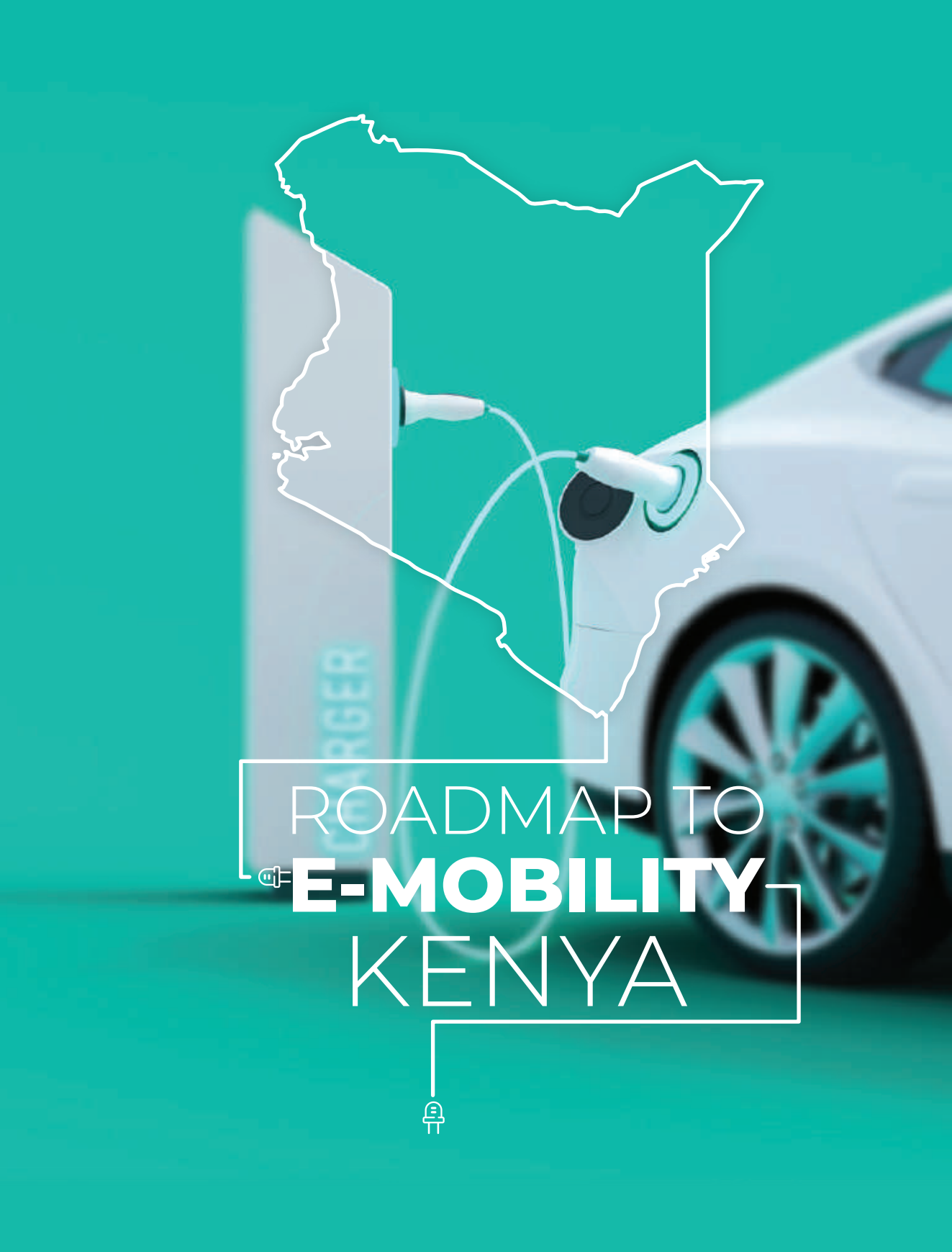


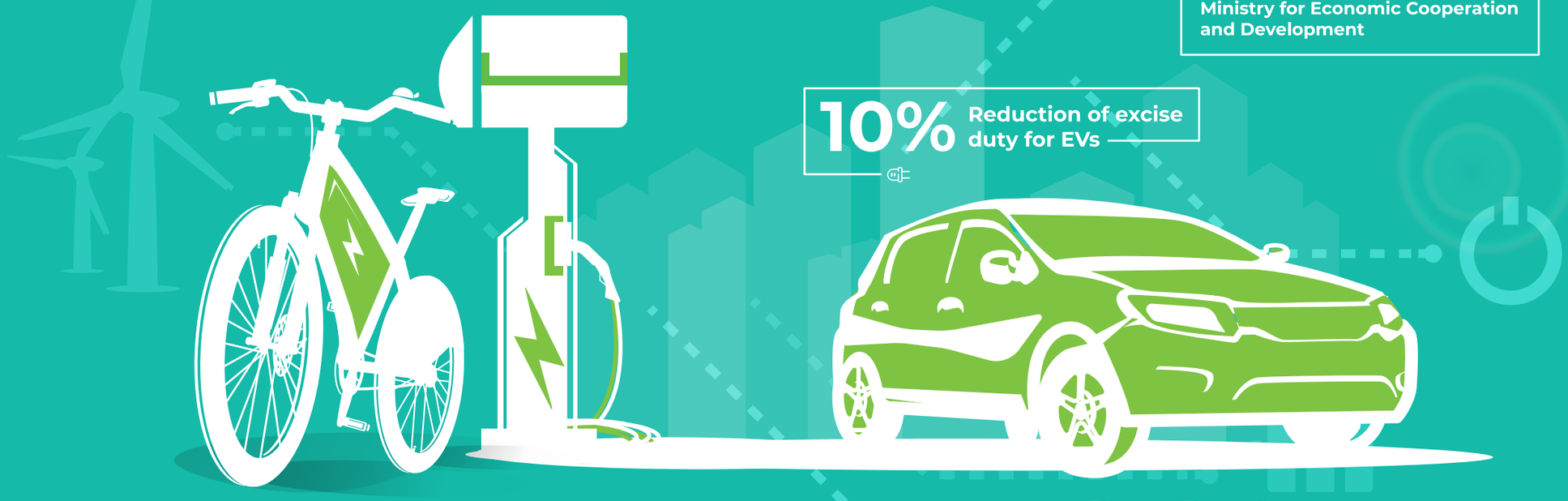
ROADMAP TO E-MOBILITY KENYA

GERMAN EMBASSY GREEN ECONOMY CYCLE

2025 Kenya aims to increase the share of electric vehicles to 5% of annual vehicle imports by 2025

50 No of electric motorcycles in Kenya's Electric Mobility Pilot supported by UNEP with funding from the International Climate Initiative (IKI) of the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety

6 Million Euros Promotion of e-Mobility Kenya funding from the German Federal Ministry for Economic Cooperation and Development



10% Reduction of excise duty for EVs

62 Billion USD Kenya's Total cost of implementing mitigation and adaptation actions in the updated NDC

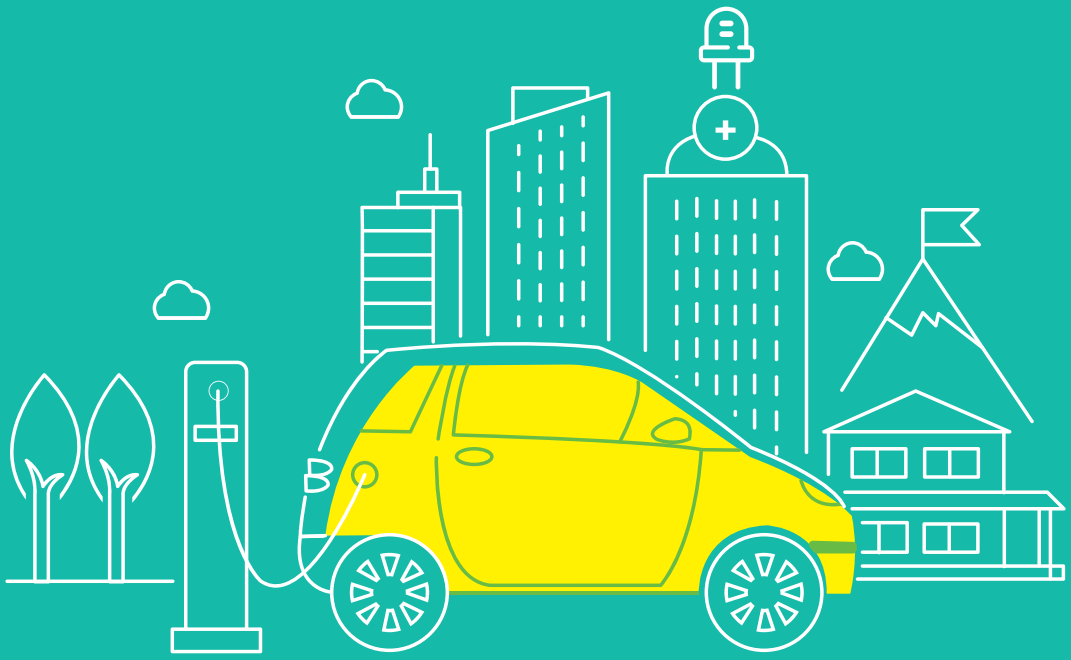
2030 Kisumu County to transition to a fully electric bus fleet

90% Kenya's generation mix from renewable energy

Embassy of the Federal Republic of Germany Nairobi

AHK Delegation of German Industry and Commerce for Eastern Africa

ROADMAP TO **E-MOBILITY** KENYA



This document was supported by the Embassy of the Federal Republic of Germany in Kenya and the Delegation of German Industry and Commerce for Eastern Africa (AHK). They recognize the invaluable contributions of all partners and respondents who offered information, opinions, and data towards this effort. These include the public sector stakeholders, development agencies, research institutions, e-Mobility entrepreneurs, energy sector stakeholders and private sector foundations. They also acknowledge the consultants, EED Advisory, who facilitated the wide-reaching consultations and led the study and Kijizi Limited, who designed the report layout.

The views and opinions expressed here are those of the authors and do not necessarily reflect the official policies or positions of the Embassy and the Delegation.

Embassy
of the Federal Republic of Germany
Nairobi

AHK
Delegation of German Industry
and Commerce for Eastern Africa

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List of Abbreviations

AEMDA	Association of Electric Mobility and Development in Africa
AMDA	African Minigrid Developers Association
BAU	Business As Usual
BEV	Battery Electric Vehicles
DEG	German Investment and Development Company
EPRA	Energy and Petroleum Regulatory Authority
EVs	Electric Vehicles
FCV	Fuel Cell Vehicles
GHG	Green House Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
HEV	Hybrid Electric Vehicles
KCB	Kenya Commercial Bank
KEBS	Kenya Bureau of Standards
KenGen	Kenya Electricity Generating Company
KEREA	Kenya Renewable Energy Association
KfW	KfW Development Bank
KPLC	Kenya Power and Lighting Company
KRA	Kenya Revenue Authority
LEV	Light Electric Vehicles
NCCAP	National Climate Change Action Plan
NDC	Nationally Determined Contribution
NTSA	National Transport and Safety Authority
OEM	Original Equipment Manufacturer
PAYGO	Pay As You Go
PHEV	Plug-in Hybrid Electric Vehicles
SDoT	State Department of Transport
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
V2X	Vehicle to Everything communication
VAT	Value Added Tax
WRI	World Research Institute
ZEV	Zero Emissions Vehicles

Dear Reader,

Kenya's economy has been continuously growing over the past decades, providing greater opportunities for the country to realize its Vision 2030 and achieve various UN Sustainable Development Goals (SDGs).

As the economy has grown, Kenya has witnessed tremendous motorization in the Transport Sector, posing the primary concern of increased Green House Gas Emissions (GHG).

As the host country of the United Nations Environment Programme (UNEP), Kenya has strongly positioned itself in the past decade to address this issue, by enacting two key laws, the Climate Change Act of 2016 and the Energy Act of 2019.

We extol Kenya' s efforts to reduce its Green House Gas Emissions through the reduction strategy outlined in the Country' s National Climate Change Action Plan (NCCAP).

Germany continues to be a strong and reliable partner to Kenya in implementing this Action Plan, by providing various levels of support ranging from expertise and skills exchange to financial as well as technological assistance.

The Roadmap you hold in your hands is a landscape assessment of e-Mobility in the country. The result provides the reader with a one-stop-shop reference document for most, if not all, aspects of e-Mobility in Kenya.

This Roadmap builds on the work done under the "German Embassy Green Economy Cycle" (GEGEC) brand since its inception in 2016, spearheaded by the Embassy and our main implementation partner, the Delegation of Geman Industry and Commerce for Eastern Africa (AHK).

We sincerely hope that this study will pave the way for the establishment of a Working Group to ensure that key stakeholders in the industry continue to promote e-Mobility solutions in Kenya. Germany stands ready and committed to walking the last mile with Kenya in its noble quest to adopt more climate-friendly technologies in the e-Mobility sector.

Annett Günther
Ambassador of the Federal Republic of Germany to Kenya

Powering sustainable mobility is shifting from a dependence on energy from oil wells to electric power sources, and this shift will affect businesses, geopolitics, national economies, the environment, and the climate. Although there is no universally accepted definition of energy transitions, this term can broadly be conceptualized as a change in an energy system, usually to a particular fuel source or technology. Drivers of energy transitions are diverse and include technological advancement, policy interventions, innovative business models, cost-competitiveness of various energy forms, or a combination of these. Electric mobility covers road, rail, air, and water-borne options. Road-based electric vehicles, which is the focus of this document, can be classified using different characteristics with the most common groupings disaggregated by size: 2-wheelers, 3-wheeler, 4-wheelers (or passenger vehicles), buses and trucks. These can also be classified as battery electric vehicles (BEV), plug-in hybrid electric vehicles (PHEV), and hybrid electric vehicles (HEV) based on energy sources. It is estimated that there were 12 million passenger electric vehicles, one million commercial electric vehicles, and over 250 million electric 2 and 3-wheelers around the world as of 2020. 2 and 3-wheelers are projected to top 400 million by 2050. In September 2021, and for the first time, the sales of passenger electric vehicles constituted more than 10% of total global vehicle sales with the leading brands including Tesla Model 3, Wuling Hong, and Tesla Model Y.

Transportation contributes about one-quarter of total energy-related greenhouse gas emissions and is a leading cause of ambient air pollution. A transition to low-carbon transportation options holds significant mitigation abatement potential and great environmental benefits. With 92% of current grid-based electricity generated from renewable energy, Kenya is well-positioned to maximize these benefits. In 2019, Kenya imported over US$ 3 billion worth of petroleum products spending about 40% of foreign exchange earnings on the acquisition of petroleum products in international markets. Approximately 72% of this was used in the road transport sector. Beyond the climate and environmental benefits, a transition to e-mobility in Kenya will create several opportunities including employment creation, advancing research, development and innovation, electricity demand stimulation, reduction in foreign exchange spending, increased revenue (end-users and businesses), and carbon finance. The road transport sector in general and the public transport sector in Kenya specifically, suffers from critical shortcomings, and this transition provides an opportunity to reset the fundamental operational framework. However, there are potential negative outcomes including a reduction in government revenue, loss of jobs and income in the petroleum sector, environmental impacts from

improper e-waste disposal, and technical challenges that could result in increased grid instability. These baseline factors, therefore, require an inclusive sector-wide approach to address the opportunities and challenges of this inevitable transition. The Embassy of the Federal Republic of Germany to Kenya and the Delegation of German Industry and Commerce for Eastern Africa supported this high-level document as a basis for convening a sector-wide discussion on charting an e-mobility roadmap. The purpose of this document is to characterize the current actors in the e-mobility sector, identify the key barriers and opportunities, and highlight the priority areas that can accelerate sustainable growth in the sector.

Kenya already has a vibrant and dynamic e-mobility sector, with at least six e-bike assemblers, several large-scale adopters in the delivery and taxi sectors, retrofitters converting internal combustion engines to electric options, developers of associated infrastructure including charging stations, e-mobility focused financiers, researchers, associations, and a national electricity utility that is preparing for this transition (see figure below). Opportunities exist across the vehicle segments with the two and three-wheeler segment, and the public transport sector presenting substantial quick wins. Several policy and regulatory instruments also, directly and indirectly, affect the e-mobility sector. Kenya has prioritized e-mobility under the National Climate Change Action Plan (-), national energy efficiency strategy ( ) and its Nationally Determined Contributions ( ). The Finance Act of also provided incentives for the sector by reducing the excise duty on electric vehicles from % to %. At least standards regulate the importation of electric vehicles or parts, specifying performance, power consumption among others. This sends a strong signal on the national Government's position on e-mobility. Complementary efforts at the sub-national level are also ongoing including the Kisumu Sustainable Mobility Plan, which aims for a universal transition of urban bus fleets to electric by .

Sample of e-Mobility sector players

This study estimates that converting 50% of road transportation fleet (based by volume of fossil fuel consumed) to electric options by 2030 could result in 8.5 million tCO2e avoided, US$ 42 million in carbon market revenue, and a US$ 3 billion reduction in foreign exchange expenditure on petroleum products per year. However, there are several technical, finance, policy, and social-cultural barriers and threats. Leading barriers within these classes includes the limited supporting infrastructure (charging and battery swapping stations), lack of foundational policy and regulations, access to finance, lack of sectoral coordination, and information asymmetry. Demand from electric charging is both an opportunity and threat to the national electricity utility. Charging could potentially emerge as a new and substantial revenue stream, but uncoordinated set-up of charging stations could result in grid instability and an unfavorable load profile. Case studies from other country demonstrate that interventions at the policy, sectoral, and firm level could advance the sector. While lessons can be drawn from other jurisdictions including Norway, India, China, and Rwanda, assessing their appropriateness within the local context is critical. National circumstances including path dependency and priority areas need to guide this discussion. The rise in passenger electric vehicles in many parts of the world, especially the United States, has been driven largely due to substantial government subsidies which is hard to replicate in many developing markets. On the other hand, preferential terms which waive the high registration on electric vehicles implemented in China can be implemented across these markets.

This document finds that while there are many activities and players in the e-mobility sector, there is limited coordination and cooperation. The sector is aware of the general requirements, opportunities, barriers, and implications of this transition but detailed characterization and quantitative indicators are lacking. Programmatic approaches can yield substantial financial flows for government and sector players such as Kenya Power, and electric energy producers; climate finance and carbon markets being key sources. Aggregating opportunities into sizeable investments will also attract the needed private sector capital and this can be achieved through broader collaboration among sector players. Decarbonizing the transport sector has immense benefits but also could have negative outcomes which need to be understood and mitigated, for example, loss of employment in the petroleum sector is one. There is an outsized emphasis on policy and regulations as a tool to advance e-mobility uptake. While this is important, it needs to be responsive to the evolving needs of the sector, to ensure sufficient spaces for innovation. Key recommendations include the formation of an inclusive Kenya e-Mobility Working Group to provide a coordination platform, borrowing from other experiences such as the Kenya Climate Change Working Group; the commissioning of a comprehensive economic, social, and environmental impact assessment of the e-mobility transition in Kenya; cautioning against regulations and standards that may stifle innovation; the promotion of voluntary standards with lessons from the World Bank Lighting Global Programme; and the development of a comprehensive e-mobility sector strategy by the sector players that will guide the transition. The e-mobility sector strategy should focus on market transformation programs that aim to address barriers to entry and growth through essential and lasting changes to the sector. Elements of this strategy should include targeted and strategic policy or regulatory interventions, incentives to increase the number of equipment and service providers, support emerging and unproven business models, reduction and elimination of market barriers, technical and business capacity development, and increased awareness.

1 Introduction

1.1 Background

The way people and goods move is fundamentally changing. Powering sustainable mobility is shifting from a dependence on energy derived from oil wells to electric power sources, and this shift will affect businesses, geopolitics, national economies, the environment, and the climate. Tesla Inc, the iconic electric vehicles manufacturer, surpassed the US$ 1 trillion market capitalization on October 26, 2021, which was more than the combined value of the next five biggest automobile manufacturers in the world – Toyota Motor Corp, Volkswagen AG, Daimler AG, Ford Motor Co, and General Motors[1]. Shenzhen, a Chinese city of about 12 million people, has converted its entire fleet of about 16,000 public buses and 22,000 taxis fleet to electric power, demonstrating the immense potential with the right incentives and capabilities[2]. This transition is manifesting at micro and or macro levels, occuring rapidly or gradually, and materializing intentionally and unintentionally. On the global policy front, several commitments supporting the transition to zero-emission vehicles (ZEV) were made on the sidelines of the 2021 United Nations Framework Convention on Climate Change (UNFCCC), 26th Conference of Parties (COP26). Thirty countries, including Kenya, agreed to work together to ensure ZEVs are accessible, affordable, and sustainable in all regions by 2030 while the World Bank, in collaboration with the Zero Emission Vehicle Transition Council (ZEVTC), launched a new trust fund that will mobilize US$ 200 million over the next ten years to decarbonize road transport in emerging markets[3].

Transportation is responsible for about one-quarter of all energy-related greenhouse gas emissions.[4] The need and opportunity to transform the current modes of mobility into low carbon options are now universally acknowledged. BloombergNEF now estimates that there are 12 million passenger electric vehicles, one million commercial electric vehicles, and over 260 million electric two and three-wheelers (mopeds, scooters, pedelecs, motorcycles, and tuk-tuks) around the world.[5] UNEP estimates that the number of two and three-wheelers will increase to 400 million by 2050[6]. There are several ways of classifying electric vehicles with the most common approach including either the size of the vehicle or the source of energy as shown in Figure 1 below. Other forms of e-mobility include electric boats, electric trains, and electric planes which are not discussed in this report.

1. Reuters. (2021). Factbox: Tesla market cap eclipses that of the top 5 rival carmakers combined. Reuters, Autos and Transportation. Retrieved 28/11/2021 https://www.reuters.com/business/autos-transportation/tesla-market-cap-eclipses-that-top-5-rival-carmakers-combined-2021-10-26/
2. Crothers, B. (2021) This Chinese city has 16,000 electric buses and 22,000 electric taxis. Forbes onlines. Retrieved 28/11/2021 https://www.forbes.com/sites/brookecrothers/2021/02/14/this-chinese-city-has-16000-electric-buses-and-22000-electric-taxis/?sh=3aabd1413a92
3. UNFCCC. (2021). Zero emissions vehicles pledges made at COP 26, External Press Release 10/Nov, 2021. United Nations Framework Convention on Climate Change. Axsen, J., and Sovacool, B. K., (2019). The roles of users in electric, shared, and automated mobility transitions. Transportation Research Part D Vol 71 1-21.
4. Axsen, J., and Sovacool, B. K., (2019). The roles of users in electric, shared, and automated mobility transitions. Transportation Research Part D Vol 71 1-21.
5. BloombergNEF. (2021). Electric Vehicle Outlook 2021. Bloomberg New Energy Finance, New York.
6. UNEP (2020). Electric two and three wheelers. Available at: https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/electric-two-and-three-wheelers

Battery Electric Vehicles (BEV) are solely powered by batteries, Plug-in Hybrid Electric Vehicles (PHEV) combine both fossil fuel options and batteries, while Hybrid Electric Vehicles (HEV) are powered primarily by a fossil fuel option which also charges a battery to provide supplementary energy.

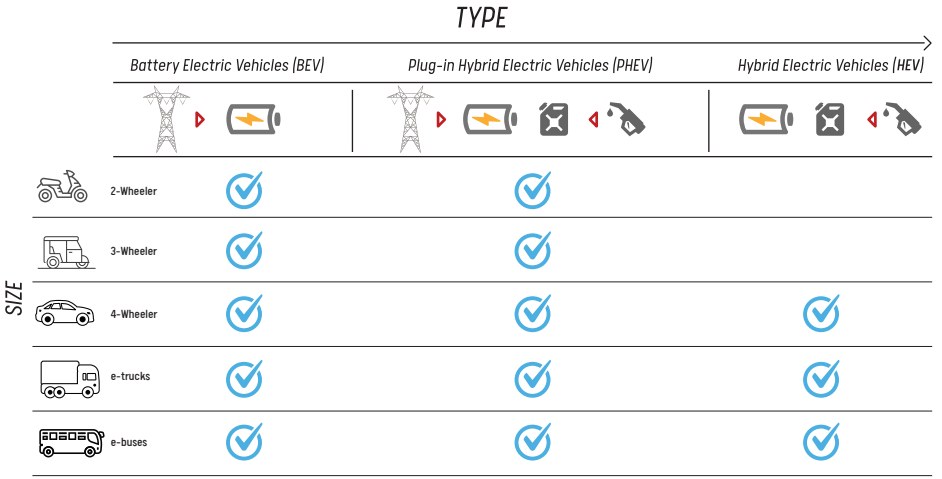


Figure 1: Classification of electric vehicles (EVs)

Studies estimate that zero-emissions vehicles (ZEV) could play a significant role in improving air quality and mitigating global warming by reducing close to 11 billion tonnes of CO2 between now and 2050.[7] Although 2-wheelers, 3-wheelers, and light-duty vehicles account for almost 90% of all vehicles globally, they contribute only 50% of total greenhouse gas emissions attributed to vehicular emissions.[8] Buses and trucks emit the rest indicating the need for transition among these segments as well. Consumer awareness, availability of the requisite supporting infrastructure including charging stations, reduction in the cost of batteries, user-friendliness of the new technology, and fossil fuel prices will be key determinants of this transition.[9]

Beyond the climate and environmental benefits, the transition to e-Mobility options in Kenya presents several positive prospects including increased demand for green electricity, employment creation, revenue generation, and reduction in foreign exchange spending on fossil fuel purchase.

7. Siemens Stiftung. (2020). E-Mobility Solutions for Rural Sub-Saharan Africa: Leveraging Economic, Social and Environmental Change.
8. Grütter, J. M., & Kim, K.-J. (2019). E-Mobility options for ADB Developing Member Countries. ADB Sustainable Development Working Paper Series, No. 60(60).
9. Bajpai, J., & Bower, J. (2020). A Road Map for e-Mobility Transition in Rwanda - Policy Brief. Igc, April. www.theigc.org

In 2019, Kenya imported over US$ 3 billion worth of petroleum products[10] spending about 40 % of foreign exchange earnings[11] on the acquisition of fossil fuels in the international market. Approximately 72% of this was used in the road transport sector, demonstrating the potential transformational impact of a transition to e-mobility.

1.2 Transportation and Energy in Kenya

1.2.1 Transportation in Kenya

The transport sector comprises the road, rail, aviation, and maritime sub-sectors. Kenya' s 161,451 km road network is valued at KES 3.5 trillion, making it the largest public-sector investment[12]. The road network Infrastructure is developed, managed, and maintained through five state corporations; Kenya Roads Board (KRB), Kenya National Highways Authority (KENHA), Kenya Rural Roads Authority (KeRRA), Kenya Urban Roads Authority (KURA), and the Kenya Wildlife Services (KWS). Both the narrow gauge track (1,000 mm) and the standard gauge track (1,435 mm) form the rail network in Kenya. The narrow-gauge main track connects Mombasa, Nairobi, and Kisumu and is estimated to be 930 km. Construction of the new standard gauge was commissioned in November 2013 and was initially expected to cover 2,937 km upon completion with links to Kampala, Kigali, Bujumbura, and Juba[13]. The domestic capacity in the aviation sub-sector has risen from 4.02 million departure seats in 2016 to 4.86 million in 2019, while the international capacity has increased from 5.77 million in 2010 to 7.15 million in 2019[14]. The covid-19 pandemic impacted the aviation sub-sector significantly, reducing the domestic and international passenger numbers to 2.32 million and 2.13 million respectively in 2020. The number of vehicles (including motor cycles) registered per year increased by 38%, from 213,715 in 2016 to 346,729 in 2020 as shown in Table 1 below and Figure 2. Passenger electric vehicles registered in Kenya remain low and are estimated at less than 400 units compared to 3.2 million internal combustion units in 2018. The demand for electric vehicles is set to increase in the future due to government incentives, consumer awareness, advancement in technological options, and the price of fossil fuels.

10. KNBS. (2021). Economic Survey 2021. Kenya National Bureau of Statistics. Nairobi
11. Ministry of Energy (2020), Kenya National Energy Efficiency and Conservation Strategy
12. Republic of Kenya (2021). Annual public roads programs for the financial year 2021/2022. Kenya Roads Board, Republic of Kenya. Nairobi.
13. Railway Gazette International. (2013). 'MoKaki' (Mombasa, Kampala, Kigali) project breaks ground in Mombasa. Railway Gazette Group. Retrieved 26/11/2021
14. KNBS. (2021). Economic Survey 2021. Kenya National Bureau of Statistics. Nairobi

Table 1: New registered road motor vehicles and motorcycles 2016-2021 (Source: KNBS, 2021)

Type of Vehicle	2016	2017	2018	2019	2020
Saloon cars	12490	11376	10504	9971	7754
Station wagon	46123	55322	64179	72512	57962
Panel vans and pick-ups	12722	9866	11220	10189	6065
Lorries	9632	7460	6514	6518	6476
Buses	1765	1072	1065	1339	900
Mini-buses	519	459	812	1932	1084
Trailers	2829	1953	2083	1639	2382
Wheeled tractors	2478	2703	4040	1815	2545
Others	1618	860	1619	3836	8960
Total Motor Vehicles	90176	91071	102036	109751	94128
2-wheeler motorcycles	119,724	186434	188994	210103	246705
3-wheeler motorcylces	3815	5167	6259	7322	5896
Total Motor Cycles	**123539**	**191601**	**195253**	**217425**	**252601**
Total Units (Combined)	**213715**	**282672**	**297289**	**327176**	**346729**

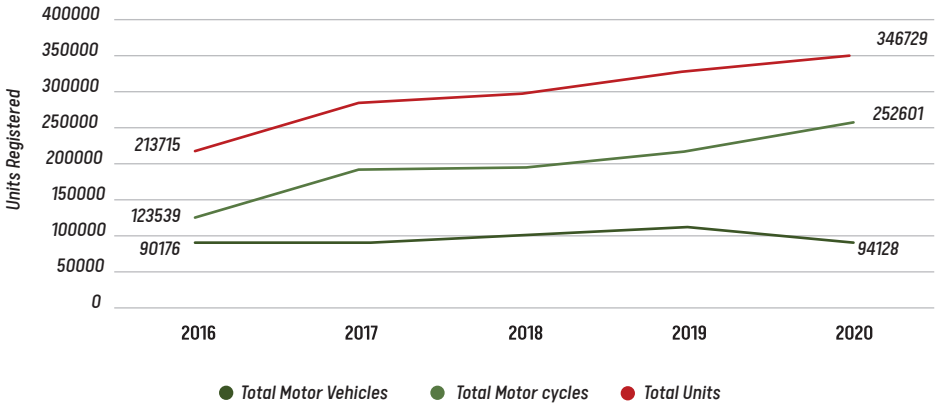
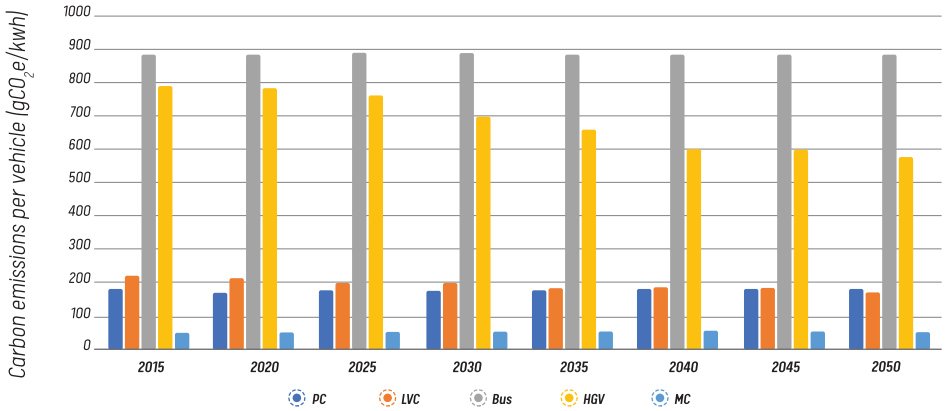


Figure 2: Total new units registered between 2016 and 2020 (Source: KNBS, 2021)

Kenya' s total greenhouse emissions are set to increase by 53%, from the 2015 levels of 93.7 MtCO2e to 143 MtCO2e by 2030. The transport sector is also set to increase its greenhouse carbon emissions by 52% from the 2015 levels of 16.9 MtCO2e to 25.7 MtCO2e by 2030.[15] However, the 2030 projections showed that fossil fuels will be the leading contributor to emissions due to the increased demand from various sectors, including the transport sector under the business as usual (BAU) scenario.[16] The road, rail, and aviation sub-sectors were responsible for 12.09 MtCO2e (98%), 0.062 MtCO2e (2%), and 0.188 MtCO2e (1%) respectively in the year 2019 as shown in Figure 3.[17] A transition to e-mobility will effectively reduce GHG emissions attributed to the mobility sector as grid-based electricity in Kenya is mainly generated from renewable energy sources.



*Key: PC-Passenger Cars, LCV -Light Commercial Vehicles, HGV- Heavy Goods Vehicles, MC- Motorcycle

Figure 3: Scenario Projections of CO2 Emissions in the Transport Sector. Source: INFRAS

Kenya has enacted two important laws that would help with this transition: the Climate Change Act of 2016, and the Energy Act, 2019. Initially, the laws were to guide the country towards reducing GHG emissions, however, with the realization that the transport sector accounts for at least 13% of its total emissions[18], the transition towards e-Mobility is now viewed as a priority. E-Mobility is a priority area under Kenya' s Nationally Determined Contribution (NDC) and a key emission reduction strategy in the county' s National Climate Change Action Plan (NCCAP) 2018-2022. Moreover, the government has indicated an interest in providing incentives and working with stakeholders to promote uptake. In the Finance Act (2019), the government as part of its objective to improve tax incentives and the existing policy framework reduced excise duty for 100% electric vehicles from 20% to 10%.[19]

15. GoK. (2020). Kenya's Updated Nationally Determined Contributions (NDC). In Unfccc. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kenya First/Kenya's First NDC (updated version).pdf
16. GoK. (2020). Kenya's Updated Nationally Determined Contributions (NDC). In Unfccc. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kenya First/Kenya's First NDC (updated version).pdf
17. Eshiwani, M., & Gacanja, E.. (2019). Transport Sector Climate Change Annual Report. State Department of Transport, Nairobi, Kenya
18. Gitau, N., Manager, A., King'ori, P., Wafula, K., Nyatwanga, W., & Wangai, G. (2019). Transport Sector Climate Change Annual Report: Performance and Implementation of Climate Change Actions.
19. Republic of Kenya. (2019). The Finance Act, 2019 [Kenya Gazette Supplement No.178 (Acts No. 23)]. 178(178). http://kenyalaw.org/kl/fileadmin/pdfdownloads/AmendmentActs/2019/FinanceAct_No23of2019.PDF

As of 2019, the country had about 3.2 million vehicles with 2 and 3-wheelers having the majority share[20]. The government is currently preparing a policy to shift 2 and 3-wheelers to electric motorcycles, and pilots projects were rolled out in Western Kenya by Siemens Stiftung (2020), Kenya Power, and UNEP (2021). Additionally, the government has demonstrated a willingness to support private sector initiatives. Support to the sector through the development of the requisite infrastructure including charging stations will further advance the sector[21]. Several players are already in the e-Mobility sector in Kenya as discussed in chapter 2 of this document.

1.2.2 Electricity in Kenya

92% of Kenya's grid-based electricity is generated from renewable energy, creating a climate change mitigation opportunity[22]. The country has an effective installed generation capacity of 2,708 MW constituted of geothermal 46.7%, hydro 32.2%, wind 11.2%, thermal 7.7%, imports 1.4%, Solar 0.8%, co-generation 0.0% (Figure 4). The current peak demand stands at 2,036 MW. The country plans to divest from fossil fuels and transition to 100% grid-based renewable electricity generation by 2030 - a commitment that was reaffirmed by President Uhuru Kenyatta during the COP26 meeting in Glasgow, Scotland[23]. The country is ranked first in Africa and eighth in the world in terms of geothermal power generation capacity, hosts the largest wind farm in Africa and the largest solar photovoltaic plant in East and Central Africa. Power generation capacity has more than doubled over the last 15 years and the electrification rate has grown from 19% in 2010 to approximately 85%[24] in 2020, which according to the World Bank, is the highest annualized average change in electrification rates in the world during this period[25]. Kenya is establishig an interconnector to Ethiopia and to Tanzania which will provide additional access to renewable energy.

20. DW (2019), Solar Motorcycles take on Nairobi smog, Deutsche Welle News Agency
21. World Economic Forum (2018), Electric Vehicles for Smarter Cities: The Future of Energy and Mobility
22. KPLC (2020). Annual Report and Financial Statements for the year ended 30th June 2020. https://kplc.co.ke/img/full/KPLC-Book-website.pdf
23. Service, R., & Negotiations, D. (2021). Earth Negotiations Bulletin. 12(NOV), 783.
24. IEA. (2020). SDG7: Data and Projections. IEA. Paris https://www.iea.org/reports/sdg7-data-and-projections.
25. IEA, IRENA, UNSD, WB, and WHO. (2019). Tracking SDG 7: The Energy Progress Report 2019, Energy Sector Management Assistance Programme, World Bank, Washington DC

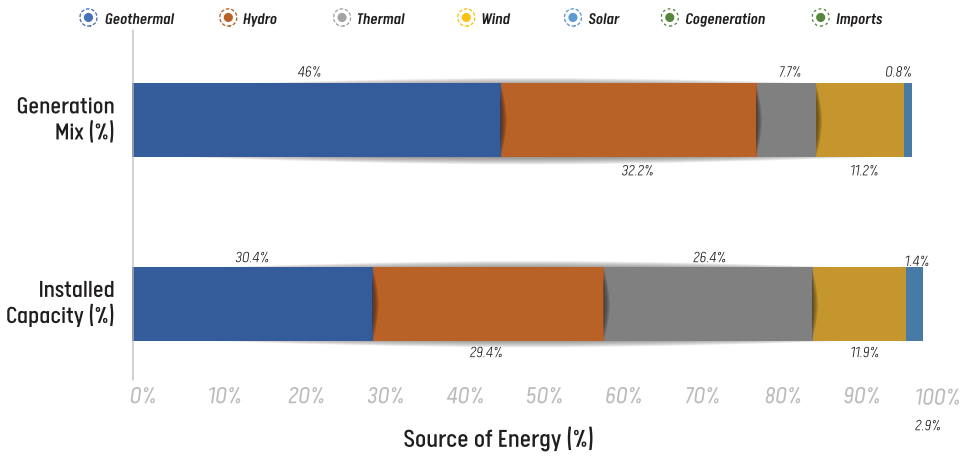


Figure 4: Kenya's Energy Mix. Source: Kenya Universal Electrification, 2021

The electricity sector is pivotal to socio-economic development and the growth of the e-Mobility sector. In 2007 the tax revenue generated from the energy sector amounted to 20% of the total tax collected, which was equivalent to 4% of the national GDP[26]. In 2019, the tax revenue generated from the sector recorded an increase of 16.3% of the total tax collected or 10.8% of the national GDP[27]. In 2017 the energy sector was estimated to provide around 15,000 people with direct and indirect employment[28]. Grid infrastructure is expensive to construct, slow to expand and suffers frequent outages. For this reason, off-grid technologies including mini-grids and stand-alone solar home systems have been proposed as a complementary solution to electrify rural areas. Mini-grids are expected to play a larger role in Kenya's drive towards universal access to energy in 2022. Kenya's National Electrification Strategy (2018) planning exercise determined that there is potential for 35,000 new connections through 121 new mini-grids[29].

Africa Minigrid Developers Association (AMDA) estimated that there are at least 192 mini-grids sites in Kenya built and operated by six developers[30]. The cost of electricity from private sector mini-grids is significantly higher than the public utility with approved tariffs ranging from US$ 0.5-0.85/kWh[31]. Powerhive, Talek, Powergen, and RVE.sol are the leading private sector developers with an estimated aggregate capacity of 500 kW.

26. https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=KE
27. Kenya Institute for Public Policy Research and Analysis. (2020). KENYA ECONOMIC REPORT 2020: Creating an Enabling Environment. 1-230.
27. Energy, C., & Project, I. (2021). Economic Project Appraisal Manual for. July.
28. GoK (2018). Kenya National Electrification Strategy. https://pubdocs.worldbank.org/en/413001554284496731/pdf/Kenya-National-Electrification-Strategy-KNES-Key-Highlights-2018.pdf
29. AMDA. (2020). Benchmarking Africa's Minigrids. Africa Minigrid Developers Association.
30. NCI. (2019). The role of renewable energy mini-grids in Kenya's electricity sector. New Climate Institute. Cologne, Germany.

Constrained demand for electricity and the low average revenue per user limits the viability of private mini-grids and therefore demand stimulation is a key priority[32]. Several developers are piloting different models to stimulate demand for electricity including the deployment of electric motorcycles. Powerhive, a solar mini-grid developer and off-grid utility company, piloted an electric vehicle business in Kisii. Powerhive piloted 33 EVs including electric 2-wheelers and 3-wheelers to sites in Kisii and Western Kenya[33].

1.3 Approach and Methodology

1.3.1 Approach

Despite the regulatory and technological developments and demonstrated goodwill from the government described above, there is no overarching framework galvanizing sector players' activities and strategies for accelerating e-Mobility. It is against this reality that the Embassy of the Federal Republic of Germany to Kenya and the Delegation of German Industry and Commerce for Eastern Africa have commissioned this high-level landscape assessment as a knowledge base and precursor to accelerating the uptake of e-Mobility applications in Kenya. The development of this document was funded by the German Federal Foreign Office as part of the GEGEC – German Embassy Green Economy Cycle 2021.

The purpose of this document is to characterize the current actors in the e-Mobility sector, identify the key barriers and opportunities, and highlight the priority areas that can advance the sector. This builds on several studies that have been completed in the recent past. The landscape assessment took a 3 step-approach, outlined as; i) Inception Phase, ii) Desk Review and Stakeholder Engagement Phase, and iii) Report Development. The steps are outlined in Figure 5 and further expounded in the methodology section.

32. Lukuyu, J., Fetter, R., Krishnapriya, P.P., Williams, N., and Taneja, J. (2020). Building the supply of demand: Experiments in mini-grid demand stimulation.Development Engineering, 6 https://doi.org/10.1016/j.deveng.2020.100058
33. Powerhive Inc (2019). Driving into the future Powerhive kicks-off electric vehicle pilot in Kisii, Kenya. https://medium.com/frontier-technologies-hub/driving-into-the-future-powerhive-kicks-off-electric-vehicle-pilot-in-kisii-kenya-89cb40713b9f

Figure 5: Landscape Assessment Approach

1.3.2 Methodology

An inception meeting was held with the Delegation of German Industry and Commerce for Eastern Africa (AHK) to discuss the approach and scope of the assessment. Key Informant Interview (KII) guides, as well as a working group selection criteria, were developed at this stage. The information and data used in this document were collected through an extensive literature review (see references in Annex 2) and 25 KIIs. This was then analyzed and synthesized to develop this document. The interviews targeted market players and stakeholders, both from the public and private sectors. The literature review focused on past and present documentation on e-Mobility including policy documents. Report synthesis focused on aggregating and analyzing qualitative and quantitative data to inform the review of the current state of the e-mobility market, and plans of different stakeholders and market players as well as a guiding framework for e-mobility transition in Kenya.

The e-Mobility working group whose aim is to advance the development of an inclusive e-Mobility roadmap is being constituted under the auspice of the Kenya Renewable Energy Association (KEREA). The working group, whose main role will be to coordinate the activities of the sector, shall be composed of actors from both the public and private sectors. This is designed with lessons from the successful Kenya Forest Working Group, Kenya Charcoal Working Group, and the Kenya Climate Change Working Group formats which were grassroot efforts to improve coordination, share knowledge, consolidate efforts, identify priority objectives, and lobby policy makers on the needed reforms. A stakeholder mapping registration form was developed to capture the current and planned/future activities of e-Mobility actors to inform the thematic areas in which the members would participate.

34. See list in Annex 1

Image of charging station courtesy of Drive Electric

2 Kenya's e-mobility Value Chain

2.1 Overview of the Value Chain

Although there are piecemeal efforts to coordinate activities in the e-Mobility sector, activities remain largely fragmented. A wide and inclusive platform to convene the diverse set of actors and interests is presently lacking. This assessment identified the key actors and characterized their focus areas along the e-Mobility value chain. Reports on past and present activities, key informant interviews, and snowballing techniques were used to identify the stakeholders. This section provides an overview of the e-Mobility value chain as summarized in Figure 6 below.

Figure 6: Sample of Kenya's e-mobility sector players

2.2 Sector Players

The e-Mobility sector in Kenya has witnessed significant growth over the past 5 years with initiatives led by the private sector[35]. The majority of the growth witnessed in the sector comes from the 2-wheeler segment which accounts for at least 80% of the electric vehicles in the country[36]. While the growth is irrefutable, the absence of a guiding policy framework remains an impediment to the e-Mobility transition in Kenya[37]. There are currently no overarching policy documents to enhance the transition to e-Mobility transition in the country. A call for consultants to develop an e-Mobility policy framework was however issued in November 2021 by the State Department of Transport (SDoT).

35. AEMDA. (2021). Electric Mobility Barriers in Kenya: Market Survey Report 2021. 0–22. https://aemda.org/

36. Galuszka, J., Martin, E., Nkurunziza, A., Achieng' Oginga, J., Senyagwa, J., Teko, E.-M., & Lah, O. (2021). Electric mobility in East-Africa: How the policy and stakeholder environment tackles the integration of informal transport systems into low-carbon transition-case studies from Kigali, Ki-sumu, Nairobi and Dar es Salaam. January. https://doi.org/10.20944/preprints202101.0029.v

37. Africa, M. (2021). Opportunity and investment potential for electric vehicles in. September. UK Aid funded Manufacturing Africa programme.

The private sector who have a keen interest in the sector, have expressed their willingness to work with public sector agencies, non-governmental organizations, and development partners to create an enabling environment conducive to support an accelerated transition[38].

Table 2: Summary of Sector Players

#	Sector player	Assembling, Sales, and Distribution	Infrastructure Development	Mass adopters	Financiers	Research and Associations
1	Kiri EV	■				
2	Fika Clean Mobility	■				
3	Opibus	■	■	■		
4	Mazi Mobility	■				
5	Arc Ride	■				
6	Eco-Boda	■				
7	Solar e-Cycles	■				
8	Drive Electric	■	■			
9	KenGen		■			
10	Knights Energy		■			
11	KPLC		■			
12	Uber			■		
13	Nopea Ride			■		
14	Bolt			■		
15	Jumia			■		
16	Get Boda			■		
17	P4G			■	■	
18	GIZ			■		■
19	eBee			■		
20	Maris				■	
21	WaTu				■	
22	Mogo Kenya				■	
23	SIEMENS Stiftung				■	

38. ACEA European Automobile Manufacturers' Association. (2021). Making the transition to zero-emission mobility. Enabling factors for alternatively-powered cars and vans in the European Union. October, 4. https://www.acea.auto/files/ACEA_progress_report_2021.pdf

24	Mobility 54					
25	InfraCo Africa					
26	Shell Foundation					
27	Total Kenya					
28	KCB Group					
29	McKinsey					
30	EED Advisory Ltd					
31	AEMDA					
32	UNEP					
33	KEREA					
34	WRI					
35	University of Massachusetts					

Different players across the country, particularly those in the private sector contribute to the e-Mobility value chain as illustrated in subsequent sub-sections; assembling, installation, and maintenance charging infrastructure, sales, and distribution, promotion, and financial services among others.

2.2.1 Importers, Assemblers, Sales, and Distributors

This assessment established that Kenya has no electric vehicle manufacturers, but at least six assemblers operate within the country' s boundary. The stakeholders involved in the sales and distribution of electric vehicles will play a critical role in developing innovative e-Mobility business models thus informing financing options for electric vehicles in Kenya[39]. The majority of the assemblers in Kenya are 2-wheeler assemblers.

39. Mobility, A. E., & Change, S. (2021). Designing a Financing Mechanism for the E-Mobility Sector In East Africa.

Table 3: Importers, Assemblers, Sales, and Distributors

	Assembler/Importer	Description
1	Kiri EV	Located on Kiambu road, Kiri EV is the first to bring a true electric 2-wheeler in Kenya, pioneering a new way of mobility. Kiri commissioned their motorcycle and battery swap-stations in 2020, provides a smart portable battery for the riders and planning for the entry of 3-wheelers into the Kenyan market in 2022
2	Fika Clean Mobility	FIKA which is a regional company began its operations in Kenya in 2019. The company aims to be the leading provider of energy solutions to Electric Vehicles (EVs) through Smart Battery Technology and interchangeable battery solutions across Africa with the ultimate aim of powering these stations via renewable energy, enabling refueling of electric vehicles at a lower cost and faster speed than conventional electric charging points. Apart from assembling 2-wheelers, Fika conducts research and development to guide their move to start local manufacturing.
3	Opibus	Founded in 2017, the company has the vision to make electric transport more accessible to a broader market by making the technology more cost-efficient and simplifying deployment. In 2021, the company raised about $7.5 million to support e-Mobility acceleration in sub-Saharan Africa[40]
4	Mazi Mobility[42]	Mazi is a Kenyan Mobility company that is re-imaging mobility through the implementation of an electric vehicle ecosystem in Africa. Currently assembles electric 2 and 3-wheelers in Nairobi Kenya. Additionally offers battery swapping options as well as flexible payment plans for their clients to drive the transformation of current mass transport systems to a smart, efficient, clean, and shared form of mobility
5	ARC Ride[43]	ARC Ride was established in East Africa in 2019 to help provide the electric solution to mass transportation in rapidly growing African cities. The company offers a versatile range of electric vehicles to meet all mobility needs. It additionally offers electric bicycles, mopeds, motorbikes, and tuk-tuks, with new models currently being developed. In 2021, the company announced plans to invest £4.5 million in growing its fleet of electric vehicles in Kenya[41]
6	Ecobodaa[44]	Ecobodaa takes pride in being Africa' s first electric taxi. Began its operations in Kenya in 2020. The company designs and assembles 2-wheelers in Nairobi, Kenya, provides battery and battery swapping stations for their clients. In 2021, the company secured an undisclosed sum of money to fund the acceleration e-Mobility in Kenya[42]

40. https://www.opibus.se/post/opibus-secures-sub-saharan-africas-largest-ever-fund-raise-in-electric-mobility-7-5-million-usd
41. https://www.gov.uk/government/news/uk-announces-132m-of-new-investments-in-kenya-and-backs-nairobi-as-an-international-financial-centre
42. https://ventureburn.com/2021/04/kenyan-e-mobility-startup-ecobodaa-secures-funding/

7	Drive Electric	Drive Electric is a subsidiary of Knights Energy. The company aims to develop, advocate and enhance mobility solutions that rely on renewable energy as their primary source of energy. The end goal is to offer a remedy against the soaring CO2-related emissions in the transport sector. It currently imports and maintains/services electric vehicles for clients as well as installing and maintaining charging infrastructure for its clients in Kenya. It has partnered with Nissan to provide customers with Nissan Leaf vehicles. It also offers electric vehicle leasing and fleet analysis as well as provide charging stations
8	BasiGo	BasiGo is an e-Mobility start-up company looking to revolutionize the public transportation sector by providing public transport bus owners with a cost-effective electric alternative to diesel. Its main aim is to create the future of clean, fully electric bus transportation in Africa. Announced their operations in Nairobi in November,[43] and are expecting to launch two 4-wheelers in December 2021
9	Powerhive	Powerhive is a technology venture founded in 2011 that partners with utilities and independent power producers to provide access to productive, affordable, and reliable mini-grid electricity for millions of rural homes and businesses around the globe. It develops scalable, bankable off-grid utility solutions to create a future where everyone has access to clean energy and the opportunities that come with it. The company currently has 30 2-wheelers operating in Kisii as a pilot
10	Energy, Petroleum and Regulatory Authority (EPRA)	The Energy and Petroleum Regulatory Authority partnered with UNEP and Kisumu County to pilot 50 electric 2-wheelers alongside KPLC. The pilot began in April 2021 running for 6 months and shall be concluded in January 2021. This was aimed at establishing what is working and what is not.
11	SIEMENS Stiftung Foundation	SIEMENS is a non-profit foundation that promotes sustainable social development. Previously piloted electric trucks, cargo bikes, and boats in Western Kenya through WE!Hub Victoria Ltd
12	Solar e-Cycles	The company has from 2014 led the effort to develop affordable environmentally clean solar-powered light electric vehicles for Africa with branches in Kenya, Morocco, and South Africa. The company has a mission to deploy electric 2, 3 & 4 wheelers, as well as develop the inexpensive solar car as a sustainable economic development tool in both isolated off-grid rural areas, and urban areas within Africa. In Kenya, the company assembles solar-powered bicycles and tricycles; 7 tricycles; 4 for passenger services, and 3 for cargo. It also has 5 electric bicycles.

43. https://techcrunch.com/2021/11/02/ev-startup-basigo-debuts-in-nairobi-after-1-million-pre-seed-funding/

2.2.2 Infrastructure Developers

Several players are involved in the provision of e-Mobility infrastructure from both the public and private sectors. These infrastructures include but are not limited to the following; charging stations, battery-swapping stations, software, e-vehicle spare parts. These players are outlined below

Table 4: Kenya's e-Mobility Infrastructure Developers

	Entity	Description
1	Knights Energy	Knights Energy is a leader in designing renewable energy solutions in the region for NGOs, commercial organizations. Currently operating in Kenya and the larger East African region, the company installs charging stations within Nairobi County, with one along Langata Road. They additionally install charging stations for individual electric car owners and have to this end installed 15 at various homes in Nairobi, Kenya
2	Kenya Power and Lighting Company (KPLC)	KPLC owns and operates most of the electricity transmission and distribution system in Kenya and sells electricity to Kenyan citizens. The government agency aims to run a pilot project with charging infrastructure in major cities to catalyse the industry; currently looking for development financing to fund the rollout.
3	KenGen	KenGen is the leading electric power generating company in East Africa. The company is currently anticipating providing infrastructure maintenance once done with piloting EV charging points. They are currently having a pilot location where it is testing the feasibility of electric vehicle charging.
4	Ampersand	Ampersand is Africa' s first and leading integrated electric motorcycle and transport energy solution. The company that is currently based in Kigali is contemplating making entries into the Kenyan Market to provide charging infrastructure

2.2.3 Mass adopters

Mass adopters are the players from both the public and private sectors who have enabled or plan to enable the visibility of e-mobility through the integration of electric vehicles into their operations as well as awareness creation through forums and workshops. As e-mobility continues to gain momentum in Kenya, both public and private sector players, are gaining interest in the market. The table below outlines how different actors integrate e-mobility into their entrepreneurial activities.

Table 5: Kenya's e-Mobility Mass adopters

	Entity	Description
1	Uber	The company that was launched in Kenya back in 2016 offering cab services, is increasingly integrating electric fleets into the Internal Combustion Engine (ICE) powered base from the year 2020
2	NopeaRide	Nopea Ride is the first electric taxi company on the African continent and is growing its fleet in Nairobi, Kenya; aiming to have at least one hundred electric 4-wheelers by end of 2021.
3	Bolt	Bolt began its operations in Kenya in the year 2017 offering cab services using both 2 and 3-wheelers. The company is increasingly integrating electric fleets into the ICE powered base especially the 2-wheelers
4	Jumia	Jumia is a service company offering goods and services to its clients. In partnership with Bolt and Uber, the company provides logistical services using electric 2-Wheelers
5	GetBoda	GetBoda is a service company that offers a logistics and delivery application to help move items safely and reliably across cities. The company currently provides logistical services using electric 2-Wheelers
6	eBee	eBee is a Kenyan start-up established in 2020. The company offers electric bicycles on a subscription basis for the delivery market. It uses the Vehicle-as-a-Service concept we want to make e-bikes affordable and accessible to millions of Africans who use vehicles to generate an income.

2.2.4 Financiers

Different actors are positioning themselves in the electric vehicle markets through financial assistance. Outlined below are some of the entities offering or anticipating to offer financing options, and support for the integration of electric vehicles in the Kenyan market.

Table 6: Kenya's e-Mobility Financiers

	Entity	Description
1	Maris	Maris is an investment holding company, diversified across five key economic sectors in nine countries. Maris is investing heavily in the implementation, monitoring, and reviewing of Environmental and Social Management. The company provides loans for Boda Boda[44] drivers at a 50% interest rate annualized to acquire electric 2-wheelers
2	Watu[45]	WaTu is a company that operates in Kenya, Uganda, and Nigeria and offers asset financing to provide tools needed to move and improve people' s lives across Africa. Majorly focuses on start-up companies and entrepreneurs. The company is looking at investing in the e-Mobility space in Kenya is presently providing asset financing that entails loans of up to 18 months especially for 2-wheelers.
3	Mogo	Mogo Kenya is part of the Mogo Finance Group who are specializes in used car financing in Kenya. The company also offers logbook loans and boda boda (2-wheelers) loans to its potential customers in a convenient, quick, and easy way as a way of enhancing e-Mobility transition.
4	P4G Partnership[46]	P4G is a global platform accelerating innovative multistakeholder partnerships and is currently funding over 30 public-private partnerships with projects on the acceleration of e-Mobility, in developing countries, Kenya included. The partnership includes SIEMENS Stifftung, Opibus, Tugende, We!Hub among others. Previously supported relevant ministries to facilitate a robust regulative framework for e-Mobility on the country and national level[47].
5	SIEMENS Stiftung	SIEMENS Stiftung is a non-profit foundation that promotes sustainable social development. The company whose geographical focus includes Africa and Latin America currently mobilizes funding for the acceleration of e-Mobility through financing programs. It offers grants based on the competitive application for entities in the e-mobility space
6	Total Kenya	The foundation is presently partnering in P4G, WRI, and other interested parties in offering capacity building and resource (fund) mobilization to accelerate e-Mobility in Kenya[48].
7	Mobility 54	The company was established in October 2019 as a mobility-dedicated Corporate Venture Capital (CVC) for Africa under Toyota Tsusho Corporation and CFAO group. Currently, partners with other relevant players like InfraCo Africa raise funds in support for e-Mobility in developing countries, particularly East Africa

44. Boda boda is a type of motorcycle or bicycle with a space for a passenger or for carrying goods, often used as a taxi.
45. https://watuafrica.com/
46. KII, and https://p4gpartnerships.org/news-events/mobilizing-finance-reach-net-zero-developing-countries
47. https://p4gpartnerships.org/pioneering-green-partnerships/all-p4g-partnerships/accelerating-e-mobility-solutions-social-change
48. https://p4gpartnerships.org/news-events/roundtable-accelerates-e-mobility-solutions-kenya

8	InfraCo Africa 	InfraCo Africa is part of the Private Infrastructure Development Group (PIDG). The company receives funding, through PIDG' s publicly funded trust, from governments in the UK (FCDO), the Netherlands (DGIS), and Switzerland (SECO). It is presently supporting fundraising on e-Mobility acceleration in East Africa. Together with DOB Equity and Mobility54, and in agreement with Zembo, committed over €3 million to support the growth of the company' s electric motorcycle business in Kampala, Uganda.
9	Shell Foundation (SF) 	Shell Foundation is a worldwide, social investment initiative to concentrate on working with external partners to promote sustainable development. The foundation is presently supporting the African Mobility Initiative (AMI) to find start-ups and innovations addressing sustainable mobility in the informal transport sector in Kenya and Uganda. This is currently done through its Africa Transformative Mobility Accelerator (ATMA) and supported by the Transformative Urban Mobility Initiative (TUMI).

2.3 Roles of Sector Players in the e-Mobility Transition

2.3.1 Manufacturers, Assemblers, Importers and, or Suppliers

The transition to e-Mobility will require manufacturers, assemblers, and or suppliers to take center stage. Their core task will be the development and production of low-cost and end-user-friendly electric vehicles and vehicle components. The cost of electric vehicles has been highlighted as a barrier to the integration of EVs into the market[49], the manufacture of low-cost electric vehicles will not only attract more players in the market (importers and assemblers) but also increase job opportunities that some practitioners argue will be lost during the transition. Kenya Power and Lighting Company, and KenGen, should directly participate in the development of charging infrastructure. Manufacture of EVs and components should be based on market needs and viability assessments as this will inform a systematic and seamless transition to electric mobility in Kenya. Already, the Ministry of Transport is working with General Motors to ensure at least 15% of their total imports are electric. This will only be successful when the cost of EVs is feasible and market-friendly.

50. AEMDA. (2021). Electric Mobility Barriers in Kenya: Market Survey Report 2021. 0-22. https://aemda.org/

2.3.2 Public Sector Agencies

The transition to e-mobility is a primary role of the government as it is responsible for the provision of an enabling environment for the conceptualization, development, and mainstreaming e-Mobility. Apart from the coordination in setting up electric vehicle infrastructure, the government and its agencies will be responsible for aligning the current legal and regulatory frameworks to suit the e-Mobility transition. It is also within its prerequisites to establish and provide financing options for electric vehicles; incentives on importations, reduction of excise duty, and Value Added Tax on electric vehicles. Further, the government through the Kenya Bureau of Standards would be responsible for the development of standards for electric vehicles in partnerships with relevant entities like the United Nations Environment Program among others. Such standards should also highlight research policy priorities in the battery field and inform long-term phase-out of combustion technology. At least 24 standards have been developed in relation to e-Mobility in Kenya. The current standards are around the specifications and testing procedures for safety aspects as well as performance and power consumption elements[50]. Further, the government need to design an economic framework that supports more strongly the transition from fossil technologies to renewable, electrical, and sustainable energy solutions

2.3.3 The Private Sector and or Developers

Kenya's e-Mobility landscape is dominated by the private sector and developers who are currently leading the transition to e-Mobility in Kenya[51]. These players understand the market currently and will need to partner with the government of Kenya in the transition. They do not only know the market needs but also the models useful in the integration of electric vehicles in the Kenyan market. Experience from other nations has demonstrated that understanding the potential market, particularly needs and feedback is important in the transition[52] and private developers who are well established in Kenya would be useful in this.

2.3.4 e-Mobility Working Group

e-Mobility transition in Kenya will require a coordinating body to steer the implementation. The establishment of the working group should form part of the short-term plans.

50. Transport, M. O. F., & Development, U. (2021). Republic of Kenya Importation and Taxation of Electric Vehicles in Kenya. January 2021.
51. Africa, M. (2021). Opportunity and investment potential for electric vehicles in. September 2021.
52. Bajpai, J., & Bower, J. (2020). A Road Map for e-Mobility Transition in Rwanda - Policy Brief. Igc, April. www.theigc.org

The working group will oversee the implementation of the transition framework to e-Mobility in Kenya through robust stakeholder engagement, as well as monitoring and evaluation of the progress of implementation. The working group should be able to champion the establishment of an e-Mobility authority that will be responsible for the country' s transition to e-Mobility through the enactment of relevant laws and policies.

2.4 Future/Planned Initiatives

Some of these plans have no clear written reports as it is purely based on interviews conducted with different stakeholders as well as grey literature, and are subject to change.

Table 7: Future/Planned initiatives

#	Entity	Planned Initiatives	
		National	Sub-National level
1	Drive Electric	Drivelectric is developing an App that will indicate the location of different charging stations in Nairobi city and other major towns in Kenya. This is set to be launched in the first quarter of 2022	
2	Nopea Ride		Through InfraCo Africa, NopeaRide received £0.9 million in investments to accelerate access to clean transportation. The company intends to increase its number of electric vehicles from 30 to 100 electric vehicles and set up new charging infrastructure across Nairobi
3	BasiGo		BasiGo, an e-Mobility start-up secured Sh111.3 million in pre-seed funding to electrify the Kenyan public transport system. The investment will finance the manufacture of 25 and 36-seater capacities electric buses with a range of approximately 250 kilometers, sufficient to cover everyday trips[53]. The first two buses will be launched in Nairobi, in December 2021

53. Retrieved from https://www.businessdailyafrica.com/bd/corporate/technology/electric-cars-gradually-drive-kenyan-roads-3614506

4	Opibus	Opibus has obtained Sh834.37 million ($7.5 million) in grant funding and equity to increase production of electric buses and motorcycles in Kenya from next year, 2022.[54]	
5	Agilitee		Agilitee, a South Africa-based electric vehicles manufacturer, has established offices in Nairobi as it pursues new markets in the East African region. It will officially launch its operations in December 2021 and is planning to make Sh111.2 million in investments through its subsidiary company Agilitee East African[55].
6	Caetano Kenya		The official Hyundai car dealer in the country, Caetano Kenya, announced the arrival of the Hyundai KONA Electric, the first new electric vehicle to their range to be commercialized in Kenya. It will cover 400 kilometers on a single charge meeting the increasing demand for diesel and petrol substitutes[56]
7	State Department of Transport and GIZ	The State Department of Transport (SDoT) and GIZ are planning to partner to implement a project on, " Promotion of e-Mobility in Kenya", whose objective is to ensure that the framework conditions for e-Mobility (for urban and rural applications) in Kenya are improved and capacities of key actors are strengthened.	

54. Retrieved from https://allafrica.com/stories/202111050042.html
55. Retrieved from https://www.standardmedia.co.ke/business/motoring/article/2001428059/electric-car-manufacturer-sets-up-shop-in-nairobi
56. Retrieved from https://www.kenyanews.go.ke/first-new-electric-vehicle-launched-in-kenya/

	State Department of Transport and GIZ  	The project is scheduled to be implemented from January 2022 to December 2025, with the German Federal Ministry for Economic Development Cooperation funding of €6,000,000[57]. In November 2021, the SDoT signalled the intention to develop a National Electric Mobility Policy for Kenya In November 2021, the SDoT signaled the intention to develop a National Electric Mobility Policy for Kenya[58]	
8	Government of Kenya(GoK) 	According to Kenya National Energy Efficiency and Conservation Strategy, the Government of Kenya intends to grow the interest in electric vehicles in the country in the next five years to have 5% of every imported vehicle in Kenya being electric vehicles by 2025[59].	
9	German Investment Corporation (DEG) 	DEG is a subsidiary of KfW, whose mission is to promote business initiatives in developing and emerging market countries as a contribution to sustainable growth and improved living conditions of the local population[60]. To this end, KFW DEG makes long-term financing and advice available to private enterprises investing in these countries. Currently, DEG considers supporting a few of the start-up companies in the East African region, which electrify existing and 2 and 4-wheelers	

57. Partner, M. (2021). Overview Project Objective and Fields of Action involving SDoT and GIZ
58. https://transport.go.ke/department/index.php?option=com_content&view=article&id=433:development-of-a-national-electric-mobility-policy-for-kenya&catid=27:tenders&Itemid=160
59. Retrieved from http://repository.kippra.or.ke/bitstream/handle/123456789/3074/ENERGY%20STRATEGY.pdf?sequence=1&isAllowed=y
60. https://www.devex.com/organizations/kfw-deg-52092

10	SolutionsPlus 	SolutionsPlus is a four-year flagship project supporting the uptake of different types of e-Mobility in large urban areas across the world, financially supported by the European Commission (Horizon 2020, grant No 875041). The consortium is composed of 46 core organisations leaders in the field of mobility and e-mobility (UN-Habitat, UNEP, ITDP Africa, ICCT, Wuppertal Institute, Technical University of Berlin etc.) and 116 associated partners, coordinated by the Urban Electric Mobility Initiative (UEMI). In East Africa, two cities are initially supported: Kigali and Dar es Salaam. Kenya has been supported via capacity building activities and is well placed to become a replication country.	
11	eBee 	eBee plans on launching e-cargo delivery bicycles and e-scooters, pick&drop points for the B2C market, set-up e-bike assembly line at the end of 2022, expansion in other Sub Saharan Africa markets like Uganda, Rwanda, and South Africa at the end of 2022.	

Image of eBee courtesy of eBee Africa

3.1 Existing Policies

Electric cars sales expanded by an annual average of 60% in 2014 – 2019, totalling 7.2 million in 2019 globally. The sales experienced exponential growth of over 40% in global sales from 2.1 million in 2019 to slightly over 3 million in 2020. Espoused by existing policy support and additional stimulus measures from the 2020 pandemic recovery packages by major markets, the electric vehicle segment accounts for about 10% and 5% of the total car sales in Europe and China, respectively.

The main drivers of sales were notably, i) strong policy support in Europe due to the 2020 target year for emission standards, ii) increased purchase incentives in countries such as Germany, iii) continued decline in battery costs and upgraded original equipment manufacturer (OEM). Undoubtedly, policy plays a crucial role in accelerating the uptake of EVs.

Presently, the national policies driving e-Mobility integration into the transport sector in Kenya are summarised in Table 8.

Table 8: A non-exhaustive list of existing e-Mobility policies, regulations, and standards

#	Policy Document/Regulation/ Standard	E-Mobility Highlight
1	Nation Climate Change Action Plan (NCCAP) 2018 - 2022.	Provided action points to create an enabling environment for EVs which include:
		i) Encourage domestic technology development for electric modes of transport
		ii) Research the use of renewable energy for powering different modes of transport
		iii) Build awareness on fuel economy and electric mobility options, including exploring infrastructure needs for electric mobility
		iv) Develop and implement standards for electric cars and 2-wheelers by 2019

2	The National Energy Efficiency Strategy. (NEECS) 2020[61].	The strategy aims to increase the share of electric vehicles to 5% of annual vehicle imports by 2025 through three main action points
		i) The strategy recommends the revision of building codes to incorporate charging stations in estates and public buildings
		ii) Incentivize EV uptake through lowering import duty for electric cars, bicycles, and tuk-tuks[62] and lower vehicle road taxes
		iii) Awareness-raising on energy efficiency in vehicles and e-Mobility
		These activities were estimated to require a budget of KES 2,000,000,000 (USD 18,880,000)
3	Finance Act 2019	The Finance Act 2019 included a clause to reduce excise duty for 100% electric vehicles (EVs) from 20% to 10%.
4	Ongoing Revision of the Integrated National Transport Policy (2009)	Revision likely to include provisions for EVs and related infrastructure
5	EV Standards (Kenya Bureau of Standards)	24 standards that apply to imported EVs were developed. The standards specify the testing procedures, performance, and power consumption among others.

A few policies at the subnational level are also noted to the direct transition of cities to sustainable transport. The city of Nairobi's climate change action plan (draft) makes mention of electrifying the Bus Rapid Transit (BRT) corridor.[63] In a press release, the Principal Secretary in the State Department of Housing and Urban Development confirmed that the rollout of the BRT will be primarily for electric buses which will be procured via public-private-partnership (PPP).[64] The Kisumu Sustainable Mobility Plan outlines plans to transition to a fully electric bus fleet by 2030. The 10-year targets also include incentivizing electrification of Boda bodas, tuk-tuks, and car taxis; electrifying 50% of the boda bodas (2-wheelers), and tuk-tuks (3-wheelers) by 2025.[65]

61. MoE, 2020. Kenya National Energy Efficiency and Conservation Strategy
62. Tuk tuk is a three-wheeled motorized vehicle used as a taxi
63. Galuszka, J., Martin, E., Nkurunziza, A., Oginga, J.A., Senyagwa, E.T., and Lah. O. (2021). East Africa's Policy and Stakeholder Integration of Informal Operators in Electric Mobility Transitions - Kigali, Nairobi, Kisumu and Dar es Salaam. Sustainability,13,1703.
64. Kimuyu, H. (2021). Kenya: Nairobi BRT System is for Electric Buses Only, Says PS Hinga. Daily Nation. https://allafrica.com/stories/202106090791.html
65. Kisumu County Government (2020). Kisumu Sustainable Mobility Plan. https://www.kisumu.go.ke/wp-content/uploads/2020/12/Kisumu-Sustainable-Mobility-Plan-200716.pdf

3.2 Regulatory Frameworks for e-Mobility

3.2.1 Vehicle Registration

The State Department of Transport in collaboration with GIZ carried out a study to clarify the electric vehicle classification system in Kenya, which resulted in recommendations on vehicle registration. The vehicle classes are crucial as they are used to calculate the total importation duty on sales tax for locally assembled vehicles. A vehicle registration template was developed for use and adoption by the National Trasport and Safety Authority (NTSA). The main elements to be registered include;[66]

Table 9: Proposed registration details for EVs

i) Power rating (KW), which specifies the power capacity	i) Battery identifier (Serial No.) identifies the battery and its characteristics that are important during maintenance and replacement.
ii) Seating capacity specifying the type of vehicles and outlining the classification for bicycles, mopeds, cars, trucks, and buses	ii) Power source specifying the main source of power for the vehicles and identifying the energy source of the vehicle
iii) Size of battery (kWh) specifying the electrical energy storage capacity of the vehicles	

Although having a template for registration is foundational, discussions with different stakeholders reveal that implementation of the registration template has been a slow process. The latter is likely to hinder the implementation of the tax incentives. From a market assessment of barriers to electric mobility in Kenya that covered 60% of the market players, less than 10% of those actors reported accessing the excise duty incentive.[67]

As previously proposed in the study on registration of electric vehicles[68], some of the key recommendations for registration may include:

a. Re-Registration of retrofitted EVs using the proposed template with an additional field indicating that the vehicle is retrofitted (not using original equipment)
b. Exemption of registration fees for electric vehicles (up until a certain quota of EVs is attained in the country)
c. A definitive identifier of EV models for easy identification for exemption of parking fees, toll fees, or entry into noise-level controlled areas

66. MoTIHUP (2021). Electric Mobility Study: Electric Vehicle Registration in Kenya.
67. AEMDA (2021). Electric Mobility Barriers in Kenya.
68. MoTIHUP (2021). Electric Mobility Study: Electric Vehicle Registration in Kenya.

3.2.2 Institutional Arrangement

Electric mobility requires inter-sector coordination to enable a proper environment for the uptake of electric vehicles. Presently, the efforts of government actors are independently coordinated. Based on the activities of these different actors, an interagency coordinating body is necessary to funnel the activities and effort required to establish an electric vehicles framework in the country. Figure 7 is a simplified institutional composition of the interagency committee.

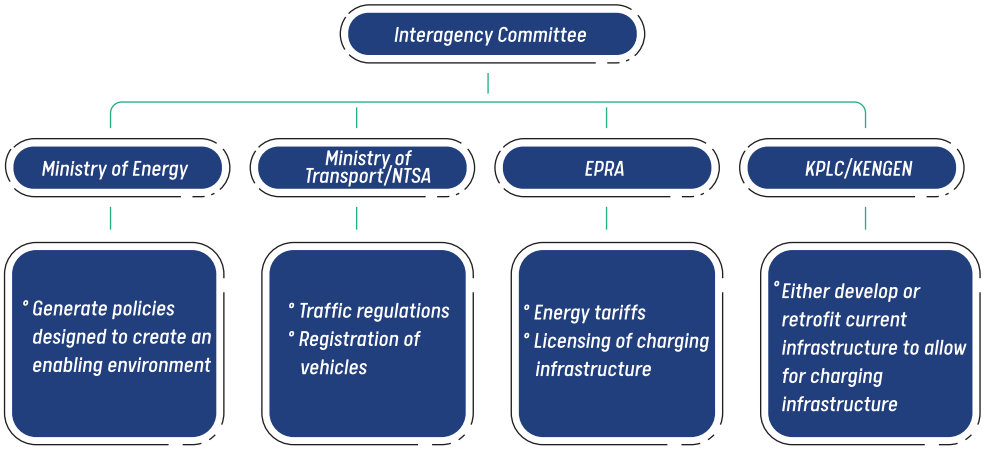


Figure 7: Proposed interagency committee with actors from various government bodies

3.3 Tax Regimes, Incentives, and Tariffs

The Finance Act of 2019 instituted a reduction of excise duty to 10% from 20% for 100% electric powered motor vehicles. Although this marks a first step in providing incentives for sector growth, there is a need for more inclusive incentives targeting 2-wheeler and 3-wheeler fleets. There are no definitive tariffs proposed for charging electric vehicles. Currently, users charging at home pay the highest tariff (domestic consumers).[69]

3.4 Standards

KEBS, with support from development partners, GIZ and UN Environment Programme, has developed standards for e-Mobility including KS ISO 8714:2002 on energy consumption and range of electric vehicles, KS ISO 23274-12:2013 for hybrid-electric road vehicles exhaust emissions, and fuel consumption measurements.[70]

69. AEMDA (2021). Electric Mobility Barriers in Kenya.
70. Ministry of Energy (2020). Kenya National Energy Efficiency and Conservation Strategy. kenya-national-energy-efficiency-and-conservation-strategy-2020.pdf (unepdtu.org)

Table 10: Non-exhaustive list of Standards on e-Mobility

#	Standard and Description
1.	KS ISO 6469-1:2019
	Electrically propelled road vehicles-Safety specifications -Part 1: Rechargeable energy storage system (RESS)
2.	KS ISO 6469-2:2018
	Electrically propelled road vehicles-Safety specifications -Part 2: Vehicle operational safety means and protection against failures.
3.	KS ISO 6469-3:2018
	Electrically propelled road vehicles-Safety Specifications-Part 3: Electrical safety
4.	KS ISO 6469 – 4:2015
	Electrically propelled road vehicles – safety specifications part 4: post-crash electrical safety
5.	KS ISO/TR 8713:2012
	Electronically propelled road vehicles – vocabulary
6.	KS ISO 8714:2002
	Electric road vehicles- reference energy consumption and range. Test procedures for passenger cars and light commercial vehicles
7.	KS ISO 8715:2001
	Electric road vehicles – road operating characteristics
8.	KS ISO/TR 11955:2008
	Hybrid electric road vehicles- guidelines for charge balance measurement
9.	KS ISO 12405-4:2018
	Electrically propelled road vehicles-Test specification for lithium-ion traction battery packs and systems-Part 4: Performance testing
10.	KS ISO/PAS 16898:2012
	Kenya Standard — Electrically propelled road vehicles — Dimensions and designation of secondary lithium-ion cells, First Edition
11.	KS ISO 17409:2015
	Kenya Standard — Electrically propelled road vehicles — Connection to an external electric power supply — Safety requirements, First Edition
12.	KS ISO 18300:2016
	Electrically propelled road vehicles — Test specifications for lithium-ion battery systems combined with lead-acid battery or capacitor, First Edition
13.	KS ISO/PAS 19295:2016
	Specification of voltage sub-classes for voltage class B

14.	KS ISO/PAS 19363:2017
	Electrically propelled road vehicles-magnetic field wireless power transfer safety and interoperability requirements
15.	KS ISO 23274-1:2013
	Hybrid-electric road vehicles-exhaust emissions and fuel consumption measurements part 1: non externally chargeable vehicles
16.	KS ISO 23274-2:2012
	Hybrid-electric road vehicles- exhaust emissions and fuel consumption measurements part 2: externally chargeable vehicles
17.	KS ISO/TR 13062:2015
	Electric mopeds and motorcycles – terminology and classification
18.	KS ISO 13063:2012
	Electrically propelled mopeds and motorcycles – safety specifications
19.	KS ISO 13064-1:2012
	Battery-electric mopeds and motorcycles- performance part 1: reference energy consumption and range
20.	KS ISO 13064-2:2012
	Battery-electric mopeds and motorcycles- performance part 2: road operating characteristics
21.	KS ISO 15031-6: 2015
	Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics Part 6: Diagnostic trouble code definitions

3.4.1 Policies adopted globally to support the uptake of EVs

The policies and incentives adopted throughout the world vary, but studies on countries with the largest electric vehicle market share indicate that four main pillars are noted to influence the sector as shown in Figure 8.

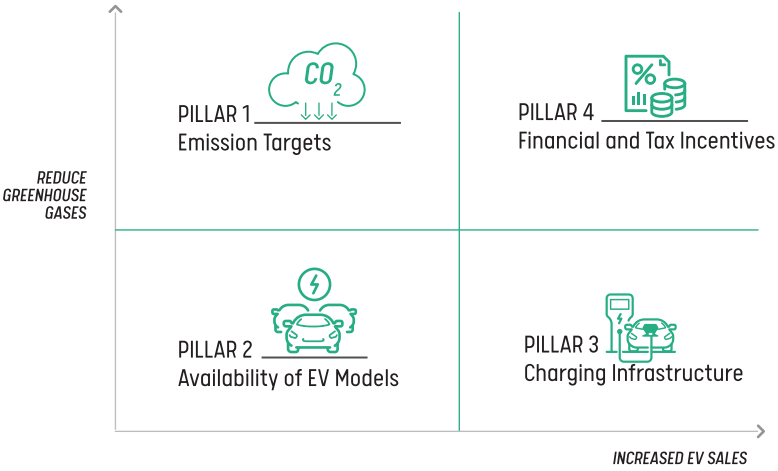


Figure 8: Pillars influencing the increased sales of EVs

Pillar 1: Emission Targets

Emission targets and vehicle sales mandate to reduce greenhouse gases in the transport[71] sector is an indirect lever that kicks into gear various planned policies and measures in the transport sector, to promote low-carbon fuels or electric cars or encourage a modal shift to public transport . China, the world' s biggest car market, launched its new energy vehicle industry plan for 2021 -2035. The plan targets a 20% share for new energy vehicles in new vehicles sales by 2025 and 100% electrification of the public fleet[72]. China also plans to stop manufacturing non-hybrid fossil-fuel-powered vehicles by 2035.[73,74]

Rwanda' s 2020 NDCs targets a mitigation potential of 0.1377 MtCO2,9% of 1.53 MtCO2, targeted in the energy sector, from EV adoption between 2020 – 2030[75]. To achieve these goals, the government has outlined several measures to increase the uptake of EVs including[76]:

- Electricity tariff for charging stations be capped at the industrial tariff level (large industry category)
- The electric vehicles to benefit from a reduced tariff during the off-peak time
- Zero-rating of electric vehicles, spare parts, batteries, and charging station equipment

71. EEA (2021). Greenhouse gas emissions from transport in Europe. https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport.
72. https://theicct.org/sites/default/files/publications/China-new-vehicle-industrial-dev-plan-jun2021.pdf
73. Boudette, N.E. and Davenport, C. (2021). G.M Annnouncement Shakes up U.S. Automakers' Transition to Electric Cars. The New York Times. https://www.nytimes.com/2021/01/29/business/general-motors-electric-cars.html
74. Dow J. (2020). China Plans 2035 gas car ban that doesn't actually ban gas cars.electrek. https://electrek.co/2020/10/27/china-plans-2035-gas-car-ban-that-doesnt-actually-ban-gas-cars/
75. EED Advisory and Siemens Stiftung (2020).
76. Ministry of Infrastructure (2021). Strategic Paper on Electric Mobility Adaptation in Rwanda.

- Exemption of import and excise duties on electric vehicles, spare parts, batteries, and charging infrastructure
- Exemption of withholding tax of 5% at customs
- Introduce carbon tax to discourage polluting vehicles

Pillar 2: Availability of EVs

Stimulating investment in EV production can occur either through mandates or financial incentives. Mandates would require that current manufacturers fulfil a certain quota of production for EVs based on their share of conventional vehicles sales. Local manufacturers such as General Motors are committing to the production of up to 15% of EVs in their current quota, as they aim to transition their global production to zero-emission vehicles by 2035[77].

The government can offer incentives to set up manufacturing units such as subsidies, low-interest or interest-free loans, stamp duty, and land registration charge exemptions or discounts, discounts on power and water tariffs, subsidies for setting up effluent treatment plants, and making land and ready-made infrastructure for manufacturing available[78].

Pillar 3: Charging infrastructure

Cash grants for the purchase of electric vehicles are attractive to end-users, however, combinations of lower grants with charging facilities can result in similar market shares[79] European countries provide nationwide incentives including subsidies or tax deductions for installations of private charging stations, public funding, or the free use of infrastructure[80]. In Kenya' s case, the public charging infrastructure that requires distribution will depend on KPLC' s current network. Although Kenya' s electricity supply can handle the conversion of about 10% of the conventional fleet to electric models, the infrastructure such as transformers is likely to be strained if more vehicles are charged at home[81]. Currently, the charging infrastructure setup is privatized, and the owners of the stations have set up their supply of electricity. Having a guiding framework outlining how public and private sectors can collaborate in setting up charging infrastructure will be necessary to kick-start the adoption of electric vehicles.

77. Boudette, N.E. and Davenport, C. (2021). G.M Annnouncement Shakes up U.S. Automakers' Transition to Electric Cars. The New York Times. https://www.nytimes.com/2021/01/29/business/general-motors-electric-cars.html
78. Menon et al (2019).
79. Lieven T. (2015). Policy measures to promote electric mobility - A global perspective. Transportation Research Part A 82 78 -93.
80. Rietmann et al (2019)
81. KII Interview with Umass Researchers based on their modelling scenarios - work pending publishing

The supply-side policies will need to clearly define the role of distribution companies, tariff design, incentives, permitting processes, and data privacy, and the demand side will need to address payment methods, minimum facilities, charging stations, user registration, and consumer complaints. A brief guide to the policy considerations at each stage of market growth is indicated in Figure 9[82].

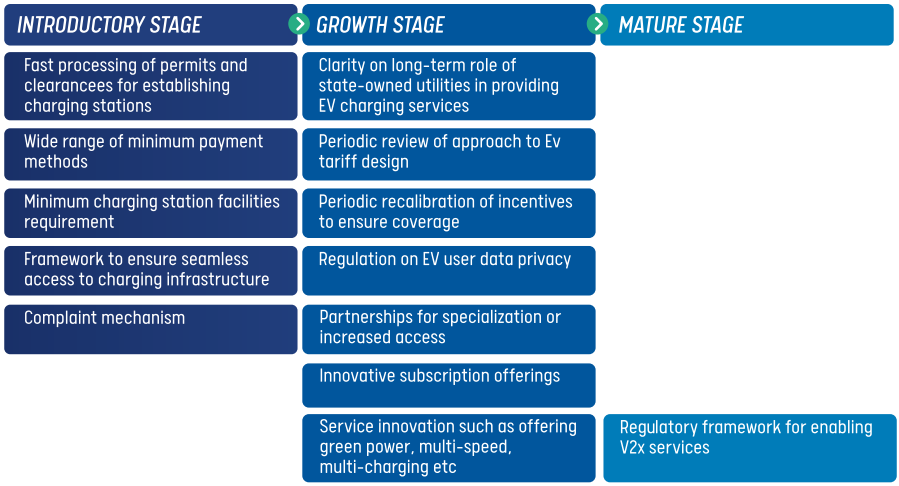


Figure 9: Policies to enable charging infrastructure deployment

Pillar 4: Financial and Tax Incentives

Financial incentives adopted include purchasing subsidies and tax benefits. The application of these purchase subsidies has included:

i. USA - Federal tax credit of between US$ 2,500 – US$ 7,500
ii. Exemption from road and registration taxes for BEV owners for the Netherlands.
iii. Reduction or zero-rating of import duty for EVs e.g. Brazil and Russia[83].
iv. Germany providing up to 8 Billion Euros support for subsidies in the EV automotive sector, including the electric vehicle purchase incentives and investment program for e-Mobility manufacturers
v. France has increased its subsidies for the purchase of electric vehicles and included scrappage bonuses for low to middle-income households

82. Bhagwat P., Hadush S., Bhagwat S., (2019). Charging up India's Electric Vehicles. Florence School of Regulation. https://cadmus.eui.eu/bitstream/handle/1814/64925/RSCAS_PB_2019_15.pdf?sequence=1
83. Rietmann N., and Lieven T., (2019). How policy measures succeeded to promote electric mobility - Worldwide review and outlook. Journal of Cleaner Production 206 66 - 75.

vi. Italy has approved bonuses for the purchase of electric vehicles, hybrids, and Euro 6 Vehicles
vii. China has extended the central subsidy program for new energy vehicles to 2022[84].

Due to the financial limitations of developing countries, cash-for-purchase schemes are unlikely to feature prominently. However, the Kenyan government can consider increasing initiatives such as zero-rating import duty and VAT on electric vehicles, offering subsidies to electric vehicle manufacturer' s and increasing financing to electric vehicle start-ups in Kenya.

The government may consider offering tax incentives to transition large private and commercial fleets, including offering relaxed regulations on permits and offering open permits for commercial fleets which would provide flexibility for owners. The government should standardize guidelines to streamline the electric vehicle procurement process and facilitate government purchases. Collaboration with ride-sharing companies, app-based aggregators, and manufacturers such as Nopea Ride is also crucial in promoting electric ride-sharing[85].

Image of e-vehicle being plugged in courtesy of Drive Electric

84. Cui, H., and He, H. (2020). China announced 2020 - 2022 subsidies for new energy vehicles. The International Council on Clean Transportation. https://theicct.org/publications/china-2020-22-subsidies-new-energy-vehicles-jul2020
85. EED Advisory and Siemens (2020)

Successful integration of electric vehicles in the Kenyan space will require both short, medium, and long-term plans. Short-term plans will include capacity building, updating and aligning relevant policies to e-Mobility and setting up charging infrastructure. The setting up of charging infrastructure systematically would prepare the market for the introduction of various models of electric vehicles from the local assemblers as well as inform imports of the same. Long-term plans would build on the success of the short-term plans to expand and operationalize the strategies for e-Mobility transition. In below Figure 10, we present Kenya' s e-Mobility transition framework.

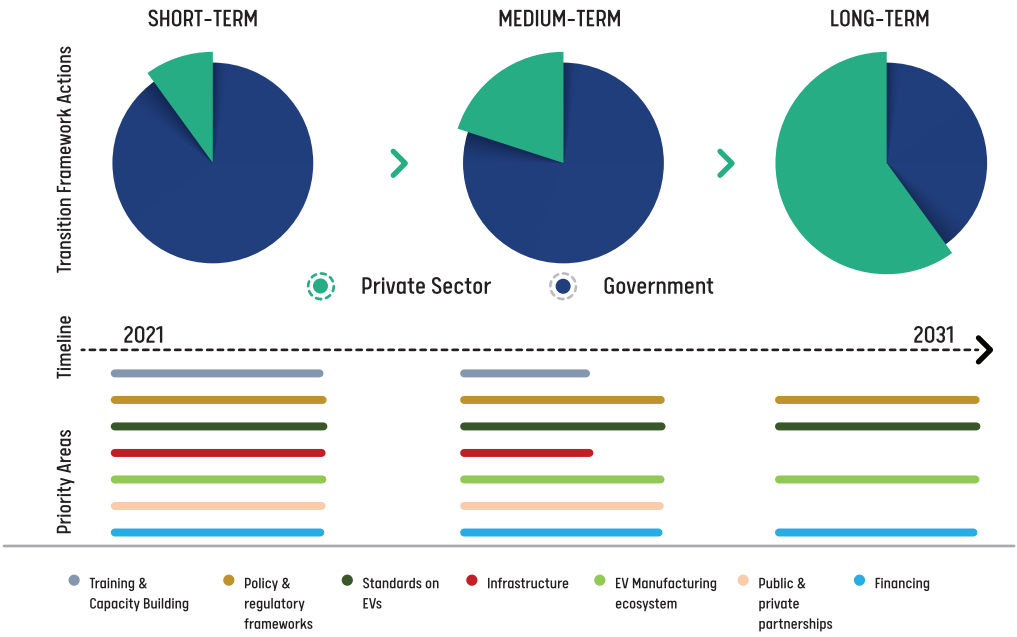


Figure 10: Kenya's e-Mobility Transition Framework

Table 11: Summary of Kenya's e-Mobility transition framework - potential interventions

#	Priority Area	Short-term actions	Medium-term actions	Long-term actions
1	Training and Capacity Building (Government of Kenya, Working Group, private sector)	• Developing actor-specific training manuals for electric vehicles	• Review workforce skill gaps and launch a skill development plan	Establishing special visa/work permit regulations to attract foreign talents to boost the transition to e-Mobility
		• Establishing a curriculum for TVETs on e-Mobility	• Persuading cost-sensitive personal motor vehicle owners, who have relatively longer travel distances in a day to take up electric vehicles	
		• Planning and organizing workshops and dialogues on e-Mobility		
		• Awareness creation through the mainstream media		
		• Benchmarking from countries that have more developed e-Mobility through continuous foreign trips		
2	Policy and Regulatory Framework (Government of Kenya)	• Carry out a policy gap analysis	• Establishing mechanisms for potential policy review based on current developmental needs in the sector	• Establish regulations mandating companies/ car dealers to have some of their imported cars being electric

		• Aligning all relevant policies to e-Mobility	• Establishing regulations mandating parastatals to have some of their imported cars being electric	• Entrench e-vehicle quotas for Ministries and (departments and agencies) MDAs as part of their procurement plan within the public procurement act
		• Reduce excise duty and VAT on importation of electric vehicles	• Institute preferential tariffs to electric vehicle charging period (time-of-use tariffs)	
		• Establish a policy for tax reliefs on electric vehicle components/parts	• Signal sustainable modes of transport through e-bike sharing schemes	
		• Amend building by-laws and codes that are set by the municipal bodies and housing department to allow the creation of charging points in residential and commercial buildings		
3	Standards on Electric Vehicles (Government of Kenya, Development partners)	• Develop regulations and safety standards	• Review standards and identify if there exist gaps to be filled	• Developing standards on electric vehicle specifications, models and components/ parts, power consumption elements, safety standards
			• Operationalize standards on electric vehicles	

4	Infrastructure (Government agencies, Importers, and assemblers)	• Institute a grid stability study	• Establish a network of charging facilities for the electric vehicles	• Densify network of charging infrastructure for electric vehicle
		• Setting up charging facilities at government offices and other commercial centres, parking lots, petrol stations, and residential locations, public transport depots, and vehicle fleet depots	• Increase charging infrastructure access	
		• Supporting private entities to put up infrastructure on electric vehicles	• Establishing charging as a business model for electric vehicles to enable battery swapping	
		• Facilitating KPLC and KenGen to establish charging infrastructure	• Catalyzing a battery swapping industry	
		• Mapping electric vehicle growth points to establish charging needs		
5	Electric Vehicle Manufacturing Ecosystem (Manufacturers, Importers, and assemblers, Government of Kenya)	• Establishing links with International manufacturers of electric vehicles and their components	• Form partnerships with international players while simultaneously building Public Service Units in the state	• Introduce EVs into the Government fleet, especially vehicles of senior officers
		• Signal demand by announcing plans as well as convert buses on selected routes to electric	• Focus on building industrial strength in vehicle manufacturing but also individual vehicle components	• Boosting the EV manufacturing potential for local vehicle manufacturers and assemblers (e.g. GM Motors) – 20% of total vehicles

		• Commission an e-Mobility economic, social and environmental impact assessment		
6	Public and Private Partnerships	• Mapping of key players and stakeholders in the e-Mobility landscape in Kenya	• Increase private sector investment and donor interest	• Establish an annual conference on e-mobility to enhance the transition process
		• Formation of a working group to mainstream e-Mobility in Kenya	• Develop partnerships for managing e-waste arising from electric vehicles	
		• Developing a framework for private sector engagement on e-Mobility	• Establish an e-Mobility inter-agency team consisting of relevant public sector institutions (SDoT, KEBS, KRA, NTSA) stakeholders, Ministry of Energy, Ministry of Environment, and private sector representatives. This could be a Kenya e-Mobility Transition Authority, established through the alignment of the Integrated National Transport Policy to accommodate the provision for the creation of such an authority	
		• Establish the Kenya e-mobility sector working group		

7	Financing (Financial Institutions, private sector, and the Government)	• Mapping potential funding entities within and outside Kenya' s landscape on e-Mobility	• Operationalize the incentives and regulatory measures and the plans already announced	• Monitor progress and evaluate if other measures are needed
		• Establish mechanisms to reduce the up-front cost of electric vehicles imported into the country	• Finance clean energy production to facilitate e-Mobility transition	• Grant/low-interest incentives for investment in charging and swapping infrastructure to reduce the risk of low demand in the early years of the transition especially for 4-Wheelers
		• Establish an EV promotion fund. The understanding of different technologies across 2-wheelers, 3-wheelers, 4-wheelers, and e-boats, should influence the approach to financing needs as there are various business models for different technologies.	• Provide subsidies on the importation of EVs	
			• Lower the interest rates on loans for EV purchasing loans	
			• Adopt the use of green bonds as a fundraising mechanism for EVs	

Image of Lake Turkana Wind Power courtesy of Buno Woche | bunophotography.com

5.1 Summary of Opportunities

The transport sector contributes approximately a quarter of energy-related carbon dioxide emissions worldwide and is nearly entirely dependent on fossil fuels. According to the Transport Sector Climate Change Annual Report, 2019/2020,[86] the total domestic transport sector emissions amounted to 12.3 million tonnes of Carbon Dioxide Equivalent (MtCO2e) of Kenya' s entire greenhouse gases emissions. This is projected to rise to 17% by 2030.[87] On the other hand, emissions from the road sub-sector accounted for the majority of the 12.09 MtCO2e in the year 2019.[88] Cleaner and low emitting transportation have been identified as a significant climate change abatement option under Kenya' s Nationally Determined Contribution (NDC) which aims to reduce national emissions by 32% before 2030. e-Mobility is a prioritized mitigation intervention under the NDC and the National Climate Change Action Plan (NCCAP) 2018-2022. The transportation sector is also a leading source of ambient air pollution, especially in large cities. Over 5,000 premature deaths in Kenya were attributable to ambient air pollution in 2019[89]. Kenya imported over US$ 3 billion worth of petroleum products in 2019[90] spending about 40% of foreign exchange earnings[91] on the acquisition of fossil fuels in the international market. Approximately 72% of this was used in the road transport sector demonstrating the potentially transformational impact of a transition to e-Mobility. 92% of grid-based electricity is now generated from renewable energy sources and the current system generation capacity exceeds demand. These baselines factors create several opportunities including a reduction in ambient air pollution, GHG abatement potential, employment creation, advancing research, development, and innovation, electricity demand stimulation, reduction in foreign exchange spending, increased revenue (end-users and businesses), and carbon finance (Figure 12).

86. Government of Kenya (2020). Transport Sector Climate Change Annual Report 2019-2020: Performance and Implementation of Climate Change Actions. Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works. Nairobi, Kenya
87. Government of the Republic of Kenya (2018). National Climate Change Action Plan 2018-2022. Ministry of Environment and Forestry, Nairobi
88. Ibid
89. Health Effects Institute. (2020). State of global air 2020. Special Report. Health Effect Institute, Boston, MA.
90. KNBS. (2021). Economic Survey 2021. Kenya National Bureau of Statistics. Nairobi
91. Ministry of Energy (2020), Kenya National Energy Efficiency and Conservation Strategy

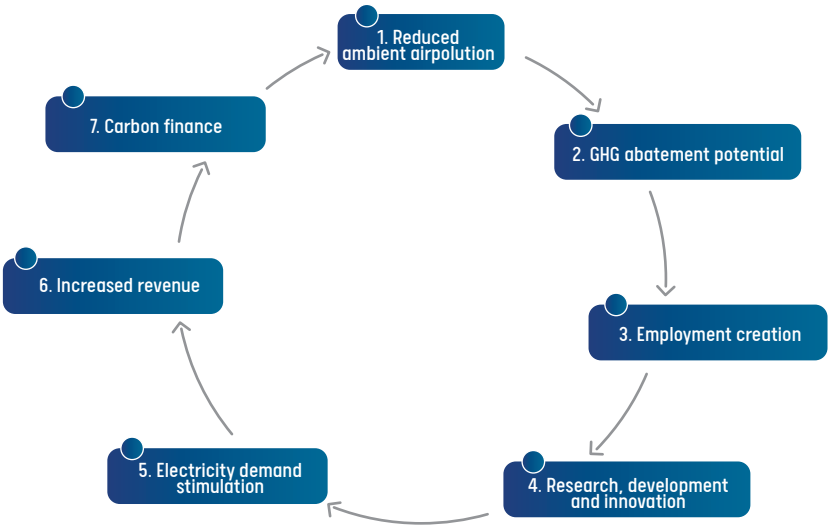


Figure 11: A summary of key opportunities for electric mobility in Kenya

Kenya commits to reduce GHGs emissions by 32% by 2030 relative to the BAU scenario of 143MtCO2eq. It is projected that of these emissions, the domestic transport emissions will increase to 17% by 2030. As such, under the business-as-usual scenario, the transport sector in Kenya will be emitting 24MtCO2eq. by 2030. Given that approximately 70% of the total fuel imports are used for ground transportation, then we assume that 16.8MtCO2eq are from road transportation. Therefore, converting 50% of the ground transport to electric, will potentially reduce about 8.5MtCO2eq per year to 2030. Assuming the price of carbon at US$ 5/tCOe, the amount of carbon revenue that would be generated from trading these emissions would be approximately 42MtCO2eq per year by 2030.

Reduction in ambient air pollution especially in large cities such as Nairobi, Mombasa, Nakuru and Kisumu will result in significant positive health outcomes with lesser incidences of respiratory infections. Under the business-as-usual scenario in the NDC, the transport sector in Kenya will be emitting about 24 MtCO2e of the total national emissions. Converting 50% of the ground transport fleet to electric will potentially reduce approximately 8.5 million tCO2e per year by 2030, given that about 70% of total fuel imports were used for ground transportation. Claiming carbon reduction emissions against this reduction could potentially generate carbon revenue from trading these emissions of up to 42 MtCO2e per year by 2030 (conservatively assuming the price of carbon at US$ 5/tCOe[92]). Thousands to tens of thousands of direct and indirect employment opportunities will be created from this transition. A reduction in oil demand from the transport sector will reduce the foreign exchange revenue expenditure by 30-40% translating to savings of about US$ 3 billion per year by 2030, assuming a 3% annual increase of global petroleum cost.

92. Hamerkop Climate change & Finance. (2021). The Carbon Finance Handbook. This analysis provides the average price of carbon as about US$ 5/tCO2e although is ranges from as little as US$2 to as high as US$ 12.

However, this reduction will also mean a significant reduction in government and business revenue of US$ 1.5 billion and US$ 360 million respectively per year by 2030 given that there are approximately 6 billion litres of fuel consumed every year and the government getting on average about KES 50/litre and oil marketers getting about KES 12/litre. This could however be recouped and surpassed from VAT and other taxes that will be imposed on the electricity consumed by the electric fleets. The transition will crowd in and integrate various technologies from renewable energy, battery storage, fin-tech (including mobile money), artificial intelligence, and the internet of things with the potential to create a new industry that could serve local, regional, and international markets. Innovative financing, revenue, and business models are expected to emerge from this transition increasing revenue for actors along the value chain. Power sector actors including electricity generators and distributors are projected to gain from the increased demand for green electricity. This could potentially be a transformational windfall for Kenya Power.

5.2 Summary of Barriers

The transition process is, however, not one without challenges, as it is characterized by a set of technical, financial, and socio-cultural difficulties which limit the uptake of e-Mobility initiatives. These include the high upfront purchase costs; range anxiety due to limited charging and battery swapping infrastructure; limited vehicle options; low consumer awareness; path dependency and vested interest in the fossil fuel industry; evolving standards and regulatory frameworks. Although there are many players, there is a general lack of coordination and cooperation. Experiences in coordination from another sector, including the solar PV sector, mini-bus sector, information technology, and others, will be useful for the e-Mobility sector. The high cost of electric vehicles is a major concern facing consumers. Other factors such as high battery replacement costs, erratic electricity costs, and lack of credit access are also considered as barriers to the uptake of electric vehicles. The cost of electric 2 and 4-wheelers will significantly be out of reach for most Kenyan riders and drivers. Subsidies and fiscal incentives should be offered to accelerate the uptake of e-Mobility in the country.

One of the main challenges to the uptake of electric vehicles in Kenya is the lack of awareness since people think that electric vehicles are more complex to run, expensive, and need additional or excessive power to operate. People also display a reluctance to invest in e-vehicles because of frequent power blackouts. While manufacturing companies focus on the development, research, and production of electric vehicles, the government in collaboration with private players, and development partners should develop knowledge products on electric mobility to build up public interest in the issue.

This ought to consist of creating a fact sheet describing the state of electric mobility advancements in Kenya, a brochure responding to common questions on electric mobility, and a quick fact sheet on the subject.

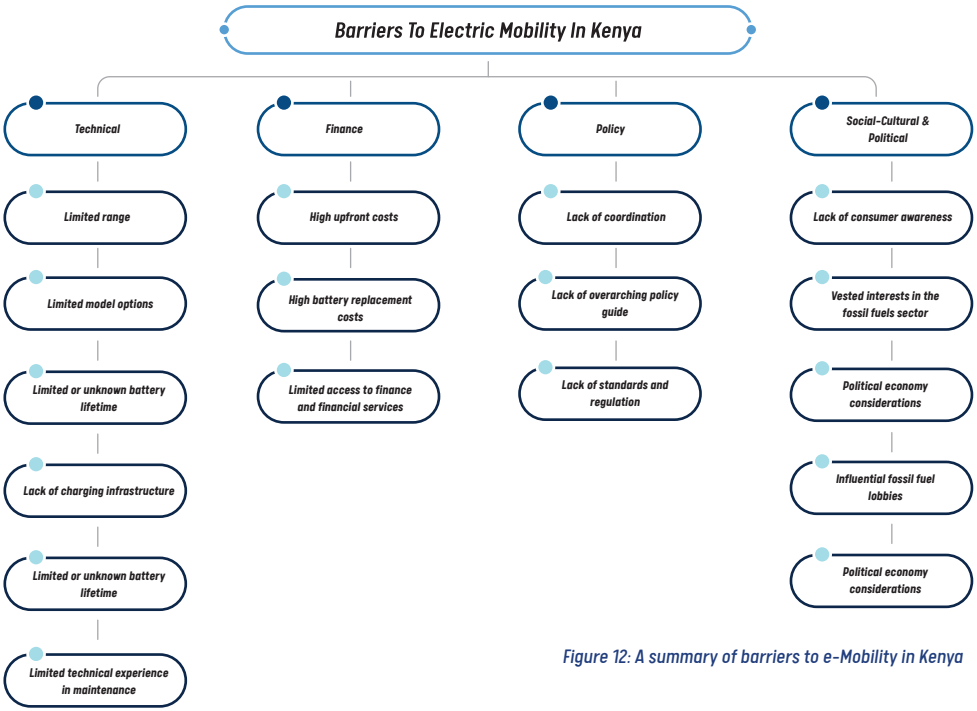


Figure 12: A summary of barriers to e-Mobility in Kenya

Batteries are envisioned to be key to the transition from dependence on fossil fuels. Electric vehicles' performance is directly connected to the battery packability that provides power to the engine. Four major kinds of batteries are currently in use for Plug-in Hybrid Electric Vehicles (PHEV) and electric vehicles. There will be an increase in the need for raw materials such as nickel, cobalt, graphite, and lithium used to manufacture EV batteries as the usage of the electric vehicle also increases.

Table 12: An illustration of the different kinds of batteries

Characteristics	Lithium-Ion	Nickel Metal	Lead Acid	Ultracapacitors
	Are the most common type of battery used in electric cars as well as portable cars. Used in both AEVs and PHEVs	Nickel-metal hydride batteries are more widely used in hybrid-electric vehicles but are also used successfully in some all-electric vehicles	Lead-acid batteries are only currently being used in electric vehicles to supplement other battery loads	They store polarized liquid between an electrode and an electrolyte. As the liquid's surface area increases, the capacity for energy storage also increases.
Easy Access/Inexpensive	✓	✗	✓	✗
Energy Efficient (less consumption)	✓	✓	✓	✓
Temperature Performance (high)	✓	✗	✗	✓
Weight (light)	✓	✓	✓	✓
Life-Cycle	✓	✗	✓	✗

The disposal of electric vehicles batteries presents a challenge. Sustainability, ethics, and e-waste are all critical features that will need systems set up which might take time as the production and transition to electric mobility advances. A policy to support the recycling of lithium-ion batteries as opposed to disposal would result in fewer environmental concerns. Additionally, facilities and procedures for the disposal of batteries should ensure that they are compliant with the relevant environmental standards and regulations. The increasing demand for batteries and shifting supplies have enhanced incentives for manufacturers of batteries to construct production plants in the region. Start-ups are piloting the assembling and production of battery electric vehicles (BEVs) locally. Kenya has incentivized manufacturers to obtain an assembler' s license or registration of bonded warehouses where upfront VAT payments have been eliminated, reducing importation duties.

There is insufficient public charging infrastructure for both 2 and 4-wheeled electric vehicles, especially in densely populated urban spaces where a higher population and higher demand for low-carbon public transport, are anticipated. The support from private investors, development finance institutions, and the government will assist in bridging the gaps in the infrastructure.

Since the e-Mobility sector is still nascent, Kenya has not developed any specifications on charging infrastructure in the country. Consequently, despite the opportunities that exist for the private sector to tap into the charging infrastructure market, there are limited incentives to attract private sector investment. As such, the government will need to develop standards and guidelines on the development of charging infrastructure. Fast charging technologies will be a key attribute for consideration while developing the infrastructure, to ensure that inconveniences and congestion brought about by the long wait time for the batteries to be fully charged in the stations are reduced. For example, there is a need to install a level 3 charger for the 4-wheelers, and for out-board engines and the 2-wheelers, the battery swap stations offer a more favourable approach.

Table 13: Different levels of chargers

Charger Level	Power Rating	Charging Time	Plugs
1	1KW	20 hrs	120v plug
2	5KW	4 hrs	240v plug
3	80KW	40 mins	Direct Current (DC)
4	120KW	25 mins	Direct Current (DC)

5.3 Business Models

Many enterprises fully or partly dedicated to promoting various forms of e-Mobility have emerged on the continent over the last few years. Their primary focus is on offering reasonable mobility solutions customized to meet the needs of the people. Micro-mobility, which mostly comprises 2 and 3-wheelers is the most popular method of transportation in relatively developing markets, owing to its relative affordability and small size[93]. Nevertheless, the transition to an electric micro-mobility is still emerging in numerous rural and urban areas of developing economies, despite a lack of infrastructure, affordability challenges, and unpredictable energy systems. Some of the business models which are currently being adopted in the market include direct sales, product service system, conversion-based approach, and lease to own, among others

93. UNEP, Electric two and three wheelers. (2021), https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/electric-two-and-three-wheelers

5.3.1 Direct sales

This is a conventional sales model in the industry where a product, in this case, an electric vehicle/motorcycle is sold directly to the consumers. However, owing to the high purchase costs associated with e-Mobility infrastructure, particularly the batteries, this model may prove challenging as it will pose problems in terms of making direct sales at full price to most users in Kenya.

5.3.2 Product Service System (PSS) - Mobility-as-a-service

This model allows clients to make payments for short or long-term accessibility to a product, normally through a lease agreement, while the investor/supplier maintains full ownership of the product. It is very specific to 2-wheelers and provides the option of battery renting or swapping. Battery swapping is aimed at stakeholders who might not be able to pay for batteries but are willing to pay some rental charges. Drivers and riders can exchange their discharged batteries for fully charged ones at some fee. It helps in managing long charging times, offsetting the high upfront costs of ownership of 2-wheelers and 4-wheelers, and allowing investors to maintain control of the use and disposal of their batteries. A detailed management structure is essential in observing the performance of the battery and monitoring its charge levels and locations. Hence, operators will not discharge batteries past their acceptable levels. It also reduces the need for fast charging which speeds up the degradation of the battery. Battery swapping stations are more inclined to be provided in collaboration with vehicle rental, causing a 40-50% reduction in vehicular costs, since the vehicles are offered without a battery.

There is a reduction in the idle time for a vehicle as numerous users share every vehicle, leading to product use intensification. Since the company keeps vehicular ownership, there is a timely repair, service, and stocking of spare parts, extending the lifespan of a product, which lessens the demand for material extraction for the production of new products. In Kenya, some of the start-ups offering product-service systems are Stima Mobility, Powerhive, eBee, and Asobo. Stima Mobility provides urban riders with a combination of battery swapping with a PAYGo system, taking responsibility for battery health and management. On the other hand, Powerhive is taking the lead in implementing locally assembled battery swapping units while also renting vehicles as part of their mini-grid services. Using their Vehicle-as-a Service concept, eBee offers electric bicycles on a subscription basis for the delivery market. Asobo, on the other hand, is renting out electric motors with batteries to the fisherfolk along with Lake Victoria. During the daytime, batteries are charged using solar energy for night-time fishing usage, thus reducing the operational costs of users.

5.3.3 A conversion-based approach

This model entails converting internal combustion engine (ICE) vehicles to electric ones. The durable ICE vehicles designed for off-road terrain and converting them into electric vehicles work best for this kind of model. In Kenya, Opibus, a Swedish company with operations in the country has adopted this approach by converting Land Rovers Defender 90/110s and Toyota Land Cruisers 70 series into electric vehicles, which are then used for safaris. On their website, they allow for the conversion of other models upon request.

5.3.4 Lease to own

This model is mostly being applied by electric motorcycle start-up companies where riders in urban areas can make weekly payments over two years to secure full ownership of the motorcycle. Battery recharging and maintenance fees are included in the use of the electric 2-wheelers[94].

5.4 Case Studies

5.4.1 Context

The documented case studies illustrate different options from Rwanda, Norway, and India on e-Mobility transition touching on policy issues, financing, and infrastructure among others, Consequently, the discussions illustrate options that Kenya can opt for to address the described barriers and leverage opportunities to accelerate the transition to e-Mobility.

5.4.2 Rwanda

According to Rwanda' s national inventory, carbon dioxide emissions from road transport represent 13% of the total emissions and are estimated to keep on rising[95]. While buses constitute merely 15% of the total motor vehicles in Rwanda, they account for nearly 40% of the entire emissions from the transport industry. With the rapid increase in the number of vehicles (approximately 12% annually), the Government of Rwanda was alarmed at the declining air quality in Kigali and increasing import bills (12% of total imports[96]). A study[97] recommended that the Government of Rwanda should seek to transition 8% of cars, 30% of motorcycles, 25%of mini and microbuses, and 20% of buses to electric power by 2030, which will lead to an expected decrease of 72,000 tCO2eq.

94. EEP Africa, Electric Boda Bodas. (2020), https://eepafrica.org/wpcontent/uploads/2020/09/IBM_Zembo_DigitalVersion.pdf
95. UNFCCC (2018). Republiuc of Rwanda Rwanda Environment Management Authority, Third National Communication National Communication under the UNFCCC, Report to the United Nations Framework Convention on Climate Change. September.
96. Byiringiro, A. (2020). "Electric mobility in Rwanda: policy and vision for electric mobility". [PowerPoint presentation] Presented at "Scaling up sustainable transport systems in Rwanda" joint MININFRA-IGC workshop in Kigali on 25th February 2020, Ministry of Infrastructure, Rwanda
97. Sweco. (2019). "Electric mobility in Rwanda: background and feasibility report" Unpublished report. Sweco, SMART Project. Commissioned for KFW -FONERW A.

The private sector companies and senior government officials conveyed their aspiration for a quicker conversion, particularly, in electric motorbikes, known as e-motos. The objective was to offer low-cost environmentally friendly means of transportation, largely for motorcycle taxi riders. The project is being conducted by private investors, Ampersand, an electric vehicle company to advance mass-market transitions from petrol vehicles to direct, cheaper, better electric replacements. It has successfully set up electric-powered motorbikes with battery swap stations. Additionally, Volkswagen, the German car-maker launched an assembly plant in Rwanda in 2018 and is rolling out a pilot project on eGolfs and charging stations, in partnership with Siemens in Kigali, launching 20 electric Golfs and two charging stations in Kigali.

In April 2021, the Government of Rwanda endorsed a strategy for electric mobility seeking to increase electric motorcycles and vehicles in the country. The main highlights of the strategy were incentives that will be applied to plug-in hybrid electric vehicles, electric vehicles, and hybrid electric vehicles. The intention is to mobilize investments in the new and upcoming industry which is fast emerging as a top sector on demand. Table 14 outlines the incentives approved.

Table 14: Incentives to promote electric vehicles in Rwanda

Fiscal Incentives	Non-Fiscal Incentives	Administrative Measures
Electricity tariff for charging stations be capped at the industrial tariff level (large industry category) - charge point operators would be billed at close to USD 10 /kWh instead of close to 20 cents/kWh	Rent-free land for charging stations (for land owned by Government)	Enforcement of existing emission standards to discourage the purchase of polluting vehicles
Reduced tariffs during off-peak periods for electric vehicles	Provisions of electric vehicle charging stations in the building code and City planning rules	Establish restricted zones for green transport

Exemption from import and excise duties for electric vehicles, spare parts, batteries, and charging station equipment. These would also be considered as zero-rated VAT products and would also be exempt from 5% withholding tax.	Green license plate to allow electric vehicles access preferential treatment in parking and free entry into any future congested zones	Regulate importation of used vehicles by imposing an age limit
Introduction of a carbon tax to discourage polluting vehicles	Free license and authorization for commercial electric vehicles	Provide a preference to electric vehicles for Government hired vehicles.
	Access to High Occupancy Vehicle Lanes (Dedicated Bus Lanes).	

5.4.3 India

While the uptake of electric vehicles in India has been growing, the total sales in the country remain at about 1.66% of total vehicle sales. There is low ownership especially for the 4-wheelers which only comprise 0.1% of the total car sales. Accelerating the transition to electric vehicles across all vehicle classes, India' s government not only requires to clear up challenges such as high purchasing costs but also guarantee that the local infrastructure and sustainable manufacturing operations take place.

Although India has not committed to eliminating internal combustion engine cars by any particular year, it has an elaborate target to have 30% of all new car sales be electric by 2030. This will possibly let India save on crude imports valued at $14billion per annum. Quick uptake of 2 and 3-wheelers (LEVs- Light Electric Vehicles) is estimated to take lead in the transition process. Consistent with the central government' s statistics, India has 846,132 electric vehicles as of November 2021, with 2 and 3-wheelers accounting for the largest share of e-vehicles. The enormous contribution is by the 3-wheelers which account for 591,859 units of the entire electric vehicles in the country.

98. Retrieved from
https://www.mininfra.gov.rw/fileadmin/user_upload/Mininfra/Publications/Laws_Orders_and_Instructions/Transport/16062021_Strategic_Paper_for_e-mobility_adaptation_in_Rwanda-Final.pdf

The Government of India has been promoting the industry with subsidies under the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME-II) scheme. It has apportioned $96.8 million to the scheme and initiated many supply and demand incentives to accelerate the conversion to electric mobility. Under the FAME-II recommendations, the fiscal incentives were passed on from the Original Equipment Manufacturer (OEM) to the consumers while acquiring an electric vehicle; it was previously Rs. 10,000 per kWh, then it increased to Rs. 15,000 per Kwh to make investments to boost the industry from the union government. Numerous additional states have also developed their policies of incentive ranging from Rs. 5,000 to Rs. 10,000. The FAME II incentive has been beneficial in the growth of -wheeled electric vehicles as it lowers the high sticker price that operates on Li-ion batteries. Some States have also prepared their own elaborate electric vehicle targets, while others (18 out of 28 States) have either a draft policy prepared or have already reported one (Table 15).

The standard price of an electric vehicle has continued to be higher than the regular combustible engine selection, but new incentives towards manufacturing and heightened convenience of critical components through suppliers, are assisting electric vehicles manufacturers to generate reasonable electric solutions. Under the “Make in India” initiative, India has effectively expanded the manufacturing of batteries.

The Government of India is making efforts to drive local manufacturing by incentivizing domestic production and dis-incentivizing electric vehicles importation. According to the new regulations, the restriction on incentives would be limited to 40% of the total price in comparison to the previous cap of 20%.

Table 15: Indian states with policies on electric vehicles [99]

Policy focus	Electric Vehicle Policy Highlights	Andhra-Pradesh	Bihar	Delhi	Kar-na-taka	Kerala	Maha-rashtra	Uttara-khand	Uttar Pradesh	Tamil Nadu	Telan-gana
Demand	Conditional demand in-centives based on segments, vehicles, and time periods		✓	✓		✓	✓	✓	✓	✓	
Supply	Lower tariff on production, subsidies, and tax benefits	✓			✓	✓	✓	✓	✓	✓	
R&D	Grants and venture funds to research organizations, incubators, and start-ups	✓	✓		✓	✓	✓	✓	✓	✓	✓
Charging Ecosystem	Supporting public infra-structure by providing land, subsidy, and other support	✓	✓	✓	✓	✓		✓	✓	✓	✓
Technology	Financial support for the growth of newer technol-ogies in vehicle and charging space	✓			✓				✓		

99. Retrieved from https://www.keerney.in/article/?/a/electric-mobility-2-0-trocking-the-next-wave-in-india

The Energy Efficiency Service Ltd (EESL) which is responsible for the implementation of the Domestic Efficient Lighting Programme, was also mandated to acquire 3 lakh electric 3-wheelers for varied uses. The decisions would hugely support manufacturers in reducing their costs of electric models and would make them be at par with diesel/petro vehicles, and cheaper than them in some instances.

The Indian government is also working to offer the needed number of charging infrastructure and has authorized establishing 2,636 electric vehicle charging stations across 62 cities in 24 states and union territories of India, under the second phase of the FAME India scheme. A directive to developers to reserve 20% of the parking space of electric vehicles in all office and residential projects was also issued. This would highly provide solutions to the charging infrastructure challenge to electric vehicle owners.

5.4.4 Norway

Globally, Norway is one of the leading nations in the adoption of electric mobility. Even though it is a fairly small country, Norway is the third most valued market for electric vehicles, especially, battery electric vehicles (BEVs).[100]The success story of electric mobility in Norway is due to a significant incentives bundle established to support zero-emission vehicles into the market. The progressive introduction of the incentives (Table 16) has been by a broad coalition of parties and different governments since the early 90s to accelerate the conversion.[101] These developments are supported by many corporations providing innovative solutions for grid balancing and fast charging, urban planning, smart city development, and last-mile distribution. Only 5% of the cars marketed in Norway were electric in the past five years[102]. In 2016, the Norwegian Parliament approved a bill requiring all new city buses, private cars, and light vans to be zero-emission vehicles by 2025. Fully electric cars (BEVs) represented approximately 60% of all new car purchases in March 2019. In 2020, more than 50% of new car sales were fully electric. The country has demonstrated to the whole world that fully electric cars can replace diesel and petrol cars and make significant contributions to reducing carbon dioxide emissions. For example, in 2017, total greenhouse gas (GHG) emissions in Norway were 52.7 million tonnes of carbon dioxide equivalents, which was a decrease of 0.9 million tonnes compared to 2016[103].

100. Retrieved from https://www.statista.com/statistics/665922/global-sales-of-battery-electric-vehicles-by-country/
101. Retrieved from https://elbil.no/english/norwegian-ev-policy/
102. Retrieved from https://elbil.no/om-elbil/elbilstatistikk/
103. orwegian Environmental Agency. (2020). Norway's Fourth Biennial Report. January, 92. https://unfccc.int/sites/default/files/resource/Norway_BR4 %282%29.pdf

Renewables play a significant part in Norway' s energy system, even though it has high fossil fuel reserves. In 2016, since 98% of its electricity was generated from hydropower there was a significant greenhouse gases emission reduction related to the electrification of transport[104]. The country has an enabling environment for home charging since the majority of Norwegians park their cars at home/on their properties. Furthermore, a good number of families also have adequate grid capacity to charge electric vehicles, as this capacity is required for electric space heating for 74% of homes.[105]

Table 16: Electric Vehicle incentives in Norway[106,107]

Incentive	Trial period	Permanent year
Temporary Exemption from on-off registration tax (No import/purchase tax)	1990 - 1995	1996
No annual road tax		1996 to 2001 reduced Tax from 2021
Exemption from annual vehicle tax	-	1996
Exemption from road tolls or ferries	-	1997 to 2017
Exemption from parking fees on municipal-owned parking facilities	-	1999 to 2017
50% Reduced company car tax	-	2000 to 2018
Exemption from 25% VAT		2001
Temporary use of transit lanes	2003–2005	2005
Permanent use of transit lanes	-	2005
Further reduction in company car tax	-	2009
Exemption from paying car ferry fees	-	2009
Exemption from 25% VAT on the leasing	-	2015
New rules allow local authorities to limit the access to only include EVs that carry one or more passengers		2016
Maximum 50% of the total amount on ferry fares for electric vehicles		2018
Parking fee for EVs was introduced locally with an upper limit of a maximum of 50% of the full price		2018
Company car tax reduction reduced to 40%		2018
Fiscal compensation for the scrapping of fossil vans when converting to a zero-emission van		2018
Maximum 50% of the total amount on toll roads		2019

104. National Transport Plan. (2016). English Summary - National Transport Plan 2018-2029. Retrieved from https://www.ntp.dep.no/English/_attachment/1525049/binary/1132766?_ts=1571e02a3c0
105. Figenbaum, E. (2017). Environmental Innovation and Societal Transitions. Retrieved from Perspectives on Norway's supercharged electric vehicle policy: https://www.sciencedirect.com/science/article/pii/S2210422416301162
106. Retrieved from https://elbil.no/english/norwegian-ev-policy/
107. Retrieved from Aasness, M.A., Odeck, J. (2015). The increase of electric vehicle usage in Norway–incentives and adverse effects. Eur. Transp. Res. Rev. 7, 34 https://doi.org/10.1007/s12544-015-0182-4

Norway' s regulatory framework for electric vehicles exceeds going after customers at the point of the buying decision. It comprises political incentives for research activities, rolling out charging infrastructure, information, and marketing. It has a widespread network of public charging infrastructure whose substantial sections of installation are sponsored by Enova (previously identified as Transnova), an agency supported through the sale of petroleum and natural gas. The national-level municipalities have also considerably invested in charging infrastructure. Currently, there are roughly 16,000 charging points in Norway, an increase from approximately 3,000 since 2011.

Image of a technician repairing an eBee courtesy of eBee Africa

6.1 Conclusions

Lack of coordination and cooperation: Although the sector is now gaining prominence with mentions in government policy, development agencies' strategies, sub-national planning, and research undertaking, there is an acute lack of coordination. This however is not unusual as the e-Mobility sector is yet to be properly defined and the initiatives are still in their nascent stages. Most of the initiatives take on a piecemeal approach that addresses specific issues in isolation. There is a need for sectoral coordination towards identifying the priority areas and common positions on policy, regulations, and standards, financing, technical issues, and consumer awareness. Like renewable energy, journalism, banking, manufacturing, and other sectors, there are opportunities to identify and develop voluntary standards that can act as test-beds for mandated standards.

Limited knowledge of the potential and impacts of the e-Mobility transition: Knowledge on the current technical infrastructure especially the capability of Kenya Power, benefits of electric vehicles including GHG abatement and ambient air pollution reduction, potential financial incentives from carbon markets, and possible savings on fuel costs are crucial considerations that are not well understood. Although there are high level, mostly qualitative assertions, there are limited systematic assessments that provide quantitative analysis such as cost-benefit analysis that can inform policy and regulatory action. Such indicators also guide the priority areas, high return opportunities, and those that require the most urgent attention. Discussion on policy and regulatory recommendations are general. While stakeholders agree that there is a need for more charging points and battery swapping, there is no understanding of how many, what type, or the appropriate locations for such. Few assessments exist and these are done at a project level. More wide-scale grid-related assessments need to be carried out to understand the effect of adding electric vehicle charging points to the current infrastructure.

Outsized emphasis on policy and regulations as a tool to advance e-Mobility: While it is necessary to create a policy environment and regulatory framework for the uptake of e-Mobility in Kenya, there is a need to allow for organic growth and innovation of the sector. There are concerns that the sector, which is still at its nascent stages, can be overregulated limiting its growth and innovation process. Lessons can be drawn from the successful fin-tech sector including the mobile money revolution and the solar PV off-grid market which were first guided by light-touch safety and security regulations that were further expanded based on the needs in the market. Over prescriptive regulations could stifle innovation, competition, and growth.

Programmatic approaches can yield substantial financial flows for government and sectoral players including Kenya Power and other electricity retailers: With a grid that has an ultra-low emission factor, revenue from carbon markets should be prioritized. To achieve scale and crowd-in large investors, programmatic approaches that take on both sector level intervention need to be developed. The transition to electric mobility presents an opportunity to develop national and sub-national programs that can tap into the carbon markets and climate finance streams. With a transition from fossil fuel to electric sources, Kenya Power is best placed to develop a new and substantial revenue stream. However, a rapid and haphazard increase in e-Mobility fleets could potentially lead to increase grid instability. Other beneficiaries include decentralized electricity retailers such as stand-alone charging points and mini-grids. The Government will lose from fuel levies but there is potential to achieve a net positive outcome through VAT charge on electricity sales and reduction in foreign currency spending on the purchase of petroleum products.

Availability of a wide range of vehicle model types and battery storage capacity are key technical barriers: While an extensive variety of vehicle models can attract a wider share of consumers, the limitation of available electric vehicle models poses a barrier as it restricts users on their choices. In Kenya, various models have been sighted in the country and are mostly being used for private and commercial services. For example, NopeaRide, Africa' s first all-electric taxi-hailing service uses the Nissan Leaf model and in September 2021, Caetano Kenya which is the official Hyundai car dealer in the country announced the arrival of the Hyundai KONA Electric to be commercialized in Kenya. The storage capacities of electric vehicle batteries influence the distance that can be taken on a single charge. As such, they must be fully charged for the vehicle to run and travel long distances. Conversely, many consumers are experiencing range anxiety where they fear that their electric car would run out of charge before reaching their destination, which would leave them in a precarious situation. This discourages many consumers from investing in electric vehicles. Furthermore, batteries are sensitive to overcharging, thus limiting battery life, necessitating regular replacements which discourage potential electric vehicle consumers.

Electric mobility is gradually being recognized by governments as a significant low-carbon strategy decreasing urban air pollution and mitigating carbon emissions. Currently, policies at national and local levels continue to be at development stages, fragmented, and lacking coordination. An enabling policy environment offers the involvement of different stakeholders drawn from associations, manufacturers, public transport companies, innovators, corporations, and individual users. While there is a progressive logic of steps to

align policies and legal frameworks to e-Mobility transition; transport policies (The Integrated National Transport Policy (2009), climate policies (Nationally Determined Contributions, National Climate Change Action Plan 2018–2022), The National Energy Efficiency and Conservation Strategy 2020, and Finance Act, 2019, the country still lacks a national mitigation target through e-Mobility and a comprehensive feasibility target.

6.2 Recommendations

Operationalize the inclusive e-Mobility working group: Operationalization of the formed working group which will serve as an inclusive sector-wide forum to identify, discuss, and resolve barriers and opportunities in the e-Mobility sector is critical. Government policy should be guided by the needs of the sector players. To develop common positions on such matters as has been demonstrated in other sectors, sentiments need to be developed and discussed through such forums. Successes have been realized through similar fora such as the Kenya Charcoal Working Group which led to the enactment of the first charcoal regulations of 2009, Kenya Forest Working Group which influenced the formulation of the Forest Act of 2005 and its revision later in 2016, and the Kenya Climate Change Working Group which drafted the lobbied the enactment of the Climate Change Act of 2016. Renewable energy sector actors have also leveraged the Kenya Renewable Energy Association to lobby the Government on policy and tax incentive schemes for solar PV application and accessories as well as cooking sector solutions. Increased coordination also has the potential to identify and develop large projects that can attract substantial private and public sector investments as opposed to firm-level interventions, which are important, but may not have the needed economies of scale. For example, the development of charging infrastructure by one sector player may attract some investments, but a programmatic approach that combines efforts will not only share resources and avoid duplication but also attract larger investments. These discussions can be held through such fora.

Comprehensive economic, social and environmental, impact assessment of the e-Mobility transition: The advent of e-Mobility is commonly received with a positive expectation due to the immense potential to transform people, businesses, societies, and governments. However, there is a need for a systematic evaluation of the economic, social, and environmental impacts. Such a study will not only identify, characterize and quantify the benefits, but also the potential negative outcomes. With this understanding, interventions to limit and mitigate against such outcomes will form part of the strategy.

Minimize the risk of stifling innovation through regulations: Development of standards, policy, and regulatory should ensure that it does not stifle innovation, competition, and growth. Large or first-movers will often lobby for policy and regulation that favour their technologies or business models. This could create a market with a few winners and limit the much-needed competition in a nascent market. This study recommends the development of policy and regulations through three broad dispensations as shown in figure 13 below. The first, recognizing that the market is young and rapidly evolving should focus on basic regulations that ensure safety and security. The second dispensation should be characterized by voluntary standards and regulations developed and enforced by the sector actors. This provides a test-bed of ideas driven by the actors who are on the frontlines of developing the e-Mobility sector. Finally, the third and final dispensation which should be aligned with a more mature sector should focus on targeted incentives that can increase revenue to the government, create employment opportunities, position the country are a regional hub for innovation, manufacturing and financing, and ensure high-quality products and services.

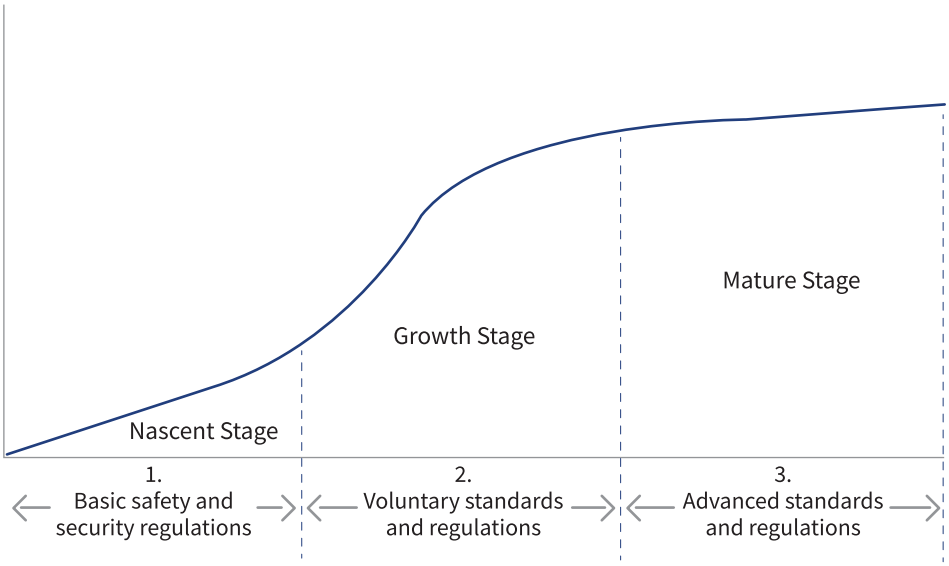


Figure 13: Stages of development and types of regulations, policy and standards

Develop a comprehensive national e-Mobility strategy: In recent years, Kenya has emerged as one of the fastest-growing economies in Sub-Saharan Africa, and is home to the most progressive startups on the continent, offering an attractive space for investors, entrepreneurs, and technologists. With its game-changing innovative mobile payments service, Mpesa, Kenya is being positioned at the forefront of the developing fintech industry. That, combined with Kenya' s low grid emission factor, Kenya offers an attractive regional hub for innovation and investment in the e-Mobility sector. A process to develop a strategy that will accelerate the rate of e-Mobility adoption in Kenya should be initiated. This will guide private and public establishments on the uptake of e-Mobility in the country. The development of such a comprehensive e-Mobility sector strategy by the sector players will guide the transition. The e-Mobility sector strategy should be focused on market transformation programs that aim to address barriers to entry and growth through essential and lasting changes to the sector. Elements of this strategy should include targeted and strategic policy or regulatory interventions, incentives to increase the number of equipment and service providers, support emerging and unproven business models, reduction and elimination of market barriers, technical and business capacity development, and increased awareness.

ANNEX 1: List of Key Informants Interviewed

#	Name	Organization	Position
1	Leila Surratt	P4G Partnerships	Director – Strategy, and Engagement
2	Alex Makalliwa	Solar e-Cycles	General Manager
3	Herman Kwoba	GIZ	Project Officer
4	Martin Eshiwani	Ministry of Transport and NMS	Head, Road Transport Services unit
5	Jane Akumu	UNEP	Africa focal
6	Emilie Martins	UEMI/UN Habitat	Africa focal
7	Sachin Gupta	Palladium Group	Team Leader
8	Chania Frost	Mckinsey	Consultant
9	Andy Amadi	KEREA	CEO
10	Andrew Gartside	FCDO - British High Commission Kenya	Manufacturing Africa Adviser
11	Silas Sanga	EPRA	Senior Surveillance & Enforcement Officer In-charge- e-Mobility
12	Warren Ondanje	AEMDA	V. President – Business Development
13	Natalie Wong	Shell Foundation	Program Officer
14	Japheth Kipkirui and Francis Romano	Knights Energy and Drive Electric	In-Charge e-Mobility
15	Stephen Omondi	WeTu	Program Officer
16	Willis Ochieng	Ken Gen	Energy Planner
17	Joel Akomo, and	National Transport and Safety Authority (NTSA)	Engineer – Vehicle Inspection Headquarters
	Moses Nderitu		Board Member
18	Crystal Mugimba	Open Capital	Project Leader
19	Philip Osano	SEI Africa	Centre Director
20	Jit Bhattacharya	BasiGo	CEO/Co-Founder
21	June Lukuyu	University of Massachusetts Amherst	Research Associate
22	Willis Ochieng	KenGen	Chief Energy Planner
23	Adrian Onsare	Kenya Power	Assistant Engineer and Advisor to the Managing Director
24	Nicodemus Mbwika	Council of Governors	Head of Transport Division
25	Tiago Neves	Rockefeller Foundation	Advisory, e-Mobility

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