tungsten, columbite, chromite and titanium for metal alloys; copper for auto electric conductors and motors etc. The Government and Private sector have embarked on some initiatives to enhance the utilization of these resources.

2.3.3.1 Mobility Industrial and Technology Park

The Mobility Industrial & Technology Park (MITP) is one of the strategic program projects in the NDPIII to support a wide range of investments in motor vehicle parts manufacturing, vehicle testing and automotive technology innovation enterprises. GoU through KMC acquired 1,280 acres of land in Bbaale, Kayunga for the establishment of the MITP.

The MITP has been conceptualized to host:

- KMC Pick-up and SUV Plant with capacity of 100,000 vehicles per year in a single shift
- At least 12 Auto Parts Supplier Plants (auto glass, brake pads, fiberglass panels, fasteners, rubber bushes, filters, vehicle electronic control units, vehicle seats, bamboo boards, banana fiber carpets, Lithium-Ion batteries and heating, ventilation, and air conditioning systems)
- Vehicle Proving Grounds and Testing Facilities
- Automotive Technology & Innovation Centre;
- Business Centre
- Automotive Industry Skilling Center
- Waste Management Facilities
- Social Amenities for Workers in the Automotive Park.

The Master Plan presented in Figure 2.3 for the MITP was approved by kayunga district council. The 10 year strategic investment plan and pre-feasibility study for the park have also been completed.

INVESTMENT OPPORTUNITIES

01	Vehicle Plant
02	Ist Industrial Cluster
03	2nd Industrial Cluster
04	3rd Industrial Cluster
05	4th Industrial Custer
06	Proving & Testing Grounds
07	Free Trade Zones
08	logistics Zones
09	Commercial Developments
10	Hotel Developments,
11	High-Density Residential
12	Medium Density
13	low density
14	Administrative Block
15	Fre & Police Station
16	Skiling Centre
17	Innavation Centre
18	Education
19	Heath
20	Gof Course
21	Neighbourhood Recreation Park
22	Biogas Plant
23	Solar Plant
24	Power Substation
24	Sold Waste Management Site
26	Wastewater Treatment Plant
27	Water Reservoir
28	Transport Terminal

Figure 2.3: Mobility and Industrial Park Master Plan

2.3.3.2 Local Parts and Component Manufacturers

The Mobility Industrial Value Chain in Uganda is still nascent, with few players assembling and manufacturing vehicle parts and components in the country.

Table 2.2: Vehicle Parts and Component Assemblers and Manufacturers in Uganda

	Vehicle Parts/Components	Entity
1.	Assembly of Lithium-Ion atteries for electric motorcycles and energy storage systems	Bodawerk/GOGO Modjo Energies Zembo Soleil Power Nexus Green
2.	Auxiliary Batteries	Uganda Batteries Ltd. Nile Batteries
3.	Electronics & Semiconductors	Innovex Microfuse
4.	Wires and Wiring Harnesses	Uganda Cable Corporation Ltd
5.	Tyres and Tubes for motorcycles	CCLE Rubber Co. Ltd
6.	Automotive Paints	Kansai Plascon Peacock Paints Regal Paints
7.	Air, Oil and Fuel Filters	Uganda Filtration Technic Co. Ltd
8.	Automotive Lubricants	Potenza Lubricants
9.	Steel	Tembo Steel Roofings Doshi
10.	Fasteners	Luwero Industries Ltd
11.	Automotive Glass	Impala Glass Industries Prayosha Enterprises

2.4 Energy

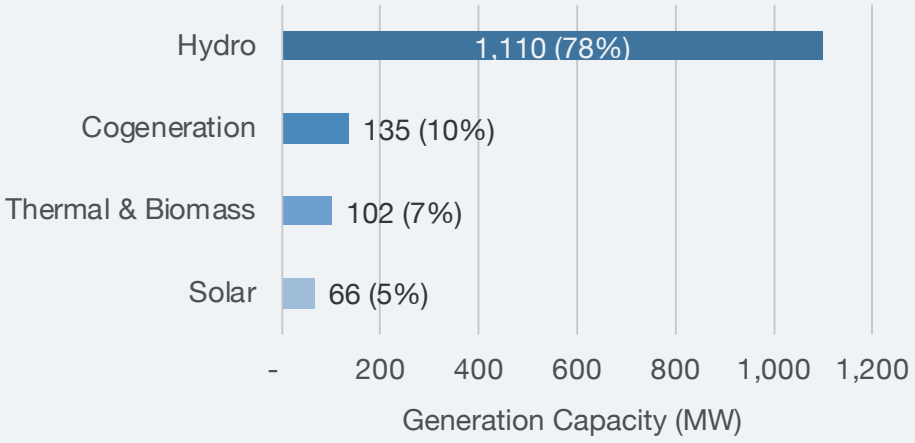
The Electric Vehicle replaces fuel (petrol or diesel) with electricity safely stored in batteries to run the vehicle and its systems. Some electric vehicles like light rail and trams may be directly connected to the power grid while others have on-board Battery Energy Storage Systems (BESS) typically charged from either a grid connection or solar plant. The BESS is made of battery cells, electronic control units, a cooling system, connectors and the packaging.

The energy value chain includes Electricity Generation, Transmission and Distribution, Energy Storage, Charging Infrastructure and related services.

2.4.1 Electricity Generation

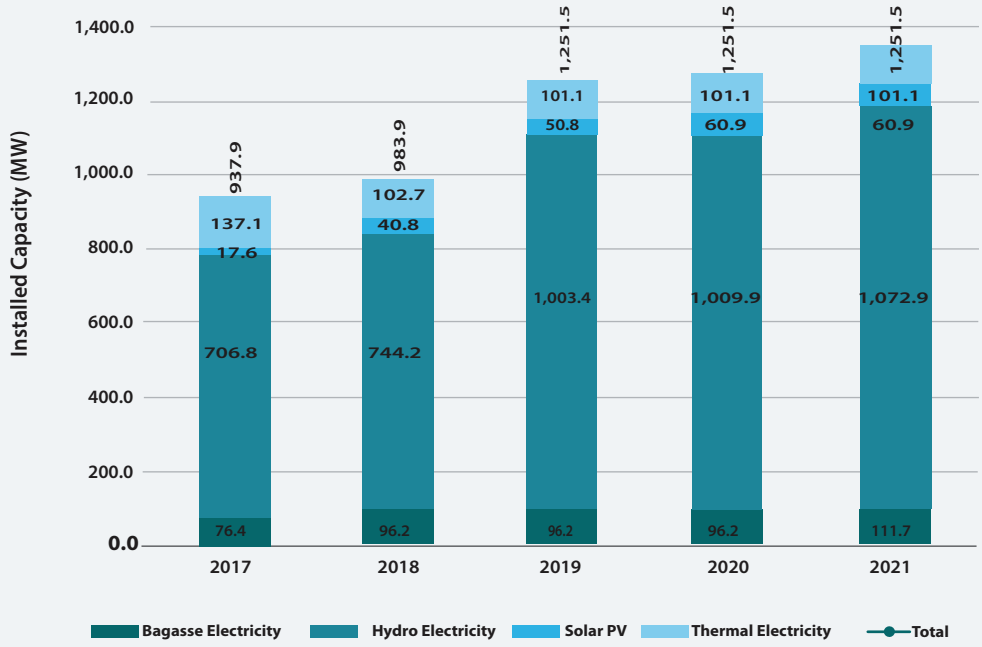
Uganda in 2023 had an installed electricity generation capacity of 1,347MW and is expected to increase to over 1,800MW once Karuma Dam is online. It is mainly generated from clean energy sources like Hydro (78%) and Solar (5%). More sources of electricity generation from wind and nuclear energy are planned.

Figure 2.4: Electricity Generation Mix in Uganda (Source: ERA)



The maximum electricity demand is currently at approximately 840MW, representing ~62% of generation capacity. This implies that in the medium term, Uganda has an excess of electricity which can be harnessed for e-Mobility. This is of particular importance because most of the electricity generation dams were constructed with the help of debt financing and the generation capacity should be fully commercially utilized.

Figure 2.5: Uganda's Electricity Generation Capacity (Source: ERA)



2.4.2 Energy Storage Systems

Currently, electricity generated is not storable and must be consumed in real time or it goes to waste. With e-Mobility, the energy generated must be converted into a storable and mobile form mainly through Battery Energy Storage Systems (BESS).

The energy needs of an EV go beyond mobility to facilitating energy access. The EV BESS can act as a source of energy storage and distribution with capabilities for providing battery stored energy back to the grid through vehicle-to-grid technologies helping to stabilize the grid.

GOGO Electric Motorcycle

Currently Uganda is importing the BESS. Uganda is endowed with lithium, nickel, manganese, cobalt, iron and phosphate deposits that are key inputs for battery manufacturing. For a sustainable BESS for the country, there is need to domesticate and localize the value chain. The following are the current efforts in the country:

1. **GOGO** is the pioneering Ugandan company in the Lithium Ion Battery and associated Electronics production value chain. They have deployed more than 5.8MWh of Lithium-Ion batteries in mobility, agriculture, domestic, commercial, and industrial applications since 2018.

   GOGO is currently covering approximately 75% of the Lithium-Ion Battery value chain through Component Design & Development, Module Assembly, Sub-system Assembly and System Integration. The remaining 15% is vested in Raw Material Processing, Component Manufacture and Testing & Validation.

   GOGO targets to increase production capacity from the current 1,500 batteries per year to 50,000 by 2024 and 150,000 by 2026 at the battery mass-production facility that will be established in the Namanve Industrial Park.

2. **Soleil Power** is a Ugandan start-up engaged in the design, production, assembly and sale of lithium-ion batteries and energy storage system solutions. Registered in early 2022, they are building the first dedicated production-scale lithium-ion battery pack assembly plant in East Africa and only the second in sub-Saharan Africa. The land and facility is currently being developed in Kirolo, Wakiso, and is expected to be completed in Q1 2023. Full production is expected to begin by the end of Q2 2023 with an initial annual capacity of 14,000 to 20,000 batteries to supply the rapidly growing regional demand for lithium-ion batteries used in energy storage systems and e-Mobility applications.

Soleil Power works independently to design energy storage products for the regional market in addition to partnering directly with e-Mobility and swapping infrastructure companies to co-develop batteries. Core to their mission is the realisation of a circular battery economy through management of the battery's entire lifecycle and the development of 2nd life lithium-ion battery products to consume the partially depleted batteries leaving the e-Mobility ecosystem.

3. **Makerere University's** Centre for Research in Transport Technologies is researching local battery production and recycling, with the goal of promoting industrial and economic growth, while lowering the cost of EV production. Uganda is strategically located near mines that produce essential ingredients for battery production such as lithium, cobalt, manganese, and graphite, yet there are no battery manufacturing plans on the continent of Africa.

   The efforts in deepening value addition in the BESS value chain through research and development are minimal and can be strengthened by leveraging the e-Mobility capacity that Government has built through KMC and other stakeholders.

2.4.3 Charging Infrastructure

Charging infrastructure is a crucial priority for the adoption of e-Mobility. There have been some Government and Private-Sector led initiatives in the development of Uganda's charging infrastructure supporting electric buses, passenger vehicles and motorcycles.

2.4.3..1 Buses

With Government support, KMC currently has 16 DC Fast Chargers supporting the current fleet of Kayoola EVS and Kayoola Electric Coach buses.

2.4.3.2 Passenger Vehicles

Existing passenger vehicle chargers are privately owned by institutions and individuals that own electric vehicles, including Level 2 slow chargers that are used at home or at institution premises.

Total Energies is exploring the establishment of an Electric Vehicle Charging Network leveraging existing fuel stations to support a wide range of vehicles. This is being undertaken in collaboration with Motorcare Uganda, the official distributor of Nissan, and KMC. The Nissan Leaf and Ariya offered by Motorcare is being used to map locations that are most appropriate for the installation of charging stations and monitor driver sentiments about having to wait to charge as opposed to the normal practice of a quick top-up.

2.4.3.3 Motorcycles

The Ministry of Energy and Mineral Development in partnership with Zembo and GIZ under the Promotion of Renewable Energy and Energy Efficiency Program undertook a pilot project of installation of 4 electric motorcycle charging stations along the Kampala-Masaka Highway in Mpigi, Buwama, Lukaya and Masaka towns.

Zembo has a network of 27 electric motorcycle battery swapping stations around the GKMA and plans to expand to 50 stations by the end of 2023. Zembo prioritizes hybrid stations utilizing the national electricity grid and solar energy.

Bodawerk has built a swapping station network of over 60 stations under the brand name “GOGO” with a plan to expand this network to over 100 by the end of 2023.

Nexus Green through the Green Hub Kampala Consortium is planning to design and install charging stations employing solar panels, invertors, and batteries to charge electric motorcycles, as well as battery swapping stations to service electric motorcycle riders. Under an already approved Presidential Directive, Nexus Green is also planning to install solar streetlights that can be used as charging points for electric motorcycles.

2.5 Transport Planning, Management, Operations, Distribution and Support

The total daily passengers that require public transport in GKMA currently stands at over 2 million and is expected to grow by 4% per annum over the next decade. The existing transport model is inadequate, with 42% of daily trips by boda-bodas transporting 9% of the passengers, 21% by matatus transporting 82% of the passengers and 37% for private cars transporting 9% of the passengers. This presents a dire need for sustainable mass public transport to improve mobility in cities, across the country, and across borders for greater economic productivity.

GoU recognises that the predominant low volume vehicles have amplified the challenges of public transport in cities and the strategic direction for the capital city in the Multi-Modal Urban Transport Master Plan for the Greater Kampala Metropolitan Area (GKMA)[10] is to reduce private car ownership and replace 14-seater matatus and boda-bodas with high volume buses with a carriage capacity of more than 60 passengers, and light rail to address the issues of traffic congestion, poor fuel efficiency and air pollution.

The master plan is part of the second phase of the Kampala Institutional and Infrastructural Development Project (KIIDP); a five-year USD 183.7 million (UGX 693 billion) project funded by GoU and the World Bank being implemented by Kampala Capital City Authority (KCCA). Under the plan, KCCA will construct and operate a robust Mass Rapid System with buses, light rail, and cable cars by 2040. The Kampala BRT System is expected to operate on 8 Routes.

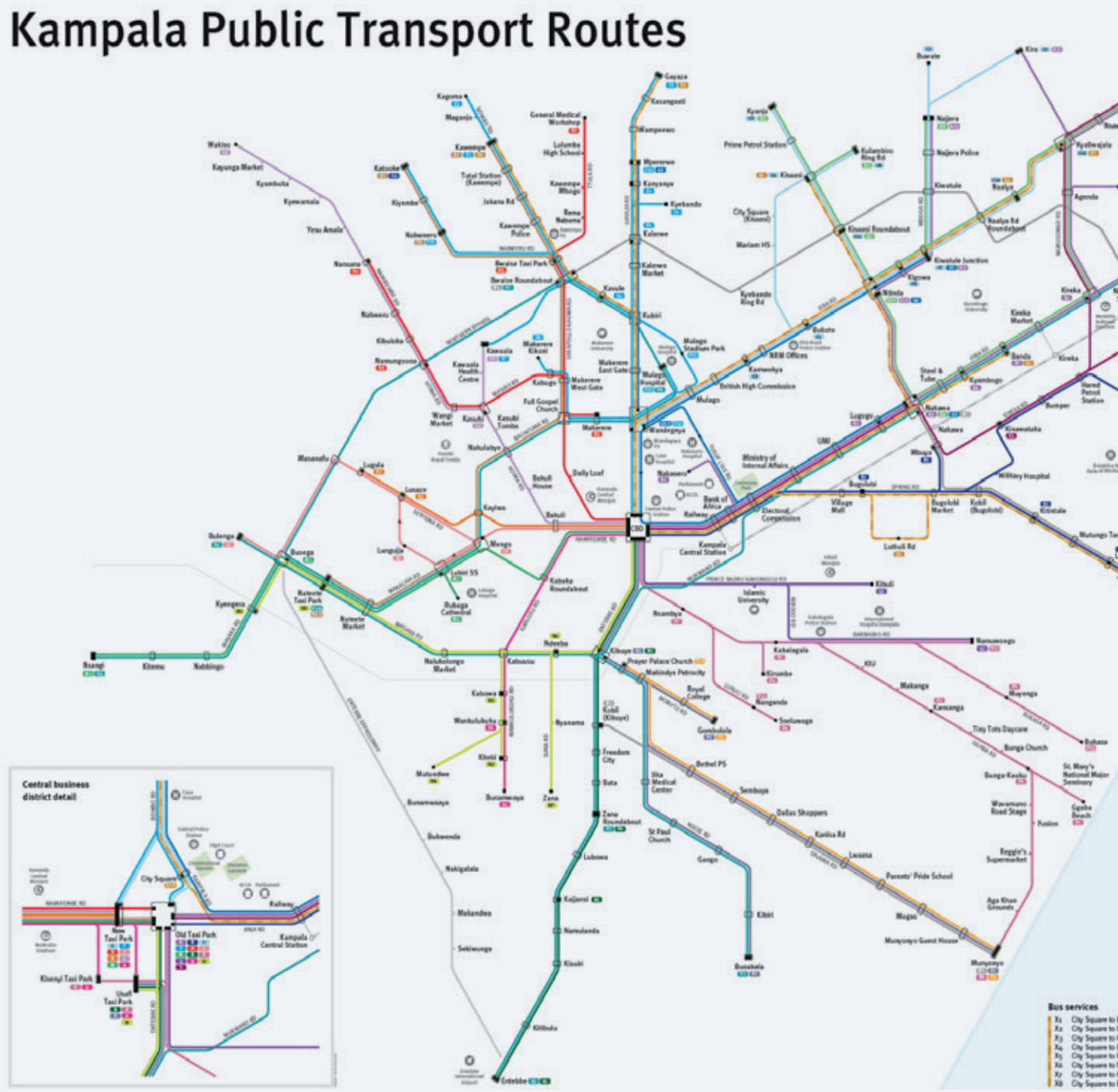
Government recognises that the predominant low volume vehicles have amplified the challenges of public transport in cities

10 Byamukama J., KCCA (2018). Multi Modal Urban Transport Master Plan for GKMA, April 2018 (theigc.org)

Spiro Swapping Station


SMART SWAP - Powered By Spiro
3
4
8
11
12

Figure 2.6: GKMA Public Transport Routes



(Source: KCCA)

Government has been one of the biggest financiers of e-Mobility having directly invested over USD 100 Million from FY2018/19 to FY2023/24 in e-Mobility research, development and manufacturing.

2.5.1 Bus Transit

The demand analysis for buses in Kampala undertaken by NPA in April 2022 ascertained that in the medium to long term (10 years), the demand is expected to grow up to: 3,136 90-seater buses; or 6,272 45-seater buses; or 9,407 30-seater buses. This growth in demand will be due to population growth and diversion of demand from existing transport modes due to efficiency and affordability of bus transport.

KCCA has green routes within the City for the implementation of an Eco-Bus/Green Mass Transit Service. Kalita Transporters is the pioneer in operating an electric bus mass transit system in Kampala using the Kayoola EVS buses. Other operators like Tondeka Metro and Uganda Taxi Operators Federation are planning to adopt electric buses in the short term.

2.5.2 Rail Transit

Uganda Railways Corporation currently operates a commuter rail service utilizing diesel trains in the Kampala Metropolitan Region, transporting about 2,000 people daily. The Service includes the Kampala-Namanve Route which has been in operation since 2015; the Kampala-Portbell Route which was added in 2019; and a third route between Kampala-Kyengera is underway.

GoU is planning to develop an Electric Light Rail Urban Mass Transit System to serve the GKMA population of Kampala, Wakiso, Mpigi and Mukono. Private Sector players such as Alijibal Investments Ltd in collaboration with China Railway Rolling Stock Corporation have expressed interest to invest in the establishment and operation of Light Rail in GKMA.

2.5.3 Motorcycle Transit

NFT Mobility, Savannah, Green Hub Kampala and SafeBoda are revolutionizing digital solutions, infrastructure and business models to enhance uptake of electric motorcycles. SafeBoda has developed a ride-hailing application for motorcycles that also integrates logistics and financial technology.

2.6 Value Chain Financing

Government has been one of the biggest financiers of e-Mobility having directly invested over USD 100 Million from FY2018/19 to FY2023/24 in e-Mobility research, development and manufacturing. This has positioned Uganda as the champion of e-Mobility solutions in Africa.

Private Sector has also mobilised investor and debt financing for scaling production and business operations. Companies like Watu, Tugende and Asaak are offering end-user financing for electric motorcycles. Uganda Development Bank is also offering affordable financing for the e-Mobility value chain, mainly in the areas of Manufacturing and Asset Financing for electric bus mass transit operators as offtake for local manufacturers.

2.7 Policy, Regulations and Standards

Regulatory frameworks have the potential to catalyze e-Mobility research, product development and acquisition. Uganda currently lacks a comprehensive regulatory framework on E-mobility. However, some policies and regulations have been established that can form a foundation for e-Mobility policy, standards, and regulations as discussed below. These are however insufficient and dedicated strategies, policies, regulations, guidelines, and standards must be developed and implemented.

2.7.1 National Transport and Logistics Policy, 2021

The National Transport and Logistics Policy serves as the overarching policy and regulatory framework for all transport and logistic infrastructure and services. The overall vision for the policy is a safe, accessible and sustainable intermodal transport system to enhance Uganda's competitiveness. The Policy highlights these strategic interventions:

(i) Promotion of inclusive, safe and sustainable mobility. Government commits to make deliberate investments in urban mobility and to improve the quality and reliability of urban transport, placing emphasis on increasing public transport and reducing the use of private vehicles. Furthermore, there will be a progressive limit to the use of motorized internal combustion engine transport.

(ii) Promotion of inclusive green growth in the transport and logistics sector especially in the construction and maintenance of transport infrastructure. The policy commits to the establishment of a framework for a gradual restriction and ban on importation of old used vehicles with high carbon emissions. URA has banned warehousing of vehicles that are 9 years old or more, and prohibited the importation of vehicles that are 15 years old or more.

(iii) Categorization of transport as a public service to the people of Uganda with the Government not only responsible for investing in transport infrastructure but also in services and operations.

2.7.2 National Integrated Transport Master Plan 2021 – 2040

The Master Plan states that the GoU will work with the transport sector to develop integrated planning and management of transport infrastructure with insights on climate prediction. It promotes the development of a long-term national transport policy that will include greenhouse gas mitigation. The transport plan uses an assessment of vehicle usage by type (50% motorcycle, 30% passenger vehicles, 12% light-good vehicles, 6% heavy vehicles, and 2% agriculture vehicles) and developing targeted plans to reduce emissions in that vehicle type. The focus of the Master Plan is also to fund international and national aid to build infrastructure that encourages usage of low-emission transportation methods. Building a robust national road system was identified as essential to both economic growth and using the least emitting transportation means.

2.7.3 Standards

The Uganda National Bureau of Standards (UNBS) is mandated to formulate, enforce, and promote the use of standards in Uganda. It has embarked on some measures to promote the adoption of e-Mobility in Uganda including the following.

(i) Vehicle Identification Number System

UNBS attained the World Manufacturer Identifier designating Uganda as a Vehicle Manufacturer and has developed the National Vehicle Identification Number (VIN) System to be adopted by all vehicle manufacturers in Uganda.

(ii) Electronic Components Testing Capabilities

UNBS has also developed laboratory capability in testing some electrical and electronic components including Lithium-Ion batteries that are vital for electric mobility.

(iii) EV Import Inspection Capabilities

UNBS has developed capabilities to conduct inspection on EV related imports including parts and components required for the assembly and manufacture of Electric motorcycles/ tricycles.

2.8 Digital Infrastructure

e-Mobility relies on the availability of digital infrastructure to enable efficient and effective charging, monitoring, and management of EVs. Private Sector players such as Scintl and KaCyber are developing cashless ticketing and revenue collection systems with capabilities for monitoring and management of fleet operations by mass bus transit operators. Other companies like SafeBoda have developed robust ride hailing systems integrating financial services for end-users.

The Financial Technologies Services Providers' Association has mobilized and organized over 194 companies in the Financial Technology space in Uganda. This includes all leading telecommunication companies, datacenter providers and payment gateway providers who are instrumental in the development of robust e-Mobility digital infrastructure.

e-Mobility relies on the availability of digital infrastructure to enable efficient and effective charging, monitoring, and management of EVs.

2.9 Barriers to E-Mobility in Uganda

Despite the many benefits of e-Mobility, several barriers limit its widespread adoption in Uganda. The appreciation of these barriers will guide in the identification of the necessary policy interventions that can be implemented to promote the widespread adoption of e-Mobility.

GOGO Electric Motorcycle

2.9.1 Inadequate Charging Infrastructure

Access to and affordability of EV charging infrastructure are the two prominent barriers to EV adoption. Compared to traditional fuel stations, charging stations are limited in number because of the high investment costs and difficulties in infrastructure development. The cost of installation which ranges from USD 2,500 for a slower charger to USD 35,800 for a fast charger as well as miscellaneous fees like permits and regulations, makes charging stations an expensive investment. The development of EVs cannot be separated from the charging infrastructure required and so to resolve this challenge a comprehensive planning scheme for an EV charging eco-system is necessary and critical. The high capital investment requirements necessitates the adoption of preferential energy tariffs to facilitate investment recovery.

2.9.2 Limited E-Mobility Human Capital

The adoption of e-Mobility requires specialized technical skills related to design, production, service, maintenance, repair, operation of EVs and infrastructure, policy, regulation and standards. It is critical that Government, Private Sector and Academia work together to develop the Human Capital with the necessary skills and knowledge to support the local production and adoption of EVs and requisite Infrastructure.

2.9.3 Perceived High Cost of Electric Vehicles in Comparison to Petrol and Diesel Engine Vehicles

Although the Total Cost of Ownership of EVs is much lower than that of traditional petrol and diesel engine vehicles especially for commercial vehicles, the up-front acquisition costs at present are higher and are a major barrier to adoption of e-Mobility. The major cost driver is the battery, currently imported as complete battery banks. The localization of battery bank manufacturing has the capacity to reduce the cost of the EV by up to 30%.

Innovative business models that do not require the outright purchase of the vehicle and batteries such as leasing battery swapping will enhance access and use. EVs shall have to be availed at scale and at comparable prices to used IEC vehicles or incentivized to be competitively priced.

2.9.4 Limited Access to Financing

Because it is relatively new, there is still limited understanding of the potential of e-Mobility in Uganda, therefore many financiers including banks, insurers and asset financiers are still reluctant to take on the risk. Financing opportunities for research, product development, manufacturing, and service provision in the mobility industry are still limited. Scaling e-Mobility in Uganda will require financing for consumers (asset financing for the vehicle), for EV manufacturers and importers, for all levels of charging infrastructure, and infrastructure financing for electricity grid and mini-grid development.

2.9.5 Limited Energy Access and Power Supply Reliability

Despite having large renewable energy potential and relying majorly on low carbon-intensive, renewable energy generation (primarily hydropower) suitable for EV implementations, Uganda is one of the top four off-grid (or mini-grid) markets in Africa. Limited energy access, high energy costs and power outages are principal barriers to e-Mobility transition, and large-scale EV fleets would place substantial pressure on the existing electricity grid. Policy-level coordination shall be required to optimize energy costs and reliability for EV Charging.

2.9.6 Limited E-Mobility Knowledge and Awareness

There is limited knowledge, awareness and a prevalence of misconceptions about e-Mobility Technology and its benefits, making it difficult for consumers and policymakers to make informed decisions about its adoption. EVs are often misconceived as dangerous, delicate, expensive and elitist. There is therefore a need to create education and awareness programs to help dispel misconceptions, build support, and drive the adoption of e-Mobility in Uganda.

The Kiira EVS Hybrid Sedan

3 NATIONAL E-MOBILITY STRATEGY FRAMEWORK

The strategic direction sets out the Vision, Mission and Objectives of the e-Mobility Strategy as well as the outcomes and guiding principles underpinning the strategy. The framework is meant to guide Uganda through to 2040 and beyond.

3.1 Vision

Uganda fully transitioned to e-Mobility in public transport and motorcycles by 2030 and passenger vehicle sales by 2040.

3.2 Mission

A robust, self-sustaining, and competitive e-Mobility ecosystem in Uganda.

3.3 Objectives

1) **Local EV Manufacturing & Supply:** To increase local manufacture and supply of electric buses, motorcycles and vehicles with associated parts, components and systems.

2) **Local EV Battery Manufacturing:** To promote local manufacture of electric vehicle batteries and battery energy storage systems for domestic, commercial, and industrial applications.

3) **Public Transport**: To electrify public transport systems based on electric buses, motorcycles and trains.

4) **Charging Network:** To establish EV charging infrastructure that supports battery swapping, contact charging, wireless charging, e-Trams, and any other emerging charging technologies.

5) **E-Mobility Human Capital Development:** To develop skills and capabilities in the e-mobility value chain.

6) **Electric Vehicle Uptake:** To increase electric vehicle uptake including electrification of the Government fleet.

7) **E-Mobility Standards Development:** To develop standards for the e-Mobility Ecosystem.

e-Mobility solutions should also be integrated with smart city solutions to enable intelligent traffic management and efficient routing.

3.4 Guiding Principles

Clear guiding principles are essential to ensuring the National e-Mobility Strategy is effective and that it is aligned with broader goals related to equity, sustainability, and economic development. These principles will form the basis and provide a framework for policies, programs, and investments in the e-Mobility ecosystem. The overarching principle is that Uganda positions itself as a technology developer and supplier for the domestic and African e-Mobility industry. The following specific guiding principles will inform the implementation of the National e-Mobility Strategy:

(i) **Ecosystem Approach:** Cross-cutting institutional cooperation should be prioritised by engaging all relevant stakeholders. This should strengthen collaboration and participation between Government MDAs, private sector, academia, development partners and the public, and create co-ownership of the transition.

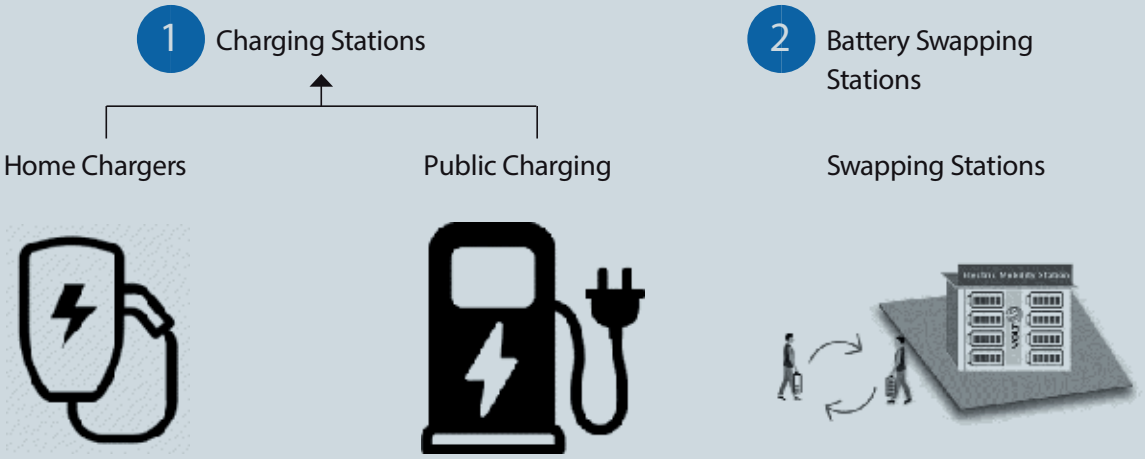
(ii) **Innovation: I**nterventions should encourage innovation in new business models, technologies, and approaches to financing. This can be achieved by supporting research, development, and innovation in e-Mobility solutions, providing incentives for innovative solutions, and fostering collaboration between industry and research institutions.

(iii) **Supply Chain Localization:** Local manufacture of key parts, components and systems should be prioritized with emphasis on the use of locally sourced materials and components. By localizing supply chains, e-Mobility solutions can promote economic growth within local communities and enhance the resilience by reducing dependence on global supply chains, which are vulnerable to disruptions.

(iv) **Equity and Inclusion:** e-Mobility solutions should benefit all members of society, regardless of income, race or gender. This can be achieved by providing access to e-Mobility solutions to underserved communities, including those in rural areas or low-income urban areas. Additionally, e-Mobility solutions should be designed to meet the needs of individuals with disabilities, ensuring that they can fully participate in the transition to e-Mobility.

(v) **Integration:** E-Mobility solutions should be integrated with existing mobility systems and infrastructure to ensure that they are seamless and convenient for users. This can be achieved by promoting the use of multimodal transportation, including biking, walking, mass transit, logistics and last mile transit. Last mile transit solutions should be sustainably designed to bridge the gap between mass transit and the commuter's destination. e-Mobility solutions should also be integrated with smart city solutions to enable intelligent traffic management and efficient routing.

EV charging ecosystem



(i) **Adaptability:** The design of e-Mobility solutions should integrate flexibility and responsiveness, enabling them to adapt to changing circumstances and needs. This can be achieved by designing solutions that are scalable, modular, and easily upgradable, allowing for the integration of new technologies and the expansion of services to meet evolving demands.

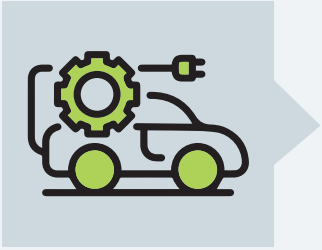
(ii) **Information and Public Awareness:** The dissemination of information and public awareness campaigns that promote the benefits of electric vehicles, charging infrastructure, and other E-Mobility solutions should be strengthened. This can be achieved by partnering with media, community organizations, academia, and other stakeholders to develop targeted communication campaigns and public education programs.

(iii) **Sustainability:** Sustainable E-Mobility Solutions should prioritize economic development (industrialization and services), job creation and environmental stewardship by reducing Greenhouse Gas Emissions and contribute to a cleaner, more sustainable future.

4. PRIORITY AREAS & STRATEGIC INTERVENTIONS

The Government's e-Mobility Strategy is premised on a range of supportive policy interventions and participation of private sector and development partners. The interventions are conceptualized to put in place measures addressing barriers to e-Mobility.

4.1 Local EV Manufacturing



Objective 1

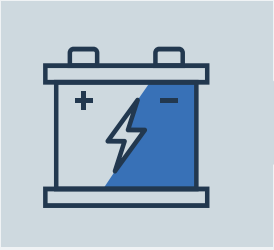
To increase local manufacturing of electric buses and motorcycles with associated parts, components and systems

The Uganda import value for vehicles and transport equipment grew from USD 115 Million in FY 2002/03 to USD 795 Million in FY 2022/23 at a CAGR of 10% representing approximately 8% of the national gross import value and the third highest valued imported goods after petroleum products and pharmaceuticals[11]. The development of capabilities for the local manufacturing of electric vehicles, associated parts, components, and systems will deepen value addition along the mobility value chain, create jobs, enhance human capital development, reduce the country's reliance on imports and create opportunity for export. These strategies and actions will be employed for this priority:

Strategies	Actions	Targets
(i) Establish EV manufacturing capabilities	(i) Operationalise the Kiira Vehicle Plant (ii) Establish mobility industrial and technology parks and strategic manufacturing facilities. (iii) Develop strategic technology partnerships with global e-Mobility players for technology development and transfer	(i) Installed production capacity of 500,000 vehicles per year by 2030. (ii) Up to 65% local content of key vehicle models produced in Uganda by 2030 (iii) Develop at least 15 strategic technology partnerships by 2030
(ii) Provide affordable financing for value chain players	(i) Establish a line of credit/facility at UDB for the e-Mobility ecosystem including asset financing for bus operators and schools. (ii) Fund strategic e-Mobility research & innovation (iii) Mobilise affordable finance for the e-Mobility ecosystem in collaboration with DFIs and relevant climate/green funds	(i) e-Mobility line of credit/ financing facility established at UDB. (ii) Commit at least USD15 Million for strategic e-Mobility research and Innovation per year. (iii) At least USD500 Million mobilized for the e-Mobility ecosystem by 2030 in collaboration with DFIs and relevant climate/green funds

11 Uganda Bureau of Statistics. Formal and Informal most Imported Products by SITC (August 2022)

4.2 Local Manufacturing of Electric Vehicle Batteries and Battery Energy Storage Systems



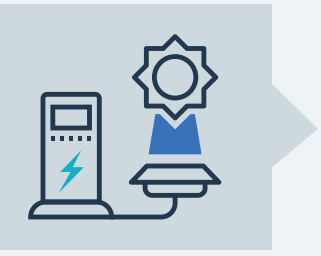
Objective 2

To promote local manufacturing of electric vehicle batteries and battery energy storage systems for domestic, commercial, and industrial applications.

It is estimated that an EV battery pack accounts for about 40%-60% of its cost. The battery cost has been declining steadily but is still projected to be substantial at approximately 20% by 2030.[12] The localization of the EV battery and battery energy storage systems therefore presents an opportunity for high value addition in the e-Mobility value chain. Uganda is also endowed with lithium, nickel, manganese, cobalt, iron, and phosphate deposits that are key inputs for manufacture of Lithium-Ion batteries. These strategies and actions will therefore be prioritized:

Strategies	Actions	Targets
(i) Localize the Battery Manufacturing Value Chain	(i) Undertake feasibility study on the establishment of a vertically integrated battery production value chain in Uganda. (ii) Invest in R&D in the production of EV Batteries (iii) Develop Strategic Technology Partnerships with Global EV Battery Players for Technology Development and Transfer	(i) Feasibility Study on the establishment of a vertically integrated battery production value chain in Uganda by 2024 (ii) Fully integrated domestic battery manufacturing value chain producing over 1GWh of batteries annually by 2040
(ii) Develop domestic capabilities for Battery Recycling	(i) Develop End of Life Strategies and Regulations for Lithium-Ion Batteries covering recycling, repurposing, reconditioning and disposal (ii) Develop Battery Recycling Facilities (iii) Invest in R&D in Battery Recycling Technologies	(i) End of Life Strategies and Regulations for Lithium-Ion Batteries (ii) At Least one Battery Recycling Facility established by 2030

4.3 Electric Vehicle Charging Infrastructure



Objective 3

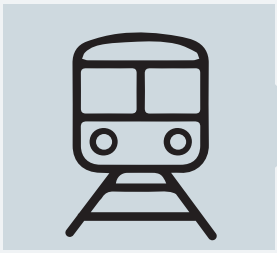
To establish electric vehicle charging infrastructure supporting battery swapping, contact charging, wireless charging, e-Trams, and any otheremerging charging technologies.

The successful implementation of the National e-Mobility Strategy is contingent upon the establishment of a sufficient, robust, convenient, and interoperable network of charging infrastructure to dispel range anxiety which may deter potential EV buyers and hinder the transition to e-Mobility. These strategies and actions will be employed:

12 Battery share of large EV costs 2030 | Statista

Strategies	Actions	Targets
(i) Establish Smart Electric Vehicle Charging Infrastructure	(i) Establish Public Charging Stations at Government MDA Offices and Strategic Public Spaces (ii) Support Private Sector in the establishment of Charging Infrastructure including Fuel Stations (iii) Increase Electricity Generation Capacity, Grid Access, and Reliability to support Charging Stations (iv) Develop Standards, Guidelines and Regulations for Charging Infrastructure	(i) Over 10,000 Fast Chargers established with a charger in every 50km radius with 3,500 Public Charging Stations by 2040 (ii) Charging Infrastructure installed at all public offices by 2030. (iii) Increase Electricity Generation to provide the up to 2,500 MW power requirements by E-Mobility by 2040

4.4 Electrification of Public Transport



Objective 4

To electrify public transport systems based on electric buses, motorcycles and trains

The 2014 National Population and Housing Census established that the day-time population of Kampala City is ~4 million persons with ~1.5 million residents and ~2.5 million commuting from the neighboring districts of Wakiso, Mukono and Mpigi. This is expected to grow at a rate of 4% per annum over the next decade to 10 million residents, escalating the challenges faced with the Metropolis' transport system.

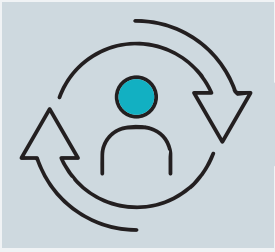
The existing public transport model in GKMA with a reliance on end-of-life petrol and diesel matatus and boda-bodas is unsustainable and has contributed to traffic congestion and poor air quality.

It is important to note that over 24,000-man hours are lost daily representing approximately USD800 million lost in productivity, and UGX500 million in extra burnt fuel daily due to traffic congestion.

The adoption of an Electric Public Transport System that uses high-capacity electric buses and trains accentuated by electric Motorcycles for first and last mile transit, will go a long way in addressing the challenges of congestion and poor air quality in urban centers in the country. These strategies and actions will be pursued:

Strategies	Actions	Targets
(i) Develop an Integrated, Sustainable, Safe and Inclusive Electric Mass Transit System	(i) Pilot Electric Mass Transit Systems in Strategic Cities in Uganda (ii) Transition Matatu Operators to large capacity Electric Buses (iii) Support Private Sector in the development and deployment of innovative business models and technologies for Electric Motorcycles (iv) Establish Intelligent Transport Systems (v) Develop the Electric Light Rail Urban Mass Transit System for GKMA	(i) At least 15,000 Electric Buses deployed for Mass Transit in Uganda by 2040 (ii) Full Electrification of motorcycles in the Greater Kampala Metropolitan Area by 2026 and in the rest of the country by 2030 for first and last mile travel (iii) Full Transition of public transport to E-Mobility by 2030 (iv) Electric Light Rail Urban Mass Transit System for GKMA by 2040

4.5 E-Mobility Human Capital Development



Objective 5

To develop skills and capabilities for the e-mobility value chain.

The e-Mobility value chain in Uganda has the potential to create over 500,000 high quality employment opportunities by 2040 including but not limited to: Engineers, IT Specialists, Planners, Welders, Painters, Designers, Architects, Lawyers, Financial Analysts, Accountants, Economists, Logistics and Supply Chain Practitioners, Auditors, Human Resources Personnel, Communication Experts, Sales Executives, Marketers, Machine Operators, Drivers, Stewards, and Cleaners. A highly skilled workforce, operating under good working conditions and with varying training opportunities that provide constant up-skilling, are of the utmost importance to keep pace with rapid technological developments in the value chain. These strategies and actions will be employed:

Strategies	Actions	Targets
(i) Develop Skills and Capabilities for E-Mobility Actors	(i) Develop a specialized curriculum to address the needs of the E-Mobility Value Chain at Higher Education Institutions (ii) Develop a National Skilling and Certification Program for Electric Vehicle Operators, Technicians, Mechanics, and Jua Kali (iii) Implement a Program for integrating informal sector actors into the E-Mobility Value Chain	(i) At least 250,000 people receiving specialized skilling along the E-Mobility Value Chain by 2040 (ii) All Public Universities offering programs addressing needs of the E-Mobility Value Chain by 2030
(ii) Mobility clubs in primary and secondary schools	(i) Establish mobility clubs in primary and secondary schools. (ii) Establish an annual National mobility competition for schools	(i) 200 Mobility clubs established in primary and secondary schools by 2030. (ii) Launch annual National Mobility Competition for Schools by June, 2026

4.6 Electric Vehicle Uptake

Objective 6

To increase Electric Vehicle Uptake including electrification of the Government Fleet.

Stakeholder findings indicate that there is a strong interest in the EV market in the region. Making EVs more affordable and reducing the costs to Ugandans of running their EVs is crucial to increasing demand for EVs in the country. However, there are several factors tempering demand – including cost, perceived limited travelling distance of EVs or range anxiety, lack of charging, infrastructure, and lengthy charging time.

Additionally, Government purchases of motor vehicles averaged 1,629 units in the period 2010 to 2018 constituting a considerable portion of new vehicle sales. The electrification of the Government fleet would create a substantial offtake demand for local manufacturers and demonstrate Government's leadership and commitment to e-Mobility, encouraging wider adoption. These strategies and actions will be adopted:

Strategies	Actions	Targets
(i) Electrification of Government Fleet	(i) Government MDAs to integrate E-Mobility in annual work plan and budget. (ii) Government MDAs to only procure locally produced Electric Vehicles where capabilities exist	(i) Full Electrification of New Government Passenger Vehicle, Bus, and Motorcycle Fleet by 2035 (ii) At least 1 (one) EV in HE the President's fleet by 2025
(ii) Implement an Incentive Package for EVs	(iii) Tax Incentives on Charging and Battery Swapping Services (iv) Incentives on EV Charging at Public Charging Points (v) Tax Incentives on EV Passenger Vehicle Imports for a given period. (vi) Disincentives for ICE Vehicles. (vii) Non-fiscal incentives on EVs on the road	(i) Increase purchase of new EVs to 30% by 2030
(iii) Increase Awareness on EVs	(i) Undertake Awareness campaigns on EVs	(i) Regular Discussions, Publications & Annual Reports

4.7 e-Mobility Standards Development

Objective 7

To develop standards, regulations, guidelines, and code of practice for the e-Mobility Industry.

Government shall advocate for development of e-Mobility standards, regulations, guidelines, and code of practice for the e-Mobility industry across all value chain and ecosystem areas to ensure quality, competitiveness and safety of products and services as well as environmental stewardship.

Strategies	Actions	Targets
(i) Review and Amendment of Existing standards, regulations, and Guidelines	(i) 5-year Periodic Review of Existing Used Vehicle Import Regulations (ii) Review of Planning Guidelines to include requirements and regulations for EV Charging Stations (iii) Streamline Motor Vehicle Registration Process to incorporate Electric Vehicles and other Alternative Technologies (iv) Harmonize vehicle emission and fuel quality standards as well as end of life regulations for vehicles with global and regional standards	(i) At least 250,000 people receiving specialized skilling along the E-Mobility Value Chain by 2040 (ii) All Public Universities offering programs addressing needs of the E-Mobility Value Chain by 2030
(ii) Development of standards, regulations, and guideline for the E-Mobility industry	(i) EV Manufacturing Standards and Regulations (ii) EV Charging Infrastructure Guidelines, Regulations and Standards (iii) EV Batteries, Parts, and Components Standards, Certification and Licensing Guidelines (iv) EV Scrapping and Battery Usage & Recycling guidelines and protocols (v) Guidelines on Disposal and Recycling of discarded ICE Vehicles (vi) Electricity Grid Management Guidelines (vii) Code of Practice; Operation and Certification Guidelines for E-Mobility Value Chain Actors	(i) Comprehensive of Standards, Regulations, Guidelines (ii) Code of Practice (iii) Certification & Accreditation Guidelines

4.8 Prioritized Policy Measures

Government will commit to the following policy measures, and the STI Secretariat will coordinate the Whole-Government Approach to create an enabling environment for the protection and growth of the domestic e-Mobility ecosystem. Governmentis committed to implementing these interventions for the next 10 years with periodic reviews:

CATEGORY	PRIORITIZED POLICY MEASURES
Targets and Mandates	(i) EV targets (ii) EV mandates
Economic & Fiscal Measures	(i) Fiscal incentives to EV Users including subsidies, concessions and tax exemptions. (ii) Incentives to manufacturers including tax holidays, tax exemptions, concessions on EV Production (iii) Affordable and special electricity (energy) tariff for charging EVs (iv) Incentives for lowering EV operational costs such as parking and toll fees concessions (v) Disincentives for ICE vehicles such as VAT increase, and pollution or environmental taxes
Infrastructural Measures	(i) Installation of intra-city and inter-city charging points (ii) Licensing of garages, maintenance workshops and training centers (iii) Traffic management: green routes; e-Bus lanes; NMT lanes
Policy, and Regulatory Measures	(i) 5-year periodic review of existing used vehicle import regulations (ii) Review of planning guidelines to include requirements and regulations for EV charging stations. (iii) Standardisation, licensing, and certification of EVs and related components (iv) EV charging infrastructure standards and safety regulations (v) EV scrapping guidelines and battery usage and recycling guidelines (vi) Electricity grid management
R&D and Capacity Building Measures	(i) Technology transfer (ii) Battery technology development to increase range and capacity. (iii) Skills development to develop, make, maintain and repair EVs (iv) EV public transport pilot projects
Local EV Development Measures	(i) Domestic manufacture of buses, motorcycles, passenger cars, and related parts (ii) Domestic manufacture of the EV battery & EV battery recycling (iii) Provide an enabling environment for domestic manufacturers, innovators, and start-ups
Social Measures	(i) EV awareness creation roadmap (ii) EV promotional measures like incentives for early adopters

4.8.1 Fiscal Incentives

(i) Tax Exemptions on expenditure on mobility R&D

(ii) 0% Import Duty, 0% VAT and 0% Withholding Tax on original equipment manufacturer vehicle parts, components (production parts), EV chargers, EV batteries, and materials imported for motor vehicle production by registered mobility industry value chain actors.

(iii) 0% Import Duty, 0% VAT, 0% Infrastructure Levy and 0% Withholding Tax on plant machinery, tools and equipment and all industrial replacement spare parts imported by registered mobility industry value chain actors.

(iv) Income Tax holiday for registered mobility industry value chain actors operating in dedicated industrial parks to enable reinvestment of profits for expansion and to encourage new investments of plant and machinery in the mobility industry value chain.

(v) 0% VAT on charging and battery swapping services.

(vi) 0% VAT and 0% Withholding Tax on sale of EV parts and components produced in Uganda.

(vii) An e-Mobility energy tariff for public and commercial charging points like the tariff for city streetlights.

4.8.2 Non-Fiscal Incentives

(i) Requisite standards for e-Mobility in the areas of charging infrastructure, vehicle safety, energy efficiency, and interoperability, among others.

(ii) Integrate requirements for charging stations at public spaces and buildings in the planning and building guidelines.

(iii) Exemption of electric vehicles from paying road tolls.

(iv) Exemption of electric vehicles from street parking fees.

4.8.3 Disincentives

(i) Increase in VAT, Import Duty and Environmental Levy for internal combustion engine vehicles.

4.9 Expected Outcomes

The implementation of the interventions in this e-Mobility Strategy are expected to catalyze economic development, create jobs, and enhance environmental stewardship. The following specific outcomes are expected:

a) **Creation of Industries:** 65% localization of e-Mobility sector leading to utilization of Uganda's abundant mineral resource.

b) **Production:** Production of over 10,000 electric buses and 1,000,000 electric motorcycles by 2030 for import substitution and export. 12.5% contribution of the mobility sector to national GDP.

c) **Productivity Acceleration:** Contributing to the reduction from over USD 800 million annual losses in productivity due to traffic congestion through established sustainable electric mass transit systems in all cities.

d) **Job Creation:** Over 500,000 green jobs created directly and indirectly by 2040.

e) **Environmental Stewardship:** Reduction in transport-based emissions by over 25% by 2040 resultant from increased uptake of electric vehicles.

5. LINKAGES TO GLOBAL, REGIONAL AND NATIONAL PLANNING FRAMEWORKS

5.1 Sustainable Development Goals

The World Bank initiative, Sustainable Mobility for All (SuM4All), defines sustainable mobility as one that is "universal, efficient, safe and green". Sustainable Mobility in this context is a critical component in achieving the Sustainable Development Goals (SDGs) as highlighted in Figure 5.1 with 15 out of 169 SDG targets indirectly related to the mobility sector, 7 of which speak directly to e-Mobility.

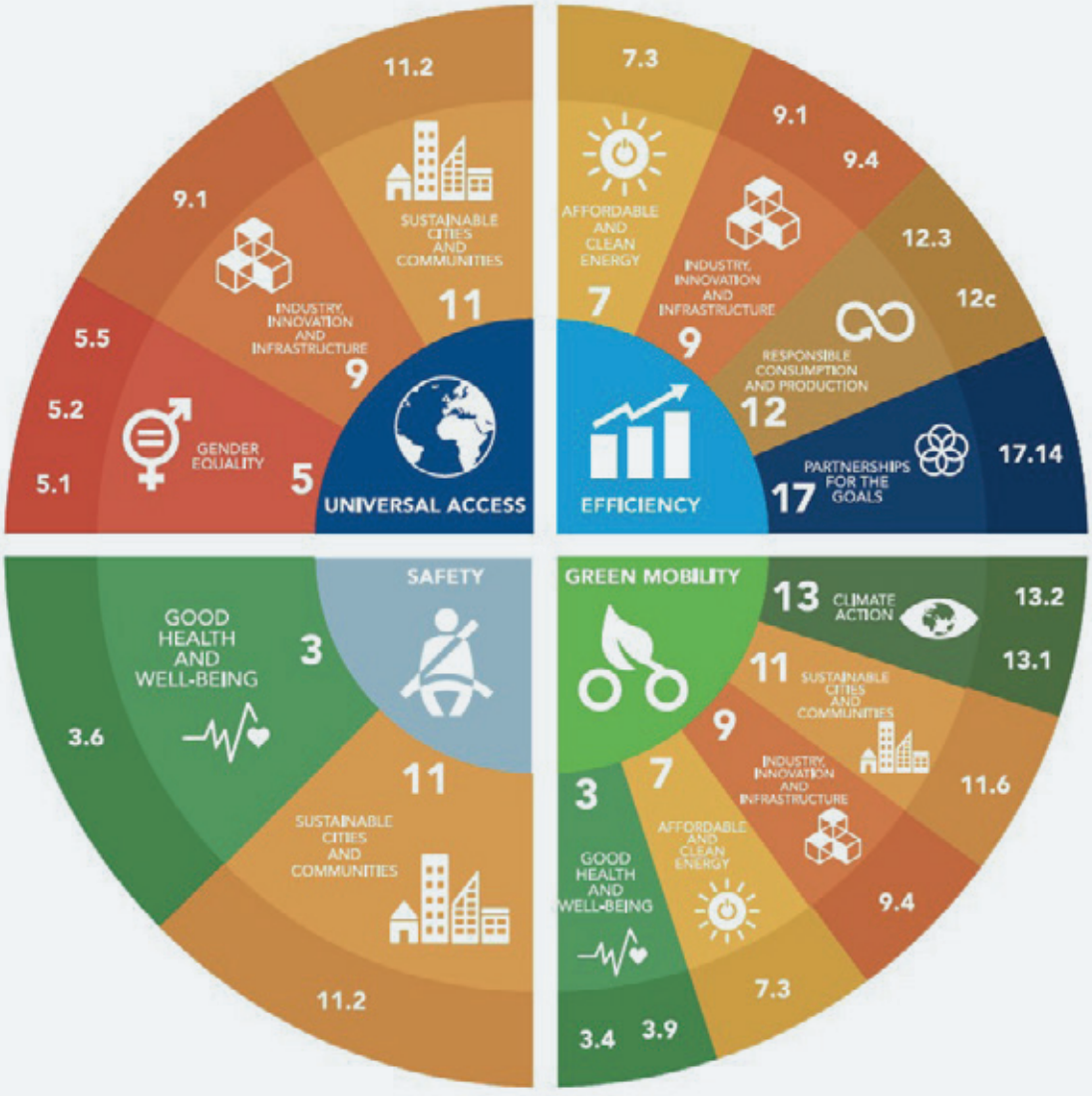


Figure 5.1: Sustainable Development Goals in Relation to Mobility
(Source: Sustainable Mobility for All)

5.2 Africa Agenda 2063

Africa Agenda 2063 envisions a prosperous Africa based on inclusive growth and sustainable development with the means and resources to drive its own development, where its cities and other settlements are hubs of cultural and economic activities, with modernized infrastructure, and people have access to all the basic necessities of life including energy, public transport and ICT.

5.3 EAC Vision 2050

The EAC Vision 2050 envisions a globally competitive upper-middle income region with a high quality of life for its population based on the principles of inclusivity and accountability. It commits to promote economic transformation and development policies that support affordable and sustainable transport. The automotive industry is identified as a key opportunity for the region to enhance manufacturing.

5.4 Uganda Vision 2040 and National Development Plan III

Building the domestic E-Mobility Value Chain is consistent with Uganda's aspirations and pathways to Vision 2040 outlined in the NDPIII. Specifically: promotion of local manufacturing of motor vehicles; establishment of an efficient, integrated, sustainable, safe and inclusive public transport system; and promotion of environmentally friendly transport solutions. Increasing adoption and use of clean energy using electric transport solutions is one of the key interventions under the Sustainable Energy Development Program of NDPIII.

5.5 NRM Manifesto 2021-2026

The NRM Manifesto 2021-2026 commits the development of the nascent automotive industry by: operationalizing the Kiira Vehicle Plant; setting up an automotive industrial and technology park; providing government offtake market for locally produced vehicles; and providing flexible financing arrangements to innovative private firms among others.

5.6 Nationally Determined Contributions, 2022

GoU in the updated Nationally Determined Contributions (2022) in line with the Paris Agreement, has committed to improve energy efficiency in the transport sector and reduce emissions by over 2 $MtCO_2e$ by 2030 through e-Mobility. The proposed mitigation measures include improvement of the national vehicle fleet database, frameworks, and fuel standards, and the introduction of electric buses, boda bodas and passenger rail. Specifically, the Government targets the introduction of at least 200 electric buses in the GKMA by 2030 and implementation of 75km fully electrified passenger metro rail and 100km fully electrified passenger light rail transit by 2040.

GOGO Swap Station for Electric Motorcycles

6 FINANCING REQUIREMENTS

The strategy will require a total investment of up to USD 1.74 billion for FY2023/24 – FY2027/28. This investment will enable the generation of over USD 15 billion in annual revenues, over UGX 1 billion in income from jobs created and reduction of transport-based emissions by over 2 $MtCO_2e$ by 2030.

E-MOBILITY OBJECTIVE		FINANCIAL REQUIREMENTS (MILLION USD)					
		2023/24	2024/25	2025/26	2026/27	2027/28	TOTAL
(i)	Local manufacturing of electric buses, motorcycles, vehicles, associated parts, components and systems	21.5	230	300	350	268.5	**1,170**
(ii)	Local manufacturing of EV batteries and battery energy storage systems	1	14.5	25	15	10	**70**
(iii)	Electrification of public transport systems	61	79	81	81	73	**375**
(iv)	Establishment of EV charging infrastructure	6	10	12.5	16.5	25	**70**
(v)	Increased demand of EVs	1	5	10	15	24	**55**
TOTAL (MILLION USD)		**95.0**	**338.5**	**428.5**	**477.5**	**400.5**	**1,740**

Funding for the National e-Mobility Strategy is anticipated to come from various sources. These are the envisaged sources of funding for the Action Plan for the National e-Mobility Strategy in Uganda:

(i) **Domestic e-Mobility Value Chain Actors:** through capital investments in their core activities.

(ii) **Financial Institutions:** these will provide debt, supplier, and asset financing to the value chain as a means of raising capital. UDB as a financial development institution will play a critical role in providing affordable financing for the nascent e-Mobility ecosystem.

(iii) **Uganda Development Bank:** funding will be provided for asset financing of electric buses for mass transit system operators and manufacturers of electric vehicles and parts.

(iv) **The Government of Uganda:** funding could be used to support electrification of the overnment fleet; e-Mobility offtake agreements; e-Mobility research and innovation; e-Mobility Human Capital Development; and the establishment of mobility industrial and technology parks and strategic manufacturing facilities, among others.

(v) **Development Partners:** will support in policy advocacy, infrastructure development, research & development, training, and skills development among others.

7 IMPLEMENTATION ARRANGEMENTS

These are the Key Stakeholder roles for the successful implementation of the National e-Mobility Strategy in Uganda:

SN	ENTITY	ROLES AND RESPONSIBILITIES
1	**Science, Technology, and Innovation Secretariat**	(1) Oversee policy coordination & implementation of the e-Mobility Strategy for Uganda (2) Coordinate e-Mobility industry value chain actors and stakeholders. (3) Oversee technology development and inovation activities in the e-Mobility ecosystem. (4) Build capacity for domestic production of parts, systems and components including batteries to support e-Mobility. (5) Establish mobility industrial apprenticeship and internship schemes to create a professional and highly skilled labour force. (6) Put in place the short term and long-term mobility industry roadmap. (7) Coordinate across Government MDAs to ensure alignment in policy and regulatory decisions in the mobility industry
2	**Other Government MDAs**	(1) Facilitate the implementation of strategy in line with their mandate
3	**Private Sector**	(1) Establish e-Mobility innovation & research firms; and manufacturing enterprises. (2) Promote and support technology advancement through research and development for the mobility industry. (3) Explore use of locally available materials and natural resources for the domestic manufacture of vehicle parts. (4) Provide end-user financial services for new vehicle purchases. (5) Implement Public-Private Partnerships in the development and management of Infrastructure for e-Mobility. (6) Invest in services to support the operation of the vehicle plants such as asset insurance, real estate development for plant staff, catering services in the proximity of the plants. (7) Create non-state sponsored industry groups and collaboration fora to improve knowledge and capabilities in the mobility industry
4	**Academia**	(1) Undertake research and development along the e-Mobility value chain. (2) Human Capital Development through formal education

SN	ENTITY	ROLES AND RESPONSIBILITIES
5	**Development Partners**	(1) Support infrastructure development requisite for e-Mobility in Uganda. (2) Provide technical assistance in undertaking feasibility studies, development of business plans and investment appraisals for the domestic manufacturers and suppliers of auto parts in the mobility industry value chain (e.g. batteries, auto filters, seats, web-frame, auto paints, body panels, etc.) (3) Provide sustainable finance facilities such as grants for R&D, innovation and manufacturing especially in e-Mobility and sustainable industry practices. (4) Provide capacity development and supplier development programs in key skills relevant for operating a sustainable indigenous mobility industry. (5) Support technology development, transfer and diffusion initiatives. (6) Support policy implementation, advocacy, promotion & review
6	**Public**	(1) Adoption of e-Mobility (2) Advocacy and support for e-Mobility policy interventions

Production of the GOGO Electric Motorcycle

ANNEX ONE: GLOSSARY

Battery Electric Vehicle (BEV)	An electric vehicle that exclusively uses chemical energy stored in rechargeable battery packs to power at least one electric motor with no secondary source of propulsion.
Charging / recharging	The process of restoring electrical energy in a battery or a battery-operated vehicle by connecting it to a power supply.
Critical minerals	A metallic or non-metallic element that is essential for the functioning of modern technologies, economies, or national security, and with a risk that its supply chains could be disrupted.
Decarbonize	To stop or reduce carbon gases, especially carbon dioxide, being release into the atmosphere as the result of a process, like the burning of fossil fuels.
Drivetrain	The group of components that deliver power to the drive wheels.
Downstream processing	Refers to manufacturing processes that occur later on in a production sequence or production line.
Electric vehicles (EVs)	Defined in this Strategy as plug-in vehicles powered at least partly by electricity.
E-Mobility	Clean and efficient transport, using electric vehicles, powered either by batteries or hydrogen fuel cells and includes full electric vehicles, plug-in hybrid electric vehicles, as well as hydrogen fuel cell vehicles that convert hydrogen into electricity.
Fuel efficiency standard	A fuel efficiency standard sets an average efficiency target, typically measured in grams of CO_2 per kilometer, for vehicles sold by each manufacturer.
Fringe Benefits Tax (FBT)	A fringe benefit is a payment made to an employee which is not their salary or wages. These benefits are subject to fringe benefits tax which is separate to income tax and calculated on the taxable value of the fringe benefit.
Fast charging DC	The second fastest electric vehicle charging technology with an electrical output ranging from 50 kW to 120 kW. This can add between 230 - 500 km driving range to an electric vehicle per hour.
Heavy road vehicles	Vehicles that have a gross vehicle mass (GVM) or aggregate trailer mass (ATM) of more than 4.5 tonnes. The GVM of a vehicle is the maximum it can weigh when fully loaded, as specified by the manufacturer.
Hydrogen fuel cell electric vehicle (FCEV)	An electric vehicle that uses electricity from a fuel cell powered by compressed hydrogen, rather than electricity from batteries.
Internal combustion engine (ICE) vehicle	A conventional vehicle is a vehicle with only an internal combustion engine system – that is, a conventional vehicle powered by fossil fuel.
Micro-mobility	Forms of transport using small, lightweight vehicles operating at speeds typically below 25 km per hour and driven by their users personally such as electric bicycles (e-bikes), segways, scooters, skateboards, electric water bikes and hover boards.
Net Zero Emissions	An overall balance between greenhouse gas emissions and removals.
Plug-in hybrid electric vehicle (PHEV)	A hybrid electric vehicle whose battery can be recharged by plugging it into an external source of electric power, as well as by its on-board engine and generator.
Range	The total distance an electric vehicle can travel on one full charge before the battery needs to be recharged.
Refueling	The process of refilling hydrogen fuel cell vehicles with hydrogen, or combustion engine vehicles with petrol or diesel fuel.
Regenerative braking	An energy recovery mechanism that slows down a moving vehicle or object by converting its kinetic energy into a form that can be used immediately or stored.
Renewable Energy	Energy sources that naturally replenish.
Tailpipe emissions	The product of fuel combustion (e.g., gasoline, diesel) and include several pollutants like carbon dioxide, carbon monoxide, and nitrogen oxides.
Ultra-fast or ultra-rapid DC charging	The fastest EV charging technology, with an average electrical output ranging from 120kW up to 350 kW. This can add between 500 km up to 1000 km in driving range for an electric vehicle per hour.
Zero-emission vehicle (ZEV)	A vehicle that emits no pollutants from its operation. Electric-only vehicles (both BEVs and FCEVs are zero-emissions vehicles.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ANNEX TWO: GLOBAL BEST PRACTICES IN E-MOBILITY

The global e-Mobility market is growing exponentially but this growth is far from evenly distributed. A handful of countries are leading the transition as can be seen in Figure 4 that highlights the top 10 countries with the most EVs per Capita in 2020. It can be observed that the top 7 countries are in Europe. It is important to draw some lessons on how these countries have managed to attain this leadership in the transition to E-Mobility.

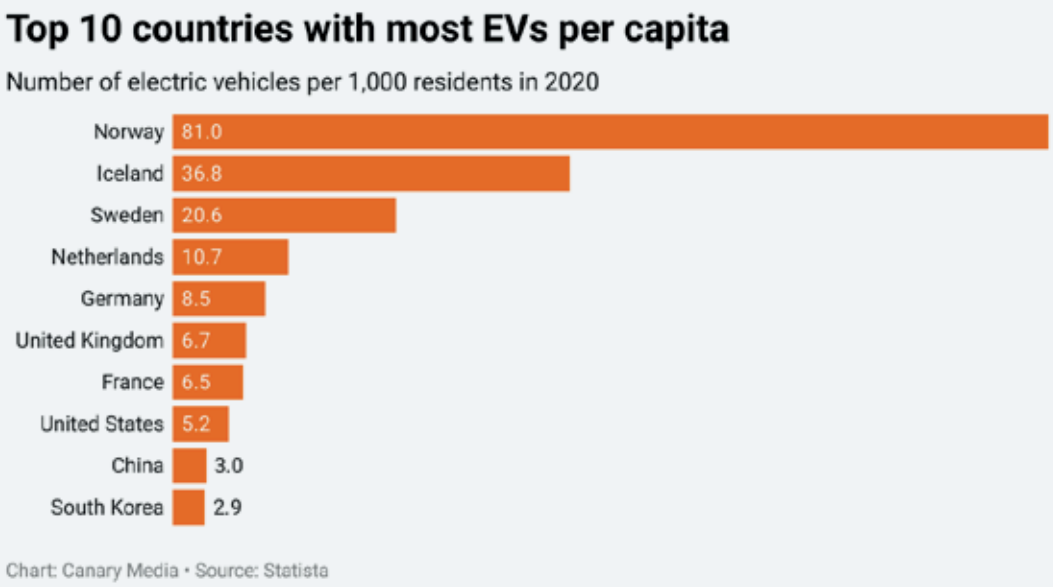


Figure 4: Top 10 Countries with most EVs per Capita (Source: Statista)

Several countries in Sub-Saharan Africa have also embraced the e-Mobility agenda and have started to set electrification targets for mobility including Rwanda, Kenya, Zimbabwe and South Africa. Additionally, a growing start-up ecosystem for EVs is emerging in the region and according to McKinsey, as of the end of 2021, there were more than 20 start-ups in the ecosystem, which combined raised over $25 million in funding that year[13].

According to the Association for Electric Mobility and Development in Africa (AEMDA), East Africa has been the focal point of the continent's revolutionary transition to electric mobility. Rwanda has implemented several policy amendments which include reduced electricity tariffs for EVs, zero VAT tax on EV

consumables, exemption from import and excise duties and rent-free land for charging stations. In addition, Kenya has accelerated the adoption rate of electric mobility and has announced that by 2025, the nation's aim is for 5% of all newly registered vehicles to be electric.

In North Africa, Morocco has committed to achieve a 23% energy saving in the transport sector by 2030 while Egypt is currently working on a national e-Mobility strategy. Egypt is planning to build 3,000 charging stations nationwide in a joint manufacturing deal between El Nasr Automotive Manufacturing Company and the Chinese Dongfeng Motor Corporation[14].

13 https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/power-to-move-accelerating-the-electric-transport-transition-in-sub-saharan-africa
14 https://energyindaba.co.za/africas-future-is-electric/

Joint Global Action Towards e-Mobility

World leaders at the 2012 UN Conference on Sustainable Development recognized that transportation and mobility are central to sustainable development. Sustainable transportation can enhance economic growth and improve accessibility. In the 2030 Agenda for Sustainable Development, sustainable transport is mainstreamed across several SDGs and targets, especially those related to food security, health, energy, economic growth, infrastructure, and cities and human settlements.

At the 26th Session of the Conference of the Parties (COP26) held in Glasgow, UK in November 2021, the Glasgow Declaration on Zero-Emission Cars and Vans was signed by over 100 Governments, Cities, Automotive Manufacturers, Fleet Operators and Financial Institutions. The parties agreed to support an accelerated transition to zero emission vehicles including all sales of new cars and vans to be zero emission in 2035 in leading markets and 2040 for the rest of the world to achieve the goals of the Paris Agreement. Figure 3 presents Countries that have already set Electrification of Vehicles and Net-Zero Targets.

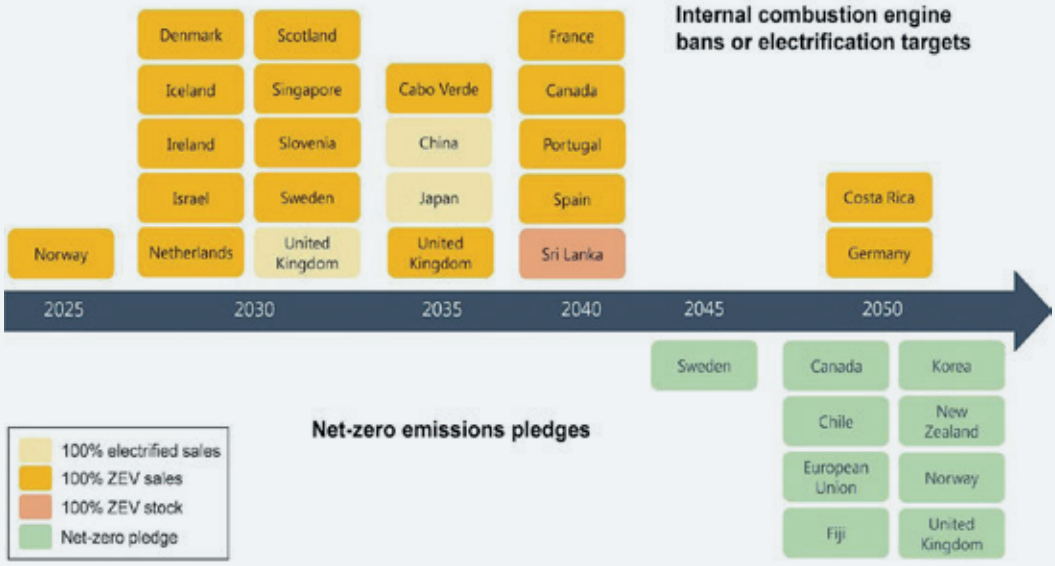


Figure 5: Electrification of Vehicles and Net-Zero Targets by Countries
(Source: International Energy Agency)

1. Fiscal Incentives

a. Purchase Subsidies

Policy support through purchase subsidies has played a key role in EV deployment in particular for driving early-stage adoption, through lowering upfront costs. According to Bloomberg, countries with such policies in place accounted for over 90% of global EV sales in 2019. Nations where electric vehicles passed the 10% adoption mark continue to offer purchase subsidies, recognizing that it will likely be necessary until they reach upfront price parity with internal combustion engine vehicles.

Figure 6: Maximum national direct purchase subsidy for passenger BEVs across select countries, 2020 (Source: BloombergNEF)

Figure 6 shows the maximum national direct purchase subsidies for passenger BEVs across select countries in 2020. It is important to note that China before 2016 provided up to USD150,000 subsidy (more than half the vehicle's price) in some cities like Shenzhen for electric buses.

The National Institution for Transforming India (NITI Aayog), a policy think tank, and World Bank are setting up a USD300 million first-loss risk-sharing instrument that protects banks from EV-related loan defaults and effectively lowers the interest rate for consumer loans from 20–25 percent to 10–12 percent.

The Scottish Government transport agency currently offers interest free loans of up to GBP35,000 for pure electric/plug-in hybrid electric vehicles and up to GBP10,000 for electric motorcycles or scooters.

b. Subsidies for Manufacturers

The Government of India has established the Production-Linked Incentive Scheme committing USD2.4 billion for investments in advanced chemistry cell battery manufacturing and USD3.5 billion for automotive manufacturing focusing on EVs and hydrogen fuel cell vehicles. Furthermore, Axis Bank and the United Kingdom's Private Infrastructure Development Group announced a capital financing guarantee of USD200 million towards manufacturing, distribution, and servicing of EVs, batteries, components, and charging infrastructure in India.

In 2021, South Africa proposed a major leap towards green transportation with a new EV promotion policy offering subsidies to manufacturers and buyers to drive up their supply and demand. The Green Transport Strategy for South Africa (2018-2050) proposes these actions:

Offer EV producers manufacturing incentives to both produce and sell affordable EVs in South Africa, for both local and export markets.

Work with local research institutions to conduct research on EV batteriesSetting annual targets for EV uptake Providing incentives related to the beneficiation of using local resources in the manufacturing of key machineries and or components.

c. Tax Benefits

These countries offer preferential Import Duty, Value Added Tax and Excise Duty on EVs, and parts and components for manufacturers.

(i) Import Duty on Fully Built Units

	Country	Rate for EVs	Rate for ICEs
1	Rwanda	0%	10-25%
2	Malaysia	0%	30%
3	Indonesia	0%	24.1-40%
4	Thailand	0%	80%

(ii) Value Added Tax

	Country	Rate for EVs	Rate for ICEs
1	Norway	0%	25%
2	Rwanda	0%	18%
3	Ethiopia	0%	15%

(iii) Excise Duty

	Country	Rate for EVs	Rate for ICEs
1	Kenya	10%	20%
2	Rwanda	0%	5-15%
3	Malaysia	0%	10%
4	Ethiopia	0%	5-500%
5	Thailand	2%	8%

2. Non-Fiscal Incentives

In addition to financial incentives, countries have put policies in place that provide for non-fiscal incentives that accelerate EV uptake without financially burdening the Government.

(i) **Free and Discounted Parking:** Sweden, Germany and UK grant free and discounted parking for EVs, with reserved parking spots in some urban areas.

(ii) **Bus Lane Use:** in Norway, Sweden, UK and Germany, EVs have unlimited access to bus lanes.

(iii) **Free and Discounted Ferry Usage:** in Norway, EVs have been exempted from charges on ferries since 2009 and in 2018, a 50% discounted charge was introduced. Some parts of Canada also allow free access to ferry services for EVs.

(iv) **Free and Discounted Access to Toll Roads:** In Norway, EVs were granted free access to toll roads from 1997 to 2017 and in 2018, a 50% discounted charge was introduced. Canada also allows free access to toll bridges on some highways.

(v) **Green Registration Plates:** have been introduced in the UK, India, Hungary and Romania to help raise awareness about the growing number of EVs, and motorists benefit from local incentives such as cheaper parking, cost-free entry into zero emission zones, ferries, and bus lanes.

3. Charging Infrastructure

Development and/or investment in enabling infrastructure such as charging stations is key in transition to e-Mobility. To this end, some countries have instituted enabling measures such as direct installation and development of charging stations while others have provided subsidies to local authorities and the private sector to ensure installation and deployment of charging stations.

Below are some examples of measures implemented by different countries:

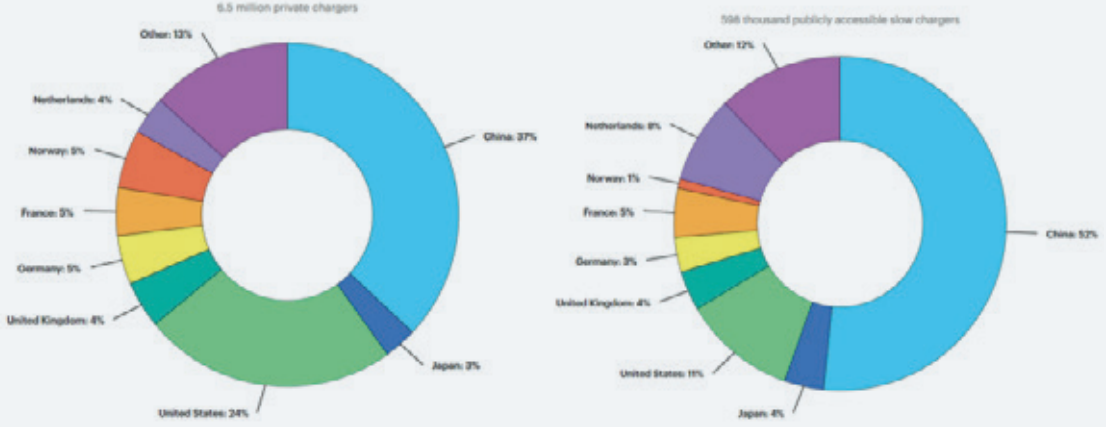
(i) **EV Charger Financing**: Germany, Sweden, France, Finland, Greece, Ireland, Italy, Luxembourg, Netherlands, Spain, Poland, USA and UK offer grant financing of 25% – 75% and/or tax returns for purchase and installation costs of charging points at workplaces, urban centers and homes.

In UK, companies that install charging infrastructure at their premises can access tax benefits through a 100% first-year allowance for expenditure incurred on EV charging equipment.

China funded the construction of EV charging stations in 88 pilot cities which earmarked state grid national fast charging corridors targeting one EV Charger for every 8 EVs within the city center.

(ii) **Preferential Energy Tariffs**: Denmark offers tax reductions on electricity used to power commercial EV Charging Infrastructure. In the UK, consumers can sign up for a preferential domestic EV charging tariff under the Energy Price Guarantee Cap with their electricity suppliers. Some US states like Minnesota and Massachusetts

Figure 27: Privately owned (left) and publicly accessible (right) EV chargers globally in 2019



provide for discounted tariffs and bill credits for EV charging infrastructure. Thailand lowered the electricity price of EV charging service providers, aiming to make charging facilities more available to the public. Rwanda has as of 2022 mandated that electricity tariffs for charging stations will be priced at the industrial tariff level; large industry category around Rwf94 per kilowatt-hour which is significantly lower than residential consumption. Energy costs for electric vehicle owners will further benefit from reduced tariff during off peak hours from 11p.m to 8a.m.

(iii) **Land for Charging Infrastructure:** Rwanda has facilitated rent-free land for charging stations on Government-owned land owned, reducing the cost of set up. The building code and city planning rules will also include provisions for EV charging stations, which has also been adopted in many European nations.

(iv) **Electrify Fuel Stations:** The German Government has announced plans that will require all fuel stations to also offer EV charging in the future. This will mean that fuel stations will now function simultaneously as EV charging stations, helping to increase electric mobility.

4. Manufacturing and Recycling of Batteries

Battery production for EVs is a strategic undertaking within an economy along the entire value chain from mining, to reuse and recycling. Many governments are creating policies that prohibit environmentally or socially destructive mining practices, while regulating disposal of batteries, incentivising reuse and recycling.

Europe and Japan have plans requiring second-life battery applications. China, which dominates global battery production, introduced a policy that requires EV batteries produced after August 2018 to have unique IDs tracking use across the battery lifespan.

The Government of India has established the Production-Linked Incentive (PLI) scheme with USD2.4 billion for investments in advanced chemistry cell battery manufacturing and US$3.5 billion for automotive manufacturing focusing on EVs and hydrogen fuel cell vehicles.

In Germany, as part of the new €130 billion package, €2.5 billion will be spent on battery cell production and the expansion of the charging infrastructure. This is towards Germany's goal of 1 million charging stations by 2030.

The European Union is working on an update on the EU's Battery Directive to ensure that batteries can be repurposed, remanufactured, or recycled at the end of their life. The proposals are linked to the EU's Circular Economy Action Plan and the EU's Industrial Strategy.

The increasing demand for electric vehicles has set attention on lithium as it's needed to produce EV batteries

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