Imperial College London

ChargeUp! Kenya Charging Forward

A brief assessment of Kenya's e-mobility policy landscape and proposed changes

Authors
Cameron Sheehan
Professor Tim Green

energy futures lab
An institute of Imperial College London

About ChargeUp!

The ChargeUp! Project is funded by P4G (Partnering for Green Growth and the Global Goals 2030) to test the commercial viability of a Battery as a Service (BaaS) model by establishing a network of charging stations in Nairobi, Kenya, which will charge a flat battery swap fee for electric two- and three-wheelers. The project partners include Energy 4 Impact (E4I) as the project coordinator, Strathmore University, and Imperial College London as the academic partners, while ARC Ride Global (ARC Ride) and Fika Mobility are the commercial partners.

In this partnership, electric bike drivers can conveniently swap out their batteries quickly and affordably, reducing operational costs and concerns about the battery not lasting long enough to complete their activities. This model will enable an inclusive ecosystem that creates long-term green jobs for charging station mechanics and electric vehicle (EV) drivers. Expanded battery swapping infrastructure can help businesses and start-ups join the E-mobility transition. During the partnership funding period, ChargeUp! plans to establish a network of 45 operational battery charging and swapping stations in Nairobi and complete a baseline assessment for the commercial viability of a BaaS model. Ultimately, the partnership aims to develop an openly accessible and replicable master plan for e-bike adoption by cities across Africa. For more information visit: www.imperial.ac.uk/energy-futures-lab/research-projects/chargeup/

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Contents

Executive summary

The transport sector's share of Kenya's total greenhouse gas (GHG) emissions has been projected to grow from 11% in 2015 to 14.7% by 2030 in a business as usual (BAU) scenario [1]. In line with the Kenyan Government's goal of reducing total GHG emissions by 32% relative to BAU in 2030 [2], it has begun several initiatives to start mitigating its transport emissions, including opportunities related to growing its nascent e-mobility sector. The private sector, with a range of around 25 new e-mobility companies [3], has been providing solutions through the supply of various electric vehicles aimed at serving the local market, while also leading the way in deploying charging and battery swapping infrastructure.

Firstly, this report aimed to provide a brief overview of this sector landscape in Kenya, which includes various policies, laws, regulations, plans, strategies, and major projects related to e-mobility. The assessment covered several themes, including targets, fiscal and financial incentives, e-mobility and renewable energy tariff structures, infrastructure planning and roll-out, data availability and sharing, and battery reuse, recycling, and disposal. While e-mobility players in the private sector have led the way in terms of commercial implementation of projects, the government has started to catch up recently in terms of providing specific policies and support. A range of different government initiatives that were either directly or indirectly related to e-mobility were noted for each of the theme areas. Some notable support provided so far included a target to have 5% of annual vehicle imports being electric or hybrid by 2025 [4], halving of the excise duty rate from 20% to 10% for fully electric vehicles [5], a proposed new retail electricity tariff of 17 KShs/kWh for e-mobility [6], and a new draft of the building code that mandates for developers of commercial buildings to allocate at least 5% of their parking spaces to electric vehicles [7].

Secondly, the report aimed to provide a snapshot of some of the changes and recommendations that have been proposed by various sources to help support and regulate the shift to e-mobility in Kenya. The assessment showed that there are several areas where new or revised policies could better enable the e-mobility sector to maximise various benefits for Kenya. Some key examples of recommendations include, inter alia, new targets to ban the sales of ICE vehicles within a certain timeframe [8], full exemptions on Import Duties, Excise Duties, and Value Added Tax (VAT) for imported electric vehicles and their associated infrastructure [7]–[15], dynamic Time of Use (ToU) pricing for e-mobility electricity tariffs [16], the development of national guidelines and plans for charging and battery swapping infrastructure [7], [11], policy to encourage and incentivise the sharing of selected anonymised data with government, researchers, or the public, where appropriate [10], [17], and planning and support for the re-use of e-mobility batteries in second life applications [10], [11], [13].

This report was produced as part of the ChargeUp! Project, funded by P4G (Partnering for Green Growth and the Global Goals 2030) to test the commercial viability of a Battery as a Service (BaaS) model by establishing a network of charging stations in Nairobi, Kenya.

Introduction

Background

In 2015, the transport sector was responsible for 11% of Kenya's total greenhouse gas (GHG) emissions, and this has been projected to grow to 14.7% by 2030 in a business as usual (BAU) scenario, according to Kenya's most recent National Climate Change Action Plan [1]. If the country is to reach its goal of reducing its total GHG emissions by 32% relative to BAU in 2030 [2], the transport sector is going to have to undergo some major changes.

The Kenyan Government is aware of this challenge to decarbonise its transport sector and has already begun several initiatives to start mitigating transport emissions, such as setting a target for electric and hybrid vehicles to reach 5% of total annual vehicle imports in 2025 [4]. Kenya's newly elected president, William Ruto, described e-mobility as one of the available opportunities in Africa for reaching net zero by 2050 in his speech at the 27th Conference of the Parties (COP 27) [18]. However, despite the government's best efforts, the development of policy for the sector currently lags the deployment of the vehicles and infrastructure. The private sector, with a range of around 25 new e-mobility companies [3], has been providing solutions through the deployment of electric motorcycles, passenger vehicles and buses aimed at serving the local market. Additionally, the private sector has also led the way in the roll-out of charging and battery swapping infrastructure to serve their customers.

The growth of e-mobility could provide a number of opportunities for positive impacts in Kenya. Not only is there potential for GHG emissions reductions, but also reductions in air pollution which would lead to improved air quality. With lower operational costs, there are also opportunities to provide economic benefits to users of e-mobility, particularly in commercial settings such as the motorcycle taxi/delivery (boda-boda) industry [10]. The installation, repair, and maintenance of charging and battery swapping infrastructure would also provide new employment opportunities [7].

While the nascent e-mobility sector has been rapidly evolving in Kenya, so too has the related literature and research on the topic. Numerous new reports on various aspects of e-mobility in Kenya have been released in recent years, each with their own assessments and recommendations. The government is also in the process of developing new policy specific to e-mobility, as described in the terms of reference published by the Kenyan State Department of Transport in 2021 [16].

Aims and scope of this report

With the rise in e-mobility companies in Kenya aiming to switch people over from polluting modes of transport to cleaner electric versions, it is important to understand the existing policy landscape and how this may improve or change in future. Firstly, this report aims to provide a brief overview of this sector landscape in Kenya, which includes various policies, laws, regulations, plans, strategies, and major projects related to e-mobility. Secondly, the report aims to provide a snapshot of some of the changes and recommendations that have been proposed by various sources to help support and regulate the shift to e-mobility in Kenya.

The scope of the report has been limited to and broken down into the following set of key theme areas:

- Targets
- Fiscal and financial incentives
- E-mobility and renewable energy electricity tariff structures
- Infrastructure planning and roll-out
- Data availability and sharing
- Battery reuse, recycling, and disposal

While the ChargeUp! project focuses on electric motorcycles and battery swapping infrastructure, the scope of this report includes content related to e-mobility more generally, including other electric vehicles and charging infrastructure in Kenya.

Methodology

For this brief assessment, a broad review of literature from various sources was conducted, including: academic papers; Kenyan Government documents such as policies, acts, strategies, tenders and reports; and other grey literature such as reports, news articles and policy documents. Relevant information was then collated, synthesised, and discussed according to the various theme areas. This included a brief overview of the e-mobility sector policy landscape in Kenya and the changes and recommendations that have been proposed by various sources to help support the country's shift to e-mobility. Only literature that was focused on or generally related to the Kenyan context were included.

Assessment of e-mobility theme areas for Kenya

Targets

Various targets related to e-mobility have been stated within Kenya in recent years and understanding these can help to bring the wider policies and plans discussed in this report into context. These include electricity access targets, electric vehicle targets and emission reduction targets, which are discussed below, and followed by a set of recommendations.

Electric vehicles targets

In 2020, a target was set for electric and hybrid vehicles to reach 5% of total annual vehicle imports in 2025, up from 0% in 2019, as set out in the *Kenya National Energy Efficiency and Conservation Strategy* [4]. According to a UN Environment Programme (UNEP) tax policy analysis [19], this equates to a target of approximately 7,600 electric motor vehicles and 20,600 electric motorcycles sold in 2025.

The *'Kenya – Small Vehicles E-Mobility' NAMA Support Project (NSP)* [20] aims to deploy subsidies to finance approximately 60,000 e-2Ws and 5,000 e-3Ws, with a focus on rural and peri-urban markets. However, since the project is still in the detailed planning phase, no specific timeline is available for when this target is hoped to be reached.

Emission reductions targets

In 2016, Kenya set its first Nationally Determined Contributions (NDC) target of 30% emission reduction by 2030 relative to its business as usual (BAU) scenario. In 2020, the NDC was updated to abate GHG emissions by a further 2%, for a revised target of 32% reductions by 2030 [2].

The *National Climate Change Action Plan 2018-2022* [1] includes details of the climate change mitigation actions related to transport. These include 1.82 MtCO2e of GHG emission reductions by 2022 through electrification of the standard gauge railway, construction of the Bus Rapid Transit system in the Nairobi metropolitan area, and low carbon technologies in the aviation and maritime sectors. The report states that shifts to electric 2- and 3-wheelers and electric hybrid vehicles in Kenya are not expected to provide significant emissions reductions relative to the NDC target for the 2018-2022 period, and so their mitigation potentials have not been fully analysed or included in the target. With more data now available and considering the growth of Kenya's e-mobility sector in recent years, analysing the GHG mitigation potential of the shift to e-mobility for the next planning period could be more accurate to quantify and more substantial than the last planning period.

A request for the assessment of mobility impacts on GHG emissions was included in the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16]. If the mitigation potential is found to be significant, it is possible that the deployment of electric 2- and 3-wheelers could form part of the core proposed mitigation actions in the transport sector in future plans. For the *'Kenya – Small Vehicles E-Mobility' NAMA Support Project (NSP)* specifically, over 1 million tCO_2e are expected to be mitigated in the ten-year period following the project's implementation [20].

Electricity access targets

With access to electricity being important for charging the batteries of electric vehicles, it is helpful to understand Kenya's goals related to this. At the beginning of 2018, the *National Energy Policy* [21] set out a plan to achieve universal access to electricity by 2020 through implementation of a new National Electrification Strategy. Later in the year, the *Kenya National Electrification Strategy* was released with an updated goal of achieving universal access to

electricity by 2022 [22], up from an estimated 75% access in 2018 [23]. Recent figures reported by the Energy and Petroleum Regulatory Authority (EPRA) estimate electricity access to be 76.5% in May 2021, which make it the leader in the East African region [24]. However, based on these values it seems unlikely that the 100% target was reached by the end of 2022. The majority of those without access are in rural areas that are out of reach from the grid and without mini-grids, which makes the use of EVs in those areas less feasible without the provision of dedicated off-grid charging infrastructure.

Recommended new targets

The following targets have been proposed by several sources:

- **Sales of internal combustion engine (ICE) passenger vehicles should be banned within an appropriate timeframe** [8]. While providing urgency for the transition, the timeframe could also provide various e-mobility stakeholders with certainty around their planning and investments going forward. Careful consideration of the affordability of alternative vehicle options will be required when deciding on the timeframe to ensure that the transition will be economically feasible and provide sustainable impact.
- **Specific targets should be set for all publicly procured vehicle fleets to transition to electric or zero-emission versions** [7], [8], [25]. Kenya's main electricity generating company, KenGen, has started this process with the purchase of four new electric vehicles which it plans to pilot before converting more of its fleet [26]. More government ministries, departments and agencies should commit to similar strategies to encourage and lead the national adoption of e-mobility in Kenya [7].

Fiscal and financial incentives

The affordability of switching to electric vehicles and the commercial viability of e-mobility related business models are strongly influenced by the various taxes, duties, and subsidies provided by the government. The Kenyan Government's approach to these fiscal and financial factors is discussed in the next section through the various policies, acts and strategies that have been released, followed by a set of recommendations.

Existing landscape

In 2009, the *Integrated National Transport Policy* [27] included the aim of promoting more energy efficient and less polluting modes of transport and the use of high quality and environmentally friendly fuels. The policy mentions that appropriations, grants, or subsidies could be used as incentives or be used to achieve an equitable distribution of resources in relation to transport [27]. In 2018, the *National Energy Policy* also mentioned the provision of incentives for the "acquisition and use of fuel-efficient technologies in motor-vehicles" [21, p. iv.], but did not mention electric vehicles specifically.

The first major fiscal push for e-mobility support came in 2019 as part of the *Finance Act, 2019*, where the excise duty rate was halved from 20% to 10% for fully electric powered motor vehicles [5]. In the same year, the *Energy Act* [28] called for the establishment of the *Consolidated Energy Fund* to cater for various energy related initiatives, including promotion of renewable energy, construction of appropriate infrastructure, and applied research, technology development and innovation allied to the energy sector. Considering the strong link between energy, its infrastructure, and e-mobility, the fund could potentially be used to financially support e-mobility if it falls under the fund's remit.

With the aim of increasing the adoption of e-mobility, the *Kenya National Energy Efficiency and Conservation Strategy (2020)* [4] stated that incentives should be provided, including lower import duties and vehicle road taxes for electric cars, bicycles and tuk-tuks. *The Finance Act, 2022* [29], removed VAT and Excise Duty for locally manufactured passenger motor vehicles that contain a minimum of thirty percent local content. The Act did not specify the fuel type of vehicles

included, so locally manufactured electric passenger vehicles are assumed to benefit from these exemptions too [15]. There are also specific tax procedures for unassembled motor vehicles [30] and motorcycles [31] that are aimed at promoting local assembly. However, these regulations don't cater specifically to electric vehicles, where battery exemptions currently don't include lithium-ion batteries.

Recently, Kenya's newly elected President included several commitments to support e-mobility in his party's manifesto, *The Kenya Kwanza Plan - The Bottom-Up Economic Transformation Agenda 2022-2027* [32]. These included making use of the Hustler Fund, which will provide financial support to the boda-boda sector, to help develop the emerging electric motorcycle and vehicle assembly industry [32]. Additionally, commitments were made to support the shift to electric versions for public service and commercial vehicles through financial and tax incentives [32].

Recommendations

The following fiscal and financial incentives have been proposed by various sources:

Fiscal incentives

- **Exemptions on Import Duties, Excise Duties, and Value Added Tax (VAT)** for imported electric vehicles, their batteries, and charging and battery swapping infrastructure were recommended in many of the reviewed documents [7]–[15].
  - Timeframes suggested for these exemptions range from five years for import related taxes, and up to 10 years for zero rating VAT on charging or battery swapping services [12]. Alternatively, these could be implemented until electric vehicles reach price parity with internal combustion engine (ICE) vehicles [14].
  - As detailed in Kenya's State Department of Transport's study on importation and taxation of electric vehicles [14], these tax reliefs aim to incentivise importation of electric vehicle components and could drive growth of local value chains in the sector. According to the same study, any loss in revenue due to reduction in taxes would be offset by the expected increase in import volumes of EVs and equipment compared to the current low volumes [14]. The solar industry in Kenya is a great example of the success that this type of policy can achieve, where significant growth in the sector occurred after import duties and VAT were waived for solar equipment and accessories [14], [33]. A UNEP cost benefit analysis on tax policy changes for electric two- and three-wheelers in Kenya also showed that there would be potential for considerable savings in foreign exchange from reduced fuel imports, in the range of 7.9-39.5 million USD over five years depending on the assumed growth scenario [19].

Financial incentives

- **Waivers on different types of fees for electric vehicles and motorcycles** including parking, toll, registration, and permitting fees could be used to incentive their use [8], [13].
- **Vehicle swapping/scrappage schemes** could be introduced to encourage internal combustion engine (ICE) vehicle owners to trade in their vehicles in exchange for a discount or waiver of fees on electric vehicles [8], [13]. This type of scheme might require age and/or emissions limits for different categories of ICE vehicles to qualify for the scheme to ensure that higher polluting vehicles are targeted. An example of these types of limits can be seen in India's Voluntary Vehicle Fleet Modernisation Program (VVFMP) [34].

E-mobility and renewable energy electricity tariff structures

Electricity tariff structures and the integration of renewable energy sources are a key factor to consider when determining the operational expenditure (OPEX), business models, and associated emissions of charging infrastructure for electric vehicles. An overview of renewable energy and e-mobility tariff structures and policies is provided in the sections below, followed by a set of recommendations.

Renewable energy tariff policies

Renewable energy focused tariff policies could potentially be used by e-mobility charging and battery swapping infrastructure operators if they choose to incorporate renewable power sources, such as solar PV, at their sites. In addition to any possible economic benefits of using renewables, their use would provide opportunities to further reduce GHG emissions associated with charging.

Kenya's Feed-in-tariff (FiT) Policy [35] was first launched in 2008 to promote the generation of electricity from renewable energy sources and has undergone several changes since its release. The policy allowed "power producers to sell renewable energy generated electricity to an off-taker at a pre-determined tariff for a given period of time" [35, p. 4]. Initially, the FiT Policy only included wind, hydropower and bioenergy generated electricity but was then revised in 2010 to also include solar. However, in 2021, the *Renewable Energy Auction Policy (REAP)* [36] was introduced which stated that solar PV and wind were no longer eligible for FiT, and any new projects were to be moved to the new competitive auction process. Therefore, the FiT scheme would no longer be applicable to charging or battery swapping sites that include solar or wind.

In 2022, net-metering was introduced in the *Energy (Net-metering) Regulations* [37] for grid-connected renewable energy generators with capacity not exceeding 1 MW. This mechanism allows "electricity consumers who generate their own power to supply electricity to the grid in times of over-production and to be compensated for or make use of the credited energy during other times" [37]. Net-metering could therefore be useful for charging or battery swapping sites that are grid-connected and would like to take advantage of installing their own renewable power sources. If eligible for the scheme, the applicant would need to cover all the costs related to the net-meter and setting up the interconnection with the grid network [37].

E-mobility specific electricity tariffs

Up until recently, there had been no specific electricity tariff structure for charging electric vehicles and their batteries. However, there were signs that these types of changes to tariffs were being considered, such as when dynamic pricing and new tariff designs were mentioned in the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16].

In January 2023, a new retail electricity tariff of 17 KShs/kWh for e-mobility was publicised in a retail tariff application to the sector regulator, the Energy and Petroleum Regulatory Authority, by the Kenya Power and Lighting Company (KPLC) [6]. If approved, the proposed tariff would be applicable to e-mobility retailers that use between 200-15,000 kilowatt hours per month and would be valid from the 1st of April 2023 until July 2025 [6]. This tariff would lead to savings of close to 22% compared to using the ordinary domestic tariff of 21.68 KShs/kWh. A lower tariff would support e-mobility by increasing revenue streams for charging and battery swap station operators and lowering charging costs for consumers [10], with KPLC aiming to influence the demand and growth of e-mobility in Kenya [6]. This would also lead to growth in electricity demand which would improve revenue for energy companies [7].

Recommendations

The lower tariff of 17 KShs/kWh for e-mobility is a great step forward for Kenya's e-mobility sector. The authors of this report believe the tariff structure should continually be assessed by different stakeholders to ensure it is providing the right level of support to influence the demand and growth of e-mobility in the region. Various recommendations for a lower electricity tariff for e-mobility had been suggested by various sources in the lead up to the new retail tariff structure put forward by KPLC [7], [10], [12]. The following alternative tariffs had also been suggested:

- **Dynamic Time of Use (ToU) pricing** was mentioned in the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16]. Conducting a study into the opportunities around a dynamic ToU tariff for e-mobility could be beneficial, especially as Kenya continues to increase its share of intermittent renewable energy sources and attempts to improve energy utilisation during off-peak periods.
- **Adopting a tariff structure similar to the industrial tariff METHOD CI5** for designated charging and battery swapping stations [7]. This would provide a lower tariff of 10.10 KShs/kWh during peak hours and a subsequent charge of 5.05 KShs/kWh during off-peak hours [7].

Infrastructure planning and roll-out

The provision of adequate charging and/or battery swapping infrastructure is critical for any transition to e-mobility. Currently, there seems to be no co-ordinated plan or strategy by the Government of Kenya for the roll-out of charging or battery swapping infrastructure across the country, and e-mobility companies have started rolling out their own infrastructure to serve their customers. This section covers the various developments related to infrastructure planning and roll-out for e-mobility by government organisations. After discussing the existing landscape, several recommendations are provided.

Existing landscape

According to the *National Energy Policy 2018* [21], National and County Governments are responsible for the provision of land and rights of way for energy infrastructure, and it is expected that charging and battery swapping infrastructure would fall under this category too. The *Kenya National Energy Efficiency and Conservation Strategy* stated that the Revised Building Code was to incorporate charging stations in public buildings and new estates [4]. The draft National Building Code 2022 for Kenya now mandates developers of commercial buildings to allocate at least 5% of their parking spaces to electric vehicles [7]. In 2022, President Ruto stated in his party's manifesto that the government plans to roll out electric vehicle charging infrastructure in all urban areas and along highways [32].

In terms of plans and implementation, two of Kenya's main electricity sector companies, The Kenya Power and Lighting Company (KPLC) and the Kenya Electricity Generating Company (KenGen), have started the process of planning and/or installing charging infrastructure. KPLC has released a Request for Expression of Interest (REOI) for e-mobility technology partners to be involved in their plans to develop an E-mobility Network Infrastructure System (ENIS) [38]. The ENIS will provide charging infrastructure, billing and payments systems, and service management in areas where KPLC has grid presence [38]. Kenya's main electricity generating company, KenGen, also has plans to deploy 30 electric vehicle charging stations in 2023, with the aim of diversifying its revenue streams while also collecting data to support the transition of the company's own fleet of vehicles to electric [26].

Standards for charging infrastructure and electric vehicles are necessary to ensure compatibility, safety and environmental sustainability of the systems [39]. According to the State Department for Transport's report on *Electric Vehicle Standards in Kenya* [39], the Kenya Bureau of Standards (KEBS) has developed 21 electric vehicle standards related to safety aspects of the vehicles, however, there are currently no charging or battery swapping standards that have been adopted [11]. Without these standards in place, commercial charging and battery swapping stations are being deployed with different plugs, sockets, communication protocols, form factors and nominal battery voltages, which can lead to interoperability issues between different suppliers and potential access issues for users [11].

These separate statements and actions show that some charging infrastructure planning has started to take place. A more comprehensive assessment and development of a strategic framework for infrastructure has been requested in the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16]. The scope of the assessment and strategic framework development relating to e-mobility infrastructure included [16]:

- A review of charging infrastructure challenges in Kenya
- Advice on the best business delivery models for charging infrastructure in public and private locations for electric private and public transport vehicles
- Assessment of electricity grid impacts from charging infrastructure
- Network planning for addressing the needs of charging infrastructure
- Integration needs related to distributed renewable energy and energy storage infrastructure, demand response, and adaptive load control platforms
- Opportunities and challenges of EVs as distributed energy resources

The results of this assessment and strategy development would be a great step forward to formalising Kenya's commitment to e-mobility and ensuring that the required infrastructure is planned appropriately and in a coordinated manner to overcome challenges and take advantages of opportunities that exist within the local context.

Recommendations

Support should be provided by national and local governments for the deployment of charging infrastructure [13]. The types of support could include:

- **The development of national guidelines for charging and battery swapping infrastructure** [11]. These guidelines could include, inter alia: licensing and permitting requirements; ensuring compliance of infrastructure with relevant Kenyan/international standards; minimum requirements for public charging/battery swapping infrastructure; guidance on the where to locate public charging/battery swapping infrastructure; and guidance on tariffs and metering [7], [11]. These guidelines would help reduce ambiguity about the process and ensure that various stakeholders involved in the roll-out of e-mobility infrastructure understand the different requirements they need to fulfil.
- **Streamline the permitting process for infrastructure set up** [11], [12]. In addition to the guidelines, this streamlining process would be required to further reduce the administrative burden that currently exists for charging/battery swapping station providers [11]. The authors of [11] suggest that a working group be setup with the key government players from different departments involved in the permitting and licensing process, so that together they can identify and simplify the procedures involved.
- **Assess the impact that e-mobility charging will have on the grid** [11]. A study, such as the one proposed in the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16], would be key to understanding the impact that charging demand would have on the grid, and provide insight into upgrade or expansion plans to needed to ensure reliability of the network [8], [11]. This type of assessment may also identify probable locations for public charging/battery swapping stations [11], and regions that might be unsuitable.
- **Standardise charging infrastructure and batteries** [7], [8], [10]–[13]. The standardisation of this infrastructure would ensure a safe and widely accessible charging/swapping network for all users. The development of a consortium of industry players has been recommended to start discussions and reach consensus on common specifications to allow interoperability [11].

Data availability and sharing

The availability of data from various parts of the energy and transport sectors is incredibly important for assessing and planning e-mobility systems [17]. This includes “EV infrastructure planning, business model design, investment decisions, and policymaking” [17, p. 563]. However, there are currently issues around data collection, completeness, aggregation, and accessibility that is hindering these types of assessments [17], [40]. This section discusses several policy commitments to improve data collection and sharing within Kenya and is then followed by a set of recommendations.

Existing landscape

The *National Energy Policy* [21, p. 93] set out plans to “enhance the capacity of the central planning unit at the ministry to collect, maintain and disseminate energy data and ensure that the energy data is disseminated through the website of the ministry on a quarterly basis”. The *Kenya National Energy Efficiency and Conservation Strategy* [4] included actions to conduct a study on the most cost-effective investments in supply infrastructure for reducing system losses, including “potential for cost-effective investments in modern energy monitoring, smart metering, and enhancements to existing meter calibration”. Should these strategies and investments be implemented, additional granular data would become available and a more accurate investigation of how charging electric vehicles may affect the local energy systems might be possible.

In Kenya, all motor vehicles require registration and records are kept by the Authority according to the *Traffic Act CAP 403* [41], but there have been issues with compliance [17]. The number of commercial vehicles operating in different regions is not currently well documented. This lack of data makes it difficult, for example, to estimate the number of taxis or delivery motorcycles in a particular area. The availability of this type of disaggregated transport data could aid in modelling and assessing various factors and policies related to the electrification of these transport systems and could help improve integrated transport planning.

One of the objectives of the *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* was to "collect relevant data on e-mobility and make projections to inform the policy" [16, p. 16]. Open access to this data after it has been collected would be beneficial for various stakeholders in Kenya's e-mobility sector, including researchers and industry players.

Recommendations

A paper titled *Data needed to decarbonize paratransit in Sub-Saharan Africa* [17] provides a great overview of this topic and proposes various policy changes to fill the "data gap". A summary of several recommendations is provided below:

- **Policy to encourage and incentivise the sharing of selected anonymised data with government, researchers, or the public, where appropriate** [10], [17]. This data could be used to gain insight into various topics, such as mobility patterns for different modes of transport or demand for cashless payments when using transport [17]. The types of data that could be shared include [17]:
  - Global Positioning System (GPS) tracking data from paratransit vehicles
  - Data related to the registration and insurance of vehicles
  - Taxi association data
- **Standardised formatting of data for sharing should be encouraged**, additionally this could also be in an open-access format from centralised storage if appropriate [17]. In some cases, data-sharing agreements between entities may be required when the data cannot be shared publicly [17].
- **Policy to support capacity building for centralised data storage** [17] would equip relevant entities with the required skills to share data in the most appropriate manner.

Battery reuse, recycling, and disposal

The growth of e-mobility in Kenya will lead to an increase in the uptake of lithium-ion batteries. Therefore, it is important to consider the various implications related to the management of batteries after they have reached the end of their first life (‹ 80% state of health [11]) as energy storage for electric vehicles. This section discusses the current state of policy in this area and provides a set of related recommendations.

Existing landscape

Kenya currently has a draft version of a *National E-waste Management Strategy* [42], which includes both lithium ion and alkaline batteries. The strategy aims to address e-waste management through policies, laws, regulations, guidelines, and standards that need to be put in place. However, the strategy does not deal with e-mobility specifically. The *Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya* [16] included a request for advisory services for the proposal of a mechanism for battery disposal. With the aim of avoiding e-waste impacting the environment, this policy framework would need to look at the full value chain of these batteries and determine the best approach to deal with their possible reuse, recycling and/or disposal.

Recommendations

During the development of the various policies, laws, regulations, guidelines, and standards as part of the *National E-waste Management Strategy* [42], the following recommendations from various sources could be considered:

- **Plan for and support the re-use of e-mobility batteries in second life applications** [10], [11], [13]. Examples of these second life applications include backup power supplies on the grid or in homes [10], and in renewable energy applications such as solar PV battery energy storage [22].
- **Establishing local electric vehicle manufacturing** could present opportunities for recycling systems to be locally integrated and enable a circular economy [43].
- **Encourage the use of battery chemistries that minimise harmful impacts** [10]. For instance, lithium iron phosphate (LFP) batteries may be a better alternative to nickel, manganese, and cobalt (NMC) batteries, since they are less prone to fire risks and the mining of cobalt for NMC batteries has been associated with human rights issues and child labour in the Democratic Republic of the Congo [10], [44].

Conclusion and key recommendations

It is clear from the documents and policies cited that momentum has started to build up around e-mobility in Kenya and the government has made in-roads to start supporting and managing this transition. Several theme areas were assessed in this report, including targets, fiscal and financial incentives, e-mobility and renewable energy tariff structures, infrastructure planning and roll-out, data availability and sharing, and battery reuse, recycling, and disposal. In each of the theme areas, there was a range of different government policies, laws, regulations, plans, strategies, or projects either directly or indirectly related to e-mobility. While e-mobility players in the private sector have led the way in terms of commercial implementation of projects, the government has started to catch up recently in terms of providing specific policies and support.

Examples of government support provided so far include:

- A target to have 5% of annual vehicle imports being electric or hybrid by 2025 [4].
- Halving of the excise duty rate from 20% to 10% for fully electric vehicles [5].
- A proposed new retail electricity tariff of 17 KShs/kWh for e-mobility [6].
- A new draft of the building code that mandates for developers of commercial buildings to allocate at least 5% of their parking spaces to electric vehicles [7].

These examples show a strong signal of commitment to e-mobility from Kenya's government to investors and other stakeholders involved in the sector. However, as this assessment has shown, there are several areas where new or revised policies could better enable the e-mobility sector to maximise various benefits for Kenya and move closer to achieving the government's goal of reaching 32% GHG reductions by 2030. These recommendations should be considered during the development of Kenya's new national e-mobility policy that is currently under way [16].

Key recommendations include, inter alia:

- Specific targets should be set for all publicly procured vehicle fleets to transition to electric or zero-emission versions [7], [8], [25].
- Full exemptions on Import Duties, Excise Duties, and Value Added Tax (VAT) for imported electric vehicles and their associated infrastructure [7]–[15].
- Dynamic Time of Use (ToU) pricing for e-mobility electricity tariffs [16].
- The development of national guidelines and plans for charging and battery swapping infrastructure [7], [11].
- Policy to encourage and incentivise the sharing of selected anonymised data with government, researchers, or the public, where appropriate [10], [17]. Furthermore, making more data available in standardised open-access format from centralised storage should be encouraged [17].
- Planning and support for the re-use of e-mobility batteries in second life applications should be provided [10], [11], [13].

This report aimed to highlight the various recommendations related to Kenyan e-mobility as cited in existing literature. Readers of the report are also encouraged to explore these further by referring to the original source documentation by using the references provided or by making use of Appendix A, where the key documents are conveniently summarised for each theme area.

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Appendix A – Summary of relevant literature broken down by theme areas

The tables provided in this appendix may be used by readers as a quick reference. For each of the theme areas, the relevant literature sources have been listed and organised by year.

Targets

Table 1: Summary of literature for the targets theme area

Literature	Year	Reference
National Climate Change Action Plan 2018-2022 - Volume 3: Mitigation Technical Analysis Report	2018	[1]
National Energy Policy	2018	[21]
Kenya National Electrification Strategy	2018	[22]
Kenya Beyond Connections: Energy Access Diagnostic Report Based on the Multi-Tier Framework	2019	[23]
Kenya's Updated Nationally Determined Contribution (NDC)	2020	[2]
Kenya National Energy Efficiency and Conservation Strategy	2020	[4]
Combined Reports on the Development of Electric Mobility Policies in Kenya: Integrating electric 2 and 3 wheelers into existing urban transport modes in Kenya	2020	[25]
Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya	2021	[16]
Energy & Petroleum Statistics Report 2021	2021	[24]
ChargeUp! Policy Recommendations for Electric Vehicle Charging Infrastructure in Kenya	2022	[7]
Power to move: Accelerating the electric transport transition in sub-Saharan Africa	2022	[8]
Development of an Electric Mobility Policy Toolkit for Kenya - Version 3.0: Cost Benefit Analysis	2022	[19]
Kenya - Small Vehicles E-mobility - NAMA Facility	2022	[20]
KenGen reveals electric vehicle project in shift from gas to EV	2023	[26]

Fiscal and financial incentives

Table 2: Summary of literature for the fiscal and financial incentives theme area

Literature	Year	Reference
Integrated National Transport Policy*	2009	[27]
VAT Amendment Act No. 7 of 2014	2014	[33]
National Energy Policy 2018	2018	[21]
The Finance Act 2019	2019	[5]
Energy Act 2019	2019	[28]
Tax Procedures (Unassembled Motor Vehicles and Trailers) Regulations, 2019	2019	[30]
Kenya National Energy Efficiency and Conservation Strategy	2020	[4]
Tax Procedures (Unassembled Motorcycle) Regulations, 2020	2020	[31]
Republic of Kenya Electric Mobility Study Importation and Taxation of Electric Vehicles in Kenya	2021	[14]
Voluntary Vehicle-Fleet Modernization Program	2021	[34]
ChargeUp! Policy Recommendations for Electric Vehicle Charging Infrastructure in Kenya	2022	[7]
Power to move: Accelerating the electric transport transition in sub-Saharan Africa	2022	[8]
Accelerating uptake of electric mobility in Kenya	2022	[9]
The Wheels of Change: Safe and Sustainable Motorcycles in Sub-Saharan Africa	2022	[10]
Review of Electric Vehicle Charging and Battery Swapping Infrastructure in Kenya and International Best Practices	2022	[11]
The EV Private Sector Experience in Kenya - Charging and Battery Swapping	2022	[12]
UNEP Electric Motorcycle Pilot Project for Kenya and Uganda	2022	[13]
Development of an Electric Mobility Policy Toolkit for Kenya - Session 2: Policy Review	2022	[15]
Development of an Electric Mobility Policy Toolkit for Kenya - Version 3.0: Cost Benefit Analysis	2022	[19]
Kenya Gazette Supplement No. 106 (Acts No. 22) - The Finance Act, 2022	2022	[29]
The Kenya Kwanza Plan - The Bottom-Up Economic Transformation Agenda 2022-2027	2022	[32]

* Currently under review [16]

E-mobility and renewable energy electricity tariff structures

Table 3: Summary of literature for the e-mobility and renewable energy electricity tariff structures theme area

Literature	Year	Reference
National Energy Policy 2018	2018	[21]
Energy Act 2019	2019	[28]
Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya	2021	[16]
Feed-in-Tariffs Policy on Renewable Energy Resource Generated Electricity (Small Hydro, Biomass and Biogas), 3rd Revision	2021	[35]
Renewable Energy Auctions Policy	2021	[36]
ChargeUp! Policy Recommendations for Electric Vehicle Charging Infrastructure in Kenya	2022	[7]
The Wheels of Change: Safe and Sustainable Motorcycles in Sub-Saharan Africa	2022	[10]
The EV Private Sector Experience in Kenya - Charging and Battery Swapping	2022	[12]
Energy (Net-metering) Regulations, 2022	2022	[37]
Abridged version of the retail tariff application to the Energy and Petroleum Regulatory Authority	2023	[6]

Infrastructure planning and roll-out

Table 4: Summary of literature for the infrastructure planning and roll-out theme area

Literature	Year	Reference
National Energy Policy 2018	2018	[21]
Kenya National Energy Efficiency and Conservation Strategy	2020	[4]
Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya	2021	[16]
ChargeUp! Policy Recommendations for Electric Vehicle Charging Infrastructure in Kenya	2022	[7]
Power to move: Accelerating the electric transport transition in sub-Saharan Africa	2022	[8]
Review of Electric Vehicle Charging and Battery Swapping Infrastructure in Kenya and International Best Practices	2022	[11]
The EV Private Sector Experience in Kenya - Charging and Battery Swapping	2022	[12]
The Kenya Kwanza Plan - The Bottom-Up Economic Transformation Agenda 2022-2027	2022	[32]
Request for Expression of Interest for Shortlisting of E-Mobility Technology Partners to Develop and Implement the Kenya Power E-mobility Proof of Concept	2022	[38]
KenGen reveals electric vehicle project in shift from gas to EV	2023	[26]

Data availability and sharing

Table 5: Summary of literature for the data availability and sharing theme area

Literature	Year	Reference
National Energy Policy 2018	2018	[21]
Traffic Act CAP 403	2019	[41]
Kenya National Energy Efficiency and Conservation Strategy	2020	[4]
Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya	2021	[16]
Data needed to decarbonize paratransit in Sub-Saharan Africa	2021	[17]
A Simulation Approach to Analyse the Impacts of Battery Swap Stations for e-Motorcycles in Africa	2021	[40]
The Wheels of Change: Safe and Sustainable Motorcycles in Sub-Saharan Africa	2022	[10]

Battery reuse, recycling, and disposal

Table 6: Summary of literature for the battery reuse, recycling, and disposal theme area

Literature	Year	Reference
Kenya Beyond Connections: Energy Access Diagnostic Report Based on the Multi-Tier Framework	2019	[23]
National E-waste Management Strategy - Revised Draft	2019	[42]
Cutting battery industry's reliance on cobalt will be an uphill task	2020	[44]
Terms of Reference for Consultancy on Development of a National Electric Mobility Policy for Kenya	2021	[16]
Solar Appliance Technology Brief: Electric mobility	2021	[43]
The Wheels of Change: Safe and Sustainable Motorcycles in Sub-Saharan Africa	2022	[10]
Review of Electric Vehicle Charging and Battery Swapping Infrastructure in Kenya and International Best Practices	2022	[11]
UNEP Electric Motorcycle Pilot Project for Kenya and Uganda	2022	[13]

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Contact us:
Imperial.ac.uk/energy-futures-lab
energyfutureslab@imperial.ac.uk

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