CHARGE UP!

BATTERY-AS-A-SERVICE: A PIONEERING BUSINESS MODEL FOR DRIVING THE E-MOBILITY TRANSITION IN AFRICA

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ENERGY4IMPACT POWERED BY MERCY CORPS

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INTRODUCTION

The potential for electric motorcycles in Kenya is considerable, however, their comparatively elevated cost presents a challenge to widespread adoption, highlighting the need for innovative solutions such as the Battery-as-a-Service (Baas) model to address this barrier. The cost of e-motorcycles, when compared to their Internal Combustion Engine (ICE) counterparts, is relatively higher, with an estimated price range of US$ 1,350-1,500. Notably, the battery component of e-motorcycles accounts for approximately 40% of this cost. Given this cost structure, there exists a promising opportunity to increase the adoption of e-motorcycles by exploring avenues for reducing battery costs through BaaS models.

There remains a dearth of knowledge concerning the profitable implementation of BaaS models models in Kenya and this report seeks to provide additional clarity. The BaaS model is gaining traction and holds the potential to address the issue of battery cost, thereby accelerating the uptake of e-motorcycles in the market.

Exploring the viability of the BaaS business model is part of the remit of the Charge Up! e-mobility project. Funded by P4G, Charge Up! is a collaboration between Energy 4 Impact, Arc Ride, Fika Mobility, Imperial College London and Strathmore University. Between February 2022 and April 2023, Charge Up! established a network of charging stations in Nairobi, Kenya, to test the commercial viability of a BaaS model.

This report investigates distinct models that may be employed in the deployment of e-bike fleets and charging/swapping infrastructures in sub-Saharan Africa. It seeks to elucidate the potential advantages of battery swapping for riders, such as ready access to charged-up batteries, reductions in time-consuming charging processes and fuel cost savings. Furthermore, it highlights emerging best practice for BaaS and provides recommendations on policy, regulation and financing to support uptake of e-motorcycles and the growth of BaaS in Kenya.

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WHAT IS BATTERY-AS-A SERVICE?

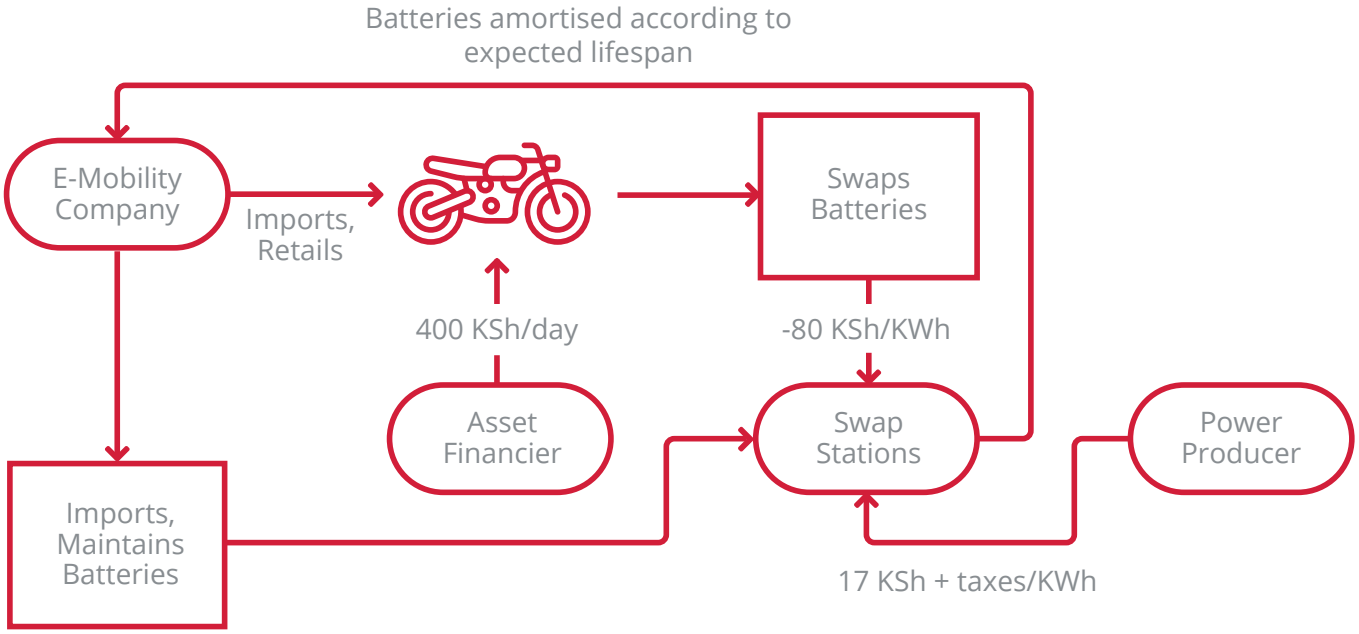
BaaS is a model that delinks battery and bike ownership, allowing customers to lease out batteries for a small fee every time they **swap/exchange depleted ones**.

How it works

The sequence of activities for battery swapping in the context of e-motorcycles involves several key steps. First, **the rider purchases a bike, and while the bike is owned by the rider, the battery is leased.**

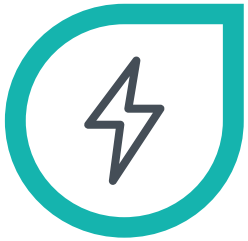
Once the bike is purchased, **the rider can utilise the swap stations** set up by the bike suppliers and exchange a discharged battery for a charged battery at a small cost. It is important to note that the bike provider/supplier retains ownership over the batteries.

The cost of the battery is amortised with the swaps, meaning that the **rider/ driver pays for each battery swap and the cost of the battery is spread out over multiple swaps**.



PROJECT CONTEXT

In the context of vehicle electrification in Africa, 2 and 3-wheeler segments represent low-hanging fruit, given their significant presence on the road. There are over 20 million vehicles currently in operation and there is potential for this number to double in the next decade. Notably, Kenya has a current roster of approximately 30 e-mobility companies actively operating within its borders and largely focused on the 2-wheeler segment (e-motorcycles).



E-motorcycles typically travel a daily distance of 100-120 kilometres in Nairobi, necessitating a relatively large battery. The high cost of the battery, which accounts for approximately 40% of the total vehicle cost, remains a significant obstacle to adoption. Additionally, the lack of public charging infrastructure further exacerbates the challenges facing the sector.

Against this backdrop, Charge Up! has explored the BaaS model's potential to seize the market opportunities for electric vehicles whilst navigating the risks and obstacles. Aiming to establish its commercial viability, Charge Up! has developed a 'business in a box' concept which draws upon data gathered by partners Fika Mobility and ARC Ride during their implementation of the BaaS models in Nairobi, in addition to broader market analyses.

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OVERVIEW OF THE BATTERY-CHARGING SECTOR

The high cost of batteries is a significant obstacle to the adoption of electric vehicles in price-sensitive markets such as Kenya.

The landed costs of batteries can reach up to $300 / kWh, which is 2-3 times higher than the ex-factory gate price in China. In the e-motorcycle cost structure, this represents almost half of the cost of the bike. Moreover, **the lack of public charging infrastructure further compounds this problem**, leaving electric vehicle owners with limited options for charging their vehicles. The challenge of charging infrastructure is being addressed through four emerging charging models that solve the cost challenge, infrastructure challenges or both:

HOME CHARGING

Home charging models provide drivers with chargers to use domestic electricity outlets to charge their vehicles. This often requires that riders purchase the battery.

CHARGE STATIONS

Charge stations are modelled like petrol stations and currently have a very small market in Kenya, as there are fewer than 1,000 EVs on the road. As a result, EV charging companies like EVChaja and ChargeNet are providing free services in the meantime to collect data and encourage usage.

SWAP STATIONS

Under the swap station model, a vehicle is sold without its battery. Batteries are provided at swap stations, where drivers can quickly replace their depleted batteries for fully charged ones. The cost of the battery is amortised through the swap cost. This has so far proved to be a popular model as it addresses both the cost and infrastructure challenge.

BATTERY RENTAL

One of several alternative models, battery rentals allow the cost of the battery to be offset through a monthly rental. Batteries are maintained and replaced by the company, and charging is done by the customer. This model has great potential.

DRIVERS AND BARRIERS TO UPTAKE

E-mobility companies seeking to accelerate the uptake of electric vehicles in Kenya will contend with a variety of contextual circumstances with the potential to either drive or dampen demand. This section provides an overview of these factors to inform the strategic approach and decision-making of stakeholders.

DRIVERS OF DEMAND:
AFFORDABILITY AND CONVENIENCE

The high cost related to adaptation of e-vehicles is a significant obstacle to adoption in price-sensitive markets such as Kenya. We have identified 5 areas that could drive up demand.

MOTORCYCLE COST

The alignment of motorcycle costs with those of ICE vehicles would increase adaptation. This could be achieved through the removal of upfront battery costs.

BATTERY MAINTENANCE

The company is accountable for ensuring the availability of quality batteries and their replacement when they reach end of life thereby obviating the need for battery replacement and upfront CAPEX on batteries

RELIABLE ELECTRICITY ACCESS

There is no requirement for costly retrofits, such as rewiring, as access to high-quality electricity at home is not a concern.

TIME SAVING

The expeditious process of battery swaps, which can be accomplished within a timeframe of 1-2 minutes, analogous to petrol refuelling, obviates the requirement for charging.

ACCESS TO FINANCE

Motorcycle asset financiers, including Mogo, Watu, and M-Kopa, are interested in financing electric motorcycles, and in certain instances, willing to decrease interest rates, owing to enhanced traceability and increased touchpoints available at swap stations.

DRIVERS OF DEMAND:
GOVERNMENT POLICY AND PLANS

The implementation of targeted policy interventions aimed at incentivising adoption would greatly facilitate the growth of the nascent e-mobility sector in Kenya. We have mapped the landscape of policy interventions that are currently driving up demand and key future potential focus areas.

PROGRESS REALISED

Fiscal Measures: The tariff rate on imported electric vehicles has been reduced by fifty percent, shifting from 20% to 10%.

Enhanced Standards: The Kenya Bureau of Standards implemented regulations for electric vehicles encompassing aspects of safety, testing protocols, operational performance, and battery specifications.

ANTICIPATED LEGISLATION

E-mobility electricity tariff: A lower tariff may be adopted in June 2023, pending approval from the Energy and Petroleum Regulatory Authority (EPRA).

Taskforce established: The Kenya Ministry of Roads & Transport is setting up a taskforce to support e-mobility development.

Designated EV parking: Recommendation that as part of the draft National Building code, 5% of parking spaces at commercial buildings are reserved for e-vehicles.

Reduction in import duties: This is specifically for lithium-ion batteries and CKD electric motorcycles.

FUTURE ACTION

National Climate Change Action Plan 2018-2022: The raising of e-mobility as a key means of reducing greenhouse gas emissions.

National Energy Efficiency and Conservation Strategy: The commitment to 5% of vehicle sales in 2025 to be electric.

Draft 2023 Budget Policy Statement: Government to roll out EV charging infrastructure.

FURTHER READING

BARRIERS TO UPTAKE:
COST, INFRASTRUCTURE AND TECHNOLOGY

BATTERY CAPEX

The construction of battery swap stations entails a per-vehicle battery capacity of approximately 4-6 kWh, with an associated cost ranging from $1,200 to $1,800. This sizable capital expenditure necessitates a two to three-year return on investment period, which poses a significant obstacle to nascent firms operating within this domain.

IMPORT TAXATION

A significant component of the import taxation expense arises from the imposition of import tariffs of approximately 25% on all imported lithium-ion batteries, alongside levies on the importation of electric vehicles.

ELECTRICITY TARIFF & TAXES

In Kenya, the surcharges and levies imposed on electricity consumption constitute a remarkably high additional cost, exceeding 100% of the base rate. Furthermore, the Kenyan Power and Lighting Company (KPLC) has proposed an e-mobility tariff of 16 KSh, which would result in a 40% increase over the current tariff rates, generating a consumer cost of nearly $0.30 per kWh, the highest in the region.

ESTABLISHING CHARGING LOCATIONS

The procurement of suitable locations and real estate in Nairobi is contingent upon their affordability, given the persistently increasing costs of land in the city.

LABOUR COSTS

The expenses incurred by the labour at swap stations – who work for 16-24 hours per day – represent a noteworthy portion, specifically exceeding 10%, of the overall cost associated with a swapping station.

SWAP CABINET INFRASTRUCTURE

Currently used cabinets are predominantly designed to accommodate relatively smaller, 48V batteries and necessitate custom construction to meet the requirements of regional firms, coupled with automated mechanisms that are impervious to tampering.

COST, INFRASTRUCTURE AND TECHNOLOGY

E-bikes are largely imported from Asia and most manufacturers make their bikes for the Asian market necessitating modifications to suit the rigorous application and heavier payloads on the roadways in Africa

BATTERY-AS-A-SERVICE BUSINESS CONCEPT AND VALUE PROPOSITION

This section endeavours to investigate the models used by our commercial partners ARC Ride and Fika Mobility. The analysis aims to identify key considerations and inform best practice for the BaaS concept.

FIKA MOBILITY

CONTEXT
Fika aims to be the leading provider of energy solutions for EVs through Smart Battery Technology and interchangeable battery solutions. Fika began by focusing on the B2B market to allow delivery companies and fleet owners to run their own swap stations. It is now looking to provide proprietary swap stations to asset financed e-motorcycle customers.

VALUE PROPOSITION
Fika provides electric motorcycles with chargers and battery rentals to allow delivery businesses to set up their own swap stations, and for motorcycle-taxis to charge at home or on the go.

CUSTOMERS
Initially focused on B2B sales and corporate clients. Fika has moved into B2C (boda riders), aiming to target boda SACCOs.

DISTRIBUTION CHANNELS
Stations are currently set up at Fika's five partner institutions: Takataka Solutions, Little Cab, Greenspoon, M-Gas and Brood Bakery. Fika will also set up at SACCO locations for B2C customers.

PRODUCTS AND SERVICES
Fika retails motorcycles to businesses and provides battery maintenance and tracking support.

PAYMENT CHANNELS
All transactions through mobile money channels, using a Buy Goods till number to avoid customer fees.

BATTERY RENTAL
Batteries are rented out for $19.20/ month, with most riders expected to rent out two batteries at a time for $38.40/ month.

COST STRUCTURE
Manufacturing; import of the e-motorcycles and batteries; maintenance and replacement of batteries.

PARTNERS

GOVERNMENT
NTSA must register bikes to allow for gazetted usage.

B2B PARTNERS
Corporate clients hosting swap stations for own usage.

ARC RIDE

CONTEXT
ARC Ride was established in East Africa in 2020 to provide affordable, reliable, clean e-mobility solutions through battery swap infrastructure and high-quality electric vehicles. ARC Ride is working to build out a large battery swap network for Nairobi motorcycle delivery and motorcycle-taxi riders.

VALUE PROPOSITION
ARC Ride provides automated battery swaps with battery swap cabinets at partner locations and ARC Ride selected locations. The automated system allows for easier swaps while reducing battery swap CAPEX and OPEX, feeding additional savings to the drivers.

CUSTOMERS
ARC Ride provides e- motorcycles to individuals as single or bulk purchases.

DISTRIBUTION CHANNELS
Stations are currently set up at Dominos in Westlands and at the warehouse in the Industrial Area.

PRODUCTS AND SERVICES
ARC Ride provides e-motorcycles, e-bicycles, battery swapping for motorcycles and maintenance support.

SWAP SITE OWNERS
ARC Ride pays the site owner for electricity and 20% on top. It initially planned to have a site operator at each swap station, but automation is now possible with improving technology which also allows for lower surface area demands.

BATTERY SWAPS
Batteries are swapped, charged a flat rate fee with leftover SoC credited to future free swaps. Riders are able to carry and swap two batteries at a time.

COST STRUCTURE
Import of e-motorcycles, design of e-motorcycles; electricity and maintenance of battery swap stations; design and deployment of swap stations.

PARTNERS

DELIVERY FLEETS
Using ARC cabinets and ARC bikes to provide deliveries.

SWAP SITE OWNERS
Hosting swap stations for ARC riders, who may be working for the site owner.

KEY CONSIDERATIONS FOR BAAS MODELS

1 TARGET CUSTOMER

The decision on the choice of a BaaS model is contingent upon the customer segment to be targeted. Our findings reveal that two distinct customer segments emerged – commercial and individual – each necessitating a unique ownership model to achieve optimal operational effectiveness.

	COMMERCIAL	INDIVIDUAL
END USER	Organisations that possess a fleet of delivery vehicles and **employ riders for their operations**.	Individuals who are engaged in **self-employment as motorcycle-taxi drivers**, with substantial daily mileage and income dependency.
OWNERSHIP MODEL	**The motorcycles and batteries are sold to customers**, enabling them to conduct battery charging and swapping at their own designated locations and at their own expense.	**The ownership of batteries is maintained while establishing swap stations** at delivery fleet companies or franchised locations, to facilitate the exchange of depleted batteries for charged batteries.
VALUE PROPOSITION	Fika Mobility has conducted testing of this approach with five business-to-business (B2B) partners, and although it **offers the advantage of decreased capital expenditure** (CAPEX) requirements, **the market for this model is smaller** compared to motorcycle-taxis, predominantly concentrated in middle- and upper-income neighbourhoods of Nairobi.	This approach has emerged as the prevalent model, adopted by companies such as ARC Ride, Ampersand, Zembo, M-Auto, and others. Although it entails significant CAPEX requirements, it offers **the advantage of increased convenience for riders whilst mitigating their range anxiety**.

2 PRICING MODEL

The selection of a pricing model for charging services is a critical issue, as the target demographic is highly sensitive to price.

KEY PRICING MODELS

FLAT RATE	› Riders are **charged a consistent amount for each battery swap**, irrespective of their actual battery usage. While this approach simplifies cash transactions and may offer accounting benefits, it does not align with energy consumption costs. Presently, M-Auto is the predominant company implementing this pricing model in Africa. › This model could have unintended consequences. For example, a flat rate could create a perverse incentive for riders to consistently discharge their batteries to the maximum, increasing range anxiety and the likelihood of running out while on the road. Additionally, this practice can result in the degradation of batteries over time, potentially leading to dissatisfaction among riders.
PER STATE OF CHARGE (SOC) DIFFERENCE	› Riders are **charged based on the energy used**, and this is calculated based on the difference in the SoC between the old and new battery. › This is the most common model, and is used by Ampersand, Mazi Mobility, Ecobodaa, Stima Boda etc. Ampersand for example charges $1.42 to fully charge a battery and this is prorated for the amount of charge in the battery e.g., 50% charge would cost $0.71.
PER KM	› Drivers are **charged based on the distance travelled**, determined through GPS devices affixed to their motorcycles. There is currently no known company in Africa that is utilizing this pricing model. › This model relies on accurate GPS data and availability, and does not consider road use, such as increased energy consumption while carrying passengers and loads.

FURTHER READING

3 BATTERY STORAGE INFRASTRUCTURE

The selection of storage infrastructure is contingent upon considerations such as cost-effectiveness and the feasibility of deriving benefits from the integration of technology solutions.

AD-HOC BATTERY SHELVES

- Many initial participants in the market opted to **construct their own swap stations within leased retail premises**. This approach provided a prompt solution, particularly in markets where rental expenses are lower and there is a ready availability of carpenters and technicians.
- This approach necessitates the leasing of retail space, which may pose challenges in markets such as Nairobi where real estate costs are comparatively elevated.

BATTERY CABINETS

- Battery cabinets are being utilised resulting in not only **reduced space utilisation, but also increased potential for automation.** e.g., with ARC Ride
- The implementation of software and hardware solutions with battery cabinets has the potential to lower labour costs as the cabinets will not have to be manned. However, the development of the technology is typically conducted in-house and imposes greater constraints on the form factor of the system.

4 TECHNOLOGY

The selection of technological solutions is contingent upon key considerations such as cost-effectiveness.

SOFTWARE NEEDS

- Companies typically **develop their own battery swap network software**, which involves tracking crucial parameters such as charging speeds, state of charge, voltages, and battery availability. Furthermore, integration of various elements, including swapper devices, driver IDs, battery IDs, charger IDs, and charger data, is imperative.
- There is therefore a need to build in-house capacity or hire niche technical support to support technology integration

HARDWARE NEEDS

- Motorcycles need to be **adapted to suit the local context** particularly by addressing key areas such as ensuring robust suspension systems can handle rough road conditions, batteries can withstand intensive daily usage, and motors can perform reliably under strenuous conditions while avoiding potential short-circuits due to exposure to rain and mud.
- There is a need to **continuously iterate with Original Equipment Manufacturers**

EMERGING BEST PRACTICE

1 BATTERY SELECTION

	BATTERY LIFECYCLES	VOLTAGES	BATTERY CHEMISTRY
IMPACT ON BAAS	› Battery lifecycles are an indicator of how many times a battery can be fully discharged and recharged. › A longer lifespan reduces CAPEX requirements.	› The voltage of the battery must match the motor voltage to optimise motorcycle and battery safety. › Technically any 12V step up is ideal; in reality, 48V and 72V are most common.	› Battery chemistry affects overall performance and safety. Two battery models exist: (i) NMC – which is physically smaller and has a higher fire risk. (ii) Lithium Iron Phosphate (LFP) – which is larger and has a low fire risk.
BEST PRACTICE	› Preventative maintenance to improve lifespan. › Slow charging times to reduce degradation.	› 48V and 72V provide higher power, but can be less safe especially with Nickel Manganese Cobalt (NMC) batteries.	› Most 72V companies use LFP batteries to get higher power; most NMC batteries are on 48V systems.

2 BATTERY SELECTION

	CHARGING RATE	KWH BATTERY PER BIKE	BATTERY SWAP NETWORK DENSITY
IMPACT ON BAAS	› Charging rate defines how quickly a depleted battery can be recharged. › Faster recharges allow for lower excess battery capacity but can degrade batteries.	› This is the total kWh battery capacity per motorcycle (e.g., 2*2 kWh batteries = 4 kWh / bike). › Excess capacity ensures battery availability but is expensive.	› Higher density network reduces range anxiety and wasted time searching for a swap station.
BEST PRACTICE	› Use swap demand data to optimise for slow charging while assuring battery availability.	› Optimise battery capacity along with charging rate to balance the needs of company and customer. 5 kWh / bike is identified as ideal.	› Explore key enablers (finance, policy etc.) to lower swap station OPEX and CAPEX costs to densify the network in anticipation of motorcycle density.

3 UNDERSTANDING RIDER NETWORKS

	RIDE BEHAVIOUR	RIDER DOWNTIME	RIDER ORGANIZATION
IMPACT ON BAAS	› Riders in some cities are used to running out of fuel on the road. › Running out of battery means a rescue team must be sent.	› Most moto-taxis spend around half of their working day waiting at a stage for customers creating an opportunity for hybridising charging.	› Stages are a powerful place for exchanging knowledge and testing bikes; boda boda SACCOs and organisations can have sway among drivers.
BEST PRACTICE	› Map rider trends and schedules to identify high risk times and locations to decrease risk by for example, setting up a swap station. › Provide training to riders.	› Co-locating swap stations with stages. › Innovative charge-and-swap models could be built at stages.	› Stage visitations to spread knowledge, and collect SACCO loans

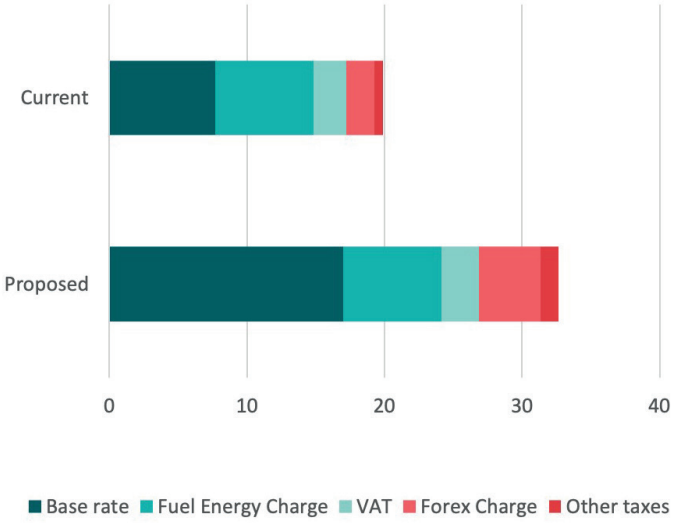
RECOMMENDATIONS

Pioneering e-mobility companies have taken different routes towards bringing electric motorcycles to market in sub-Saharan Africa, but typically face common challenges around reducing costs for drivers on marginal non-fixed incomes, high electricity tariffs, unfavourable taxation and import duties, and access to financing. Drawing upon insights gained over the course of project implementation, Charge Up! offers some key recommendation for accelerating the e-mobility transition in Kenya and beyond.

PRICING

Charging per energy used, which can be measured in kilowatt-hours (kWh), ampere-hours (Ah), or state of charge (SoC), is widely recognised as the most accurate and reflective method of measuring the energy consumption of e-motorcycles. This approach is not only consistent with the principles of fair pricing but is also comparable to fuel consumption, which has been the traditional method of measuring the consumption of vehicles. By adopting this method of charging, e-bike riders and passengers can have a clearer understanding of their energy usage and make informed decisions about their travel choices.

E-mobility electricity charges



POLICY

The high cost of e-mobility electricity tariffs in Kenya is a major challenge for electric 2-wheeler companies. Currently, the electricity tariff applied to domestic and small commercial end users ranges from Ksh10.00 to Ksh13.00, but due to taxation, this rate more than doubles to Ksh 20.00 to – Ksh26.00. A new proposed tariff targeting e-mobility has been set at a base rate of Ksh 16.00 and the total cost including levies would be approximately Ksh 33 / kWh ($0.24). It is essential to lower the cost of electricity tariffs for electric 2-wheeler companies to break even and stimulate growth in the sector.

There is a recommendation to implement the lowest proposed tariff rate for *C17 of Ksh 10.00, a proposal which has been submitted by key sector actors. The government's endorsement of this lower e-mobility electricity tariff will play a crucial role in encouraging the adoption of EVs in Kenya.

*CI7: Commercial and Industrial Band 7. Sourced from the Energy Regulatory Commission of Kenya: www.epra.go.ke/

FURTHER READING

REGULATORY

Corporate tax breaks

Corporate income tax plays a significant role in determining the profitability and sustainability of companies. In Kenya, corporations pay 30% corporate income tax, with a higher rate of 37.5% for branches of foreign companies. A time-limited corporate tax break may stimulate the growth of the e-mobility sector as in Rwanda. Given the significant potential of electric vehicles in addressing environmental concerns, a similar tax break could be applied in Kenya to incentivise e-mobility companies to invest in the country and support the government's commitment to reducing carbon emissions.

Improving e-vehicle registration processes

The importation and registration of electric vehicles (EVs) in Kenya has been plagued by significant delays, with importers such as ARC Ride and Fika Mobility reporting difficulties in registering their vehicles. To address this issue, it is imperative that the Kenya Revenue Authority and National Transport and Safety Authority take immediate measures to streamline and integrate their processes. This will involve developing efficient and effective procedures for registering EVs, including the provision of clear guidelines for importers and the establishment of a coordinated system that allows for the seamless transfer of information between the two agencies.

VAT & duty reductions

To make electric 2-wheelers more affordable and accessible to consumers, reducing import duties on both bikes and batteries could be a viable option. By doing so, the cost of electric 2-wheelers can be brought closer in line with their ICE counterparts. This approach has already been successfully implemented in several countries, including Rwanda. In addition to making electric 2-wheelers more affordable, reducing import duties could also help to incentivise manufacturers and importers to increase production and supply of these vehicles.

FINANCING

Debt for CAPEX / growth

To expand transnationally and address the substantial capital expenditure demands associated with swap networks and motorcycle imports, firms must have access to affordable debt financing, ideally denominated in local currency, to mitigate their exposure to volatile international foreign exchange markets.

Equity & convertible note financing

Supplementing equity investments and convertible note financing with investment readiness programs can serve to enhance e-mobility company's maturity and capacity to engage in debt arrangements.

Vehicle asset financing

Direct vehicle asset financing through companies such as M-Kopa, Mogo, or Watu Credit, which purchase vehicles from providers and offer financed solutions to electric vehicle riders, can effectively minimise capital expenditure requirements.

Grant funding

- For cabinet & software R&D, the current state of battery cabinets exhibits a predominantly ad hoc nature, necessitating customisation for both local environmental factors and specific usage scenarios, particularly in the context of unmanned automated operations.
- For new geographies, a noticeable contrast between the e-mobility companies in Kenya and Tanzania is that the former, despite having a smaller fleet, has raised more than fifty times the amount of funding than the latter, highlighting the requirement for grants during the nascent stages of company development to facilitate adequate preparation for investment and expansion.
- For new vehicle types, while motorcycles have been the prevailing vehicle choice for taxi purposes, it is imperative to provide support for tuk-tuks (3-wheelers) and personal use scooters, which although not being traditionally prevalent in East Africa, present significant potential for adoption in urban centres such as Kampala and Dar es Salaam.

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