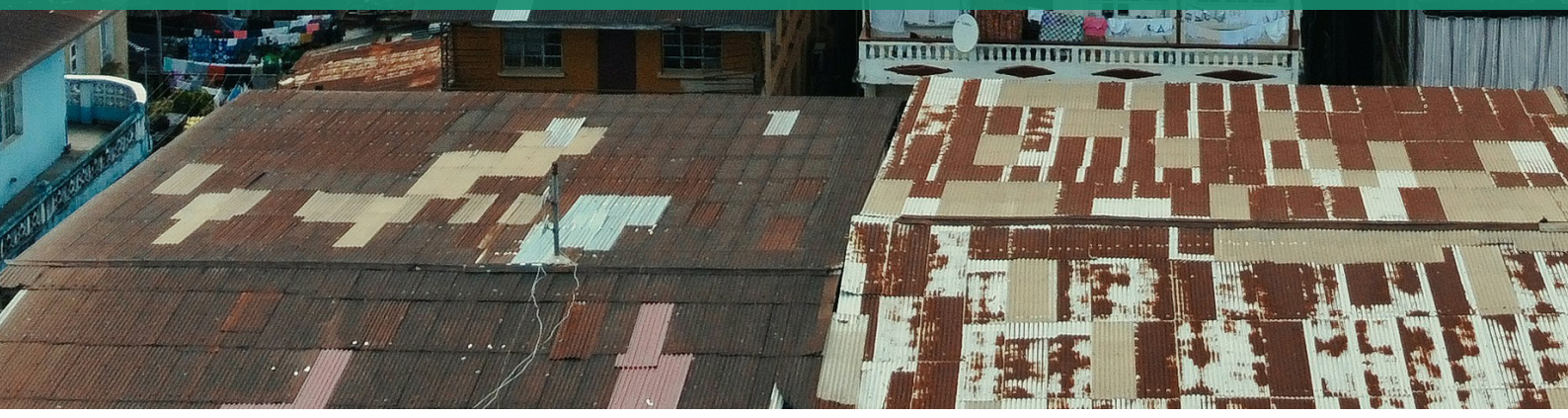
CITY ROADMAP FOR E-MOBILITY
[REPLICATION PROJECT: SOLAR BATTERY SWAPPING FOR ELECTRIC THREE WHEELERS]



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PROJECT PARTNERS

ABOUT

This document describes the roadmap to achieve e-mobility in Sierra Leone

TITLE

City Roadmap for E-mobility [Replication project: Solar battery swapping for electric three wheelers]

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City Roadmap for E-mobility

[Replication project: Solar battery swapping for electric three wheelers]

Freetown / Sierra Leone

July 2024

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Executive Summary

Freetown is a coastal city located on a peninsula which is around 38 km long by 16 km wide with the city mainly occupying the northern and eastern areas with accelerated ribbon development and expansion on the elevated, steeper and forested central belt. Many suburban areas of Freetown are characterised by steep hills sloping down to a narrow coastal strip. Over the years the settlements have been scattered along these hills making it difficult to ensure proper mobility services by the transport authorities. Then the informal transport developed and 2-3 wheelers (Okadas and Kekes) represent today about 30% of the modal share while the public transport have a 9% modal share [1].

SLRTC (Sierra Leone Road Transport Corporation) established in 1964 has been transform in SLPTA (Sierra Leone Transport Authority) in March 2023 [13]. The objective is to structure the public transport in Freetown and over the country and to offer better services to customers. The first action was to introduce 50 brand new buses to serve 2 pilot corridors in Freetown in February 2024.

The project "Supporting Sierra Leone with the Shift to Electric Mobility" has been launched by the Environmental Protection Agency Sierra Leone supported by UNEP in 2021. This project includes a demonstration of electric three-wheelers. This roadmap's goal is to envisage the full electrification of all 2-3 wheelers operating in Freetown. This should lay the ground for the successful introduction of electric mobility in Sierra Leone and raise awareness on electro mobility for all stakeholders.
In order to do this, the roadmap establishes short, medium and long term goals to address the obstacles and to implement specific actions to achieve these objectives. To get there, it presents six focus areas:

- **Urban planning** to find the best locations where to implement Charging infrastructure and related equipment and to acquire/rent the associated land
- **Regulation** in order to determine a clear framework for the deployment of these vehicles concerning various domain such low emission zones or restricted access areas, standards for the vehicles, batteries, reaching the ban of traditional ICE ones in a near future
- **Economic and financial measures** which can be established at city level complementary to the national measures
- **Communication** adapted to the various stakeholders which need to be involved in the transition process ; specific actions should be determined from simple public awareness raising to training of the operators employees
- **Governance** since the transition towards full electric deployment must be monitored at political level to be integrated in Freetown mobility strategies as well as technical level to ensure the adaptation to any future technical evolution.

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1. Background – Where are we now?

Several studies have been realized to assess the current situation of urban mobility in Freetown. The main conclusions of these studies are presented in this chapter.

1.1. Urban mobility context in selected city

The population of Sierra Leone at the last census was 7.1 million, of which some 1.5 million live in the Freetown metropolitan region and 0.8 million in Freetown itself. The national population is forecast to double in 21 years, whilst the population of the Freetown urban area is expected to double in 25 years. The Freetown outer [rural] area is expected to double in just 8 years.

Freetown is a coastal city located on a peninsula which is around 38 km long and 16 km wide with the city mainly occupying the northern and eastern areas with accelerated ribbon development and expansion on the elevated, steeper and forested central belt. Many suburban areas of Freetown are characterised by steep hills sloping down to a narrow coastal strip and in the rainy season, streams erupt into storm gullys and sudden flooding occurs; inadequate drainage causes flash flooding on some of the very densely populated hillsides.

1.1.1. Traffic organisation

In general, urban mobility is hampered by the poor state of the roads in many areas. Travel conflicts happen frequently such as bottlenecks in some pitch points or due to the intense mix of pedestrians, hawkers, traders, motor traffic of all kinds, pedestrians and non-motorised users in city center.

As noted in the Public Transport Assessment report, there are certain areas of the city inaccessible by public transport because of poor road conditions. If a 500-meter radius is considered around all the bus/poda poda and shared taxi stops, being an international standard for reasonable walking distance to transit areas, highly inaccessible areas can be identified as shown in Figure 1.

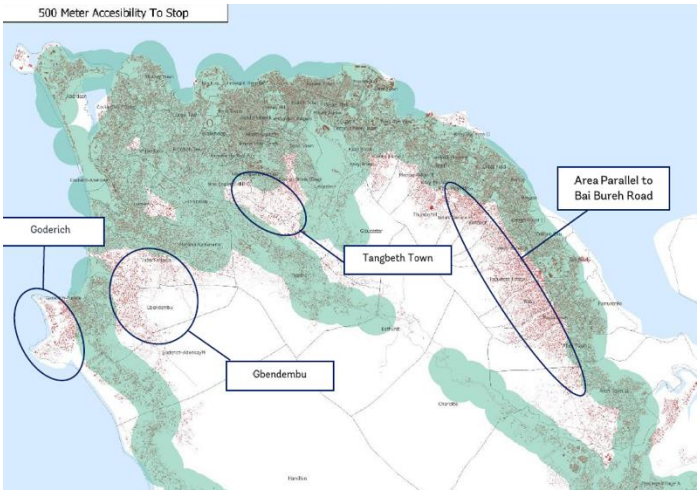

Figure 1. Global view of settlements in Freetown

Green areas represent the public transport stopping locations and in red the built areas. This figure shows the buildings in that do not fall within the 500-meter buffer and can only be accessed by okada or keke.

1.1.2. Public transport operator

The SPLTA (Sierra Leone Public Transport Authority established in 2023 [13], formerly SLRTC (Sierra Leone Road Transport Corporation established in 1964) represents the public sector input to the delivery of public transport in Freetown.

To modernize public transportation, Freetown acquired 50 Ashok Leyland 12-meter buses, named 'Waka Fine Buses' under the Integrated and Resilient Urban Mobility Project, These buses were put in operation in February 2024. The buses will run in two pilot corridors – the East Corridor from Bus Station to Calaba town and the West Corridor from Bus Station to Lumley. This introduces a major change in the organisation of public transport since bus routes have not changed since the launched of the company.

The private sector plays a dominant role in providing public transport and has a prominent on-street presence. To promote Public Transport and to reduce congestion in Freetown, vehicles and private operators non licensed by SPLTA were not authorised to use these corridors during some hours in the day. The deployment of the Waka buses and of new traffic regulations are too recent to be correctly analysed.

1.1.3. Informal/Paratransit

Paratransit operators carry around 70% of the weekday commuters in Freetown. The operators are funded mainly through daily participation fees payable at the start of activities from the terminals from which individuals operate.

The key private sector actors (in order of individual carrying capacity) are mainly:

- Minibuses, known colloquially as poda-poda, small converted vans or pick-ups carrying up to about 17 persons,
- Shared taxis [saloon cars] ; they are not for exclusive use and they can collect a full complement at various terminals, or they can pick up passengers along the way, provided the entire trip is within the authorised zone
- 3-wheel transport [auto-rickshaws], known colloquially as keke ; they are small vehicles that are popular for 2/3 persons making short trips, or for single passenger trips in the central business district. They operate from many wayside parking areas located at junctions.
- 2-wheel transport [motorbikes], known colloquially as okada ; public motor-cycle taxis that usually carry one person but occasionally a small child is also accommodated. They are a very quick form of public transport whose drivers manoeuvre at speed within traffic, but they attract accidents

Semi-formal transport providers in Freetown are organised/operate through associations or unions (for example, motor drivers' unions, tricycle and motorbikes riders' associations). These unions represent the interests of specific semi-formal modes. To enable them to perform their transport services role, each of these associations or unions have established branches dividing up the network. They are typically based at a station (off-street parking) or stage (on-street parking), and routes are operated from or between these points. Each route is then operated on the principle of filling-turn before departure.

1.1.4. Modal share

The diagram (Figure 2), issued from a survey done about travellers [1] shows that okadas and kekes represent both a key part of the transport fleet and like other West African countries provide employment to low income population. An exact fleet size is hard to estimate as registrations may not count all vehicles on the road. Borno Kamara president of the 3 wheelers association stated there are 1700 operating in Sierra Leone and 510 in Freetown (30%). The union of commercial bike riders (Okada's) reports there are 54,00 nationwide with 1,900 in Freetown. It was estimated that there are 30,000 owners nationwide.

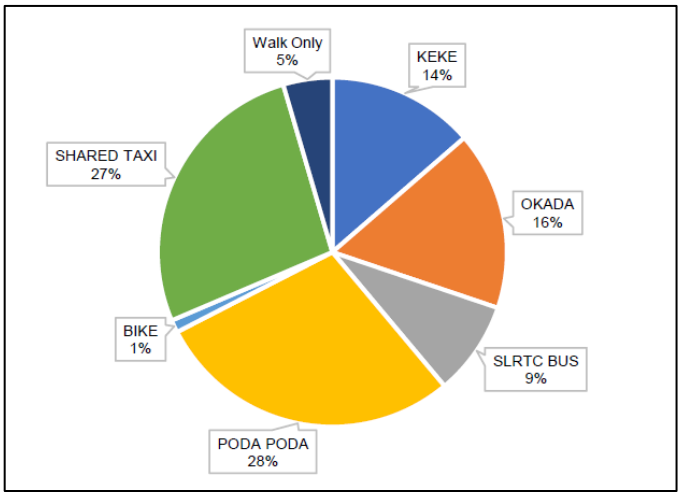

Figure 2. Modal share in Freetown

The realised during the above survey found that Okada and Keke are most popular for trips between 20-30-minute long, accounting for 49% of these kinds of trips. traveller questionnaire These modes only account for around 35%-40% of longer trips with 60% of longer trips served by public transport. Okada's and keke are a popular mode in Freetown, 30% of respondents use keke or okada at least once a week.

1.1.5. Urban Mobility policies

The Strategic National Urban Transport Policy (2013) was based on a vision aiming at " *An efficient, accessible, safe and affordable transport system that minimises travel while ensuring sustainability, equity, poverty reduction and better quality of life for all citizens.*"

The objectives were to improve the public transport services, restrict the private use of vehicles, improve the road networks and reinforce the traffic rules and regulation.

The Integrated Resilient Urban Mobility Plan [13] aims "to improve accessibility, resilience and road safety in selected areas of Western Region and enhance institutional and academic capacity in the transport sector." IRUMP will allow the Ministry of Transport and AviationTA and their respective Agencies to achieve and expand outcomes in three key areas:

- comprehensive improvement of transport services,
- comprehensive corridor improvements which will cover comprehensive traffic management measures including intersection improvements, coordinated traffic lights, improvement of sidewalks for pedestrian movement, drainage etc.;
- provision of institutional and academic capacity building and studies for MoTA staff and management and their agencies.

The Integrated Mobility Plan [14] for Freetown is built on the policies recommended in the National Urban Transport Policy. The mobility plan strategy is to:

- Encourage use of public transport and non-motorised transport (NMT)
- Minimise change to city infrastructure
- Clear the backlog of road maintenance and rehabilitation and include pedestrian improvements
- Minimise resettlement, protect environment and facilitate NMT
- Improve road capacity and traffic flow

Freetown City Council launched a first Climate Action Plan in 2022 [3]. This plan focuses on urban energy, mobility and sanitation as part of its mitigation efforts regarding climate changes, and on ecosystems and land restoration, disaster risk management, water and urban planning to foster adaptation to climate changes. Several actions have been identified to improve the mobility domain, aiming to achieve three goals:

- To encourage public transport and maintaining the share of private to public transport at low levels;
- To Proactively address historical land-use planning challenges in support of efficient and low-carbon transportation and transit oriented development;
- To promote behavioural change and enabling and encouraging the use of public transport, cycling and walking.

1.1.6. Legal framework

The Constitution has a political objective to provide facilities for, and encourage, free mobility throughout Sierra Leone. The Local Government Act provides for the decentralisation and devolution of functions, powers and services to local councils.

Road passenger transport legislation includes the following principal enactments:

- Road Traffic Act: covers licensing of drivers and vehicles, their construction and use, and testing.
- Road Transport Authority Act: provides for the entity to administer the RTA; this has subsequently been renamed the Road Safety Authority.
- Roads Authority Act: functions are the control, development, maintenance, efficient planning and reliable management of the road network.
- Road Transport Corporation Act: establishes the functions, duties and powers of the RTC; this includes financial provisions for viability.
- National Commission for Privatisation Act: this provides for the privatisation and reform of public enterprises, including the RTC.

1.1.7. Organizational framework

The principal entities relevant to the sector are:

- Ministry of Transport: responsibility for sector policy making and performance management; acts through the Road Safety Authority and its own Transport Infrastructure Development Unit.
- Ministry of Communication: responsibility for SLRTC, but this has passed to NCP.

- Ministry of Works: responsibility for sector infrastructure; acts through the Roads Authority.
- Ministry of Local Government: responsibility for Freetown City Council; hosts the inter-ministerial committee on local government and decentralisation.
- Ministry of Internal Affairs: responsibility for traffic management; acts through the Sierra Leone Police Service.
- National Commission for Privatisation: responsibility for SLRTC.

1.2. Current Policy Framework and Market Readiness for deployment of e- mobility

Several projects have been launched, such as the Integrated and Resilient Urban Mobility Project (IRUMP, 2019,) The Ministry of Transport / Aviation financed by World Bank. Since then, IRUMP achieved the following:

- Institutional transformation: The Parliament set up the Public Transport Act in 2023. This established a comprehensive planning and regulatory institution that separates policy setting, planning, and regulatory functions from operational responsibilities. Following this, the Sierra Leone Public Transport Authority (SLPTA) was created to plan, monitor, oversee, and ensure formalization of public transport operations.
- Informal transport reform: Informal transport operators were required to merge into companies to run a bus network along defined route. As a result, operators transformed their informal operations for shares in a formal operating company in May 2023 and became known as the Metro Transport Company Limited (MTCL). The company was supported with a start-up fleet of 50 buses for a pilot operation along two corridors in Freetown.
- Creating an enabling environment: IRUMP financed a strategic, resilient infrastructure investment for an efficient bus operation, including spot improvement on eight kilometer roads for protection against flooding, 77 bus shelters, five pedestrian bridges, bus priority measures, and an integrated ticketing system, among others. It also established a passenger information system and a control centre to manage MTCL buses.

Project "Supporting Sierra Leone with the Shift to Electric Mobility"

To mitigate GHG emissions in Sierra Leone by accelerating the introduction of electric mobility through development of legal, regulatory and institutional framework, capacity building, demonstration pilots of electric vehicles, development of business models for private sector engagement and finance schemes for upscaling and replication.

The objective of the electric mobility project is to lay the ground for the successful introduction of electric mobility in Sierra Leone. This comprises building the necessary administrative structures, the development of capacity among key decision-makers, and the provision of a coherent strategy. This includes for example the coordination between Ministry of Transport and Aviation, which is responsible for the implementation of mobility projects such as the World Bank IRUMP, and the Ministry of Energy, which is leading the implementation of renewable power projects, among others, such as the Ministry of Environment and the Freetown City Council. The project focuses on the introduction of electric 3-wheelers (keke) used as taxis.

To foster the development of electro mobility a pilot is envisaged dealing with the deployment of approximately 15 electric kekes as part of a commercial keke fleet owned by a local private sector partner in order to demonstrate the technical, organisational and economic viability of such e mobility.

In parallel, there are several projects aiming to develop renewable energies and increase the grid accessibility of citizens.

1.3. Replication project

The demo project is related to the above project. It was managed by Mobile Power a company which has been running e-mobility trials in Freetown for the last 2 years. However, since Mobile Power could not execute the contract, the project has been transferred to NEEV Salone, an NGO empowering youth creative opportunities and developing electromobility vehicles.

Initially, these trials used off-the-shelf batteries to power electric-motorbikes called MOPO EVs and then switched to trialing early prototype MOPOMax Batteries to power the MOPO EVs. The MOPO Batteries are designed to be used on a rental basis that is needed to work with a commercial motorbike riders called Okada riders. Battery-swap is the only viable model for Okada riders in weak-grid/off-grid markets as they cannot charge at home reliably and cannot wait hours to re-charge their e-motorbike's batteries on generators.

A key difference between the MOPO EV and common ICE Motorcycle in Freetown is that the ICE has been replaced with a battery powered drive train consisting of a rear hub motor. Power is provided to the rear motor via three MOPOMax batteries stored in the battery box where the engine of the petrol motorcycle would be located. The MOPOMax Battery design currently in use has a capacity of 1000 Watts and uses NMC (Lithium Manganese Cobalt Oxide) Chemistry. Product development is ongoing with regards to a new version of the MOPOMax Battery with increased capacity and considerations are being made to change cell chemistry to LFP (Lithium iron phosphate) or LFMP (Lithium Manganese Iron Phosphate). Once the usable energy is depleted each MOPOMax Battery takes approximately 90 minutes to recharge to full capacity at the charging station, known as an 'EV Hub'.

The main objectives of the project are:

- To purchase, store and local assembly the 55 MOPO EVs.
- to install PV solar charging equipment on 6 car washes
- to manage the MOPO Hubs, the MOPO Batteries and the relationship with the Ministry of Youth and Car Wash Chairmen

The project is scheduled on 1 year (1/7/23-30/6/24) and groups 4 partners Mobile Power Sierra Leone (MPSL) , Mobile Power UK (MPUK), Easy Solar and the Ministry of Youth Affairs which has a scheme that sets up car washes to provide youth employment.

Several performances indicators have been identified as well as impact metrics.

2. Approach – Methodology

The roadmap is based on several reports such as the Public Transport Assessment of Freetown, especially the outcomes of the survey among the various travelers using 2 and 3 wheelers, the project "Supporting Sierra Leone with the Shift to Electric Mobility" and the TSUM project (Transitions to Sustainable Urban Mobility in Sub-Saharan Africa".

The scope of the roadmap is limited to 2 and 3 wheelers:

- the costs of electric car are still quite high and the majority of citizens will not be able to afford them,
- the renewal of fleet of shared taxis and poda poda are not likely to happen quickly, considering the life cycle of existing vehicles and the various costs of electrification
- electrification of Okadas and Kekes can be deployed simultaneously since they have similar constraints regarding the management of batteries even though they have different capacity (5-6 kw for Kekes against 1 kw for Okadas)

3. The Roadmap – Where are we going?

3.1 Vision

Linked to the strategic national urban Transport Policy and the Integrated mobility Plan, the vision behind the roadmap is the implementation of sustainable mobility systems in Freetown in order to decrease the pollution and improve the traffic flows. The electrification of 2 and 3 wheelers will foster the deployment of electromobility and pave the way for other electric vehicles which could be used, for passengers (shared taxis, Podapoda) and goods (vans or small trucks for instance).

This vision is also in line with the guiding principles of the climate action strategy 2022-2030 which promote innovative solutions to climate-induced challenges in a context, within which human and financial resources are limited and behavioral change to raise awareness about climate change.

3.2 Objectives

The main target is that by 2040 all 2-3 wheelers operating in Freetown are electrified. If first regulatory measures are taken by 2025 as forecasted in the Integrated Mobility Plan, this target is quite realistic considering the life cycle of these vehicles.

As one of the aims of the Integrated Mobility Plan is to restrict the use of private vehicles, a second target is to increase the modal share of the 2-3 wheelers up to 35%, which represents a significant growth of vehicles when compared with the growth of the demography. The estimated population of Freetown is 2 million inhabitants in 2030 and 3 million minimum in 2050. If the number of travels / inhabitant remains the same, the evolution will lead to double the number of vehicles by 2050 eg 1000 Keke and 4000 Okada, globally 5000 electric 2-3 wheelers.

These targets are in line with Freetown's commitment to the Paris Agreement means contributing to achieve net zero emissions by 2050 with an interim emissions target for 2030. Of course the net zero objective depends also on other actions regarding transport sector as well as other activity sectors, industrial or private.

3.3 Timeline

The main principles of the roadmap will be:

- The creation of e hubs in order to facilitate the deployment of electric vehicles
- The set up of strong regulatory framework leading to a complete ban of ICE 2-3 wheelers by 2040.
- The organisation of the charging processes for these vehicles
- The financial supports that can be allowed to the operators
- The promotion and communication among various stakeholders
- The coordination of all actors during the operational phases of the deployment

The roadmap will be implemented in the timeline presented on next page. It is organized by 6 Focus areas as are described in the following section, and has milestones in the short, medium and long term. This table is a synthesis of measures, and details of each of these is provided in the implementation plan section according to each focus area.

Table 1. Timeline for roadmap deployment - Freetown

Phase	Demonstration (2024-2026)	Scale-Up (2027-2030)	Mainstream (2030-onwards)
Focus area 1: Urban Planning	- Define guidelines to determine the most suitable locations for deployment of e 2-3 wheelers - Identify first key locations for mobility e-hubs	- Choose the sites, and define their implementation, financial plan and pilot scale-up. - Purchase or develop (renting) agreemen ts with the owners of the sites (private or public actors) - Implement and monitor level of success (first sites)	- Deploy full network of e-mobility hubs
Focus Area 2: Regulatory measures	- Determine the type of regulations to be applied for the deployment of E2-3W - Elaborate the schedule of their implementation - Define standards to applied to batteries(swapped) and charging	- implementation of first access controlled zones - Ban the sale of ICE 2-3 wheelers - follow up the implementation of standards	- Extend the network of access controlled zones areas for 2-3 e W - Monitor the evolution of regulatory measures
Focus Area 3: Economic and Financial measures	- Elaborate accompaniment measures for start ups - Set up grouped procurement (with operators) for batteries (swapping)	- Support the deployment of e-hubs and 2-3 eW fleet - Inclusion 2-3 eW in local-level incentives, grants and taxes	- Monitor the utilisation of local level incentives
Focus Area 4: Charging and other infrastructure	- Deployment of charging stations in public spaces (pilot deployment) - Detail the operating and management activities of the e hubs - Plan the implementation of e-hubs and the growth of their functionalities	- Build first e-hubs as pilots and analyse the impacts (indicators) - Extend the network of charging stations	- Extend the functionalities of e hubs according the utilisation and demand - Full network deployment of all charging-related infrastructure
Focus area 5: Partnerships and public awareness	- detailed Stakeholder analysis - Define target groups and prioritize, create first messages;	- Implement communications campaigns to prioritized target groups;	- Continue implementation of communication

Phase	Demonstration (2024-2026)	Scale-Up (2027-2030)	Mainstream (2030-onwards)
	- Developing a public awareness campaign	- Set up training sessions for the various target groups	campaigns and expand to other target groups; - Continue training sessions
Focus area 6: Governance	- Determine the relations between Local transport Authority and operators, especially for e hubs operation and management (set up a steering committee) - Set up a technical Committee to supervise the construction of infrastructure and its technical evolutions - Elaborate a Chart for governance - Create an observatory to follow the deployment of 2-3 wheelers	- Analyse the results of first implementations and adapt the rules and the integration in the global transport system (Steering C) - Set the observatory in operation - Follow the technical implementation and technical evolutions (Technical C)	- Continue the steering & Technical committees, integrating new members - Analyse outcomes and propose technical or strategic improvements

4. Implementation plan– How do we get there?

4.1. Focus area 1: Urban Planning

Freetown's growth over the past decades has been fragmented and constrained by its geographical boundaries. Expansion has mainly occurred along road infrastructure corridors growing towards the hills. The built-up area between 1974 and 2014 expanded on average at an annual rate of 5.1%. The largest expansion occurred between the period 2000-2014 when the built-up area expanded by more than 70%. This led the urbanised areas to extend into the surrounding hilly terrain and former foot slopes of central Freetown (World Bank, 2018).

Sierra Leone's rapid rate of urbanisation, currently at 3%, along with limited housing development and relatively high poverty levels, has led to the creation of pockets of informal settlements (more than 68 settlements according TSUM [7]).

In March 2019, the Central Government devolved local strategic planning, issuance of building permits, and preparation of land use plans, and with such planning and building control amongst other responsibilities to local councils. These specific devolved functions placed the local councils (Freetown City Council) in a much better position to slow down some of these trends and introduce sustainable urban development in Freetown [8]. The deployment of 2-3 electric wheelers must be done complementary to this strategic planning as well as the growth of public transport facilities.

The locations of the e hubs must be considered as a component of urban planning, especially in the fragmented context of Freetown. They need to be clearly identified according to the potential users' demands, to the operators and to technical constraints on electricity accessibility as well as the topology and the land owners of the possible emplacement.

The main concern on urban planning will be to facilitate the paratransit utilisation of e 2-3 wheelers for passengers and goods in providing dedicated spaces for charging, parking or riding.

2 charging modes may be used in Freetown:

- Battery swapping for 2 wheelers since battery packs are not so heavy (less than 10 kg)
- Charging stations for 3 wheelers which require much heavier battery packs

Parking or customers' waiting spaces need to be clearly identified according to the potential users' demands, to the operators and to technical constraints on electricity accessibility as well as the topology and the land owners of the possible emplacement.

Several types of such spaces should be envisaged for instance:

- Parking spaces: specific secured parking spaces or waiting places for travelers; these could be used by people taking a collective mass transport or taxis' drivers waiting for customers coming out mass transport or other attractive places.

- Small e hubs: with the parking areas, these locations are equipped with charging facilities, with (automated) storage of batteries for swapping, including secured parking or access. Such hubs may also comprise e-bike sharing stations/facilities for different operators
- Complete e hubs: extended facilities may be added to small e hubs to include services such as vehicle's maintenance/ repairing, advices on the driving, the charging or the ownership. They can also include charging stations for cars or light utility vans

In order to achieve this, the following actions are necessary:

1. Define guidelines to determine the most suitable locations for integration of e 2-3 wheelers;
2. Identify key locations for mobility hubs; prioritise their implementation according criteria based on the complementarity with buses network
3. Engage land owners in the private or public sector who own land in sites that are suitable for the deployment of these locations and encourage their involvement
4. Choose the sites with highest probability of success, and define their implementation, financial plan and pilot deployment.

4.2. Focus Area 2: Regulatory measures

The deployment of electric 2-3 wheelers must be accompanied by regulatory measures in order to facilitate their integration in the Freetown mobility system. 3 types of regulations should be established more or less progressively:

- Those related to access control, linked with urbanization and traffic management, such as dedicated lanes, low emission zones, congestion zones, delivery hours. The objectives of such measures are to limit the accessibility for ICE vehicles and to facilitate the utilization of e powered ones
- Standards for the vehicles regarding :
    - the frame and performances of the vehicle (dimensions, speed, max load…..)
    - the batteries (especially for swapping), from their assembly (or importation) to the end of life of batterie
    - charging protocols, especially interoperability between providers and equipment since it is important to install powerful charging stations to minimize the charging time.
- Standards for the charging equipment in order to guarantee the interoperability on all aspects (technical/plugs, payment, accessibility…) and the accessibility
- The ban of non electric 2-3 wheelers which can begin by forbidding their importation and sales and increase taxations on the spare parts for these vehicles

4.3. Focus Area 3: Economic and Financial measures

Regarding electromobility, financial measures such as purchases incentives or tax exemptions, are more often decided at national level than at city level. However Local Authorities may also contribute to the economic support of the deployment of 2-3 wheelers. Actions can be engaged in several domains such as:

- Develop specific partnerships with the operators, for instance for the exploitation of e hubs or implementation of charging stations on public properties, like procuring the equipment, the energy, low rents, grouped tenders (ex for purchase of batteries).
- Facilitate the obtention of banks' loans for operators, especially the smaller ones (ensure warranties) ;
- Facilitate the negotiations with electricity providers to have specific costs for fleet operators
- Support the creation and development of start ups which intend to manufacture parts, assembly vehicles and in general facilitate the deployment of related supply chains (for instance for batteries' cells). Several actions could be set up to accompany start ups like hosting them in public buildings, training and capacity building, and lending equipment, among others.

4.4. Focus area 4: Communication and public awareness

The main target groups for the deployment of electric Keke et Okada are the operators, owners and drivers. A strong communication strategy must be elaborated to convince them to move towards e-mobility. The main axes of this strategy could concern:

- Economy: to show the benefit of turning to electromobility and compare the TCOs (Total Costs of Ownership) of Ice versus Electric 2-3 wheelers
- Technical knowledge: to organize shows, to demonstrate the performances and abilities of these vehicles, even in lending vehicles for a short period so that drivers get familiar with them
- Training: to organize practical training sessions / workshops for all actors from drivers to maintenance and managers

The second target comprises other stakeholders which contribute to the deployment of electric 2-3 wheelers:

- retailers of the vehicles who can promote and explain the advantages of the vehicles
- Manufacturers of 2-3 wheelers who can start producing/ assembling these new vehicles
- Clients of deliveries or passengers who can request that their travels or services are done with electric vehicles

The third target group are the numerous users of these vehicles which can be:

- Keke and Okada customers/users then the best way to convince them is to demonstrate the various advantages of the vehicles
- People owning and using 2 wheelers vehicles for their own travels for which specific awareness raising or sensibilisation campaigns may be launched, especially in line with the implementation of access zones or low emissions zones

4.5. Focus area 5: Governance

Since there are many different stakeholders with various objectives, the deployment of electric 2-3 wheelers must be carefully organized and monitored over the years.

In this context, the position of the Transport Authorities regarding the integration of Paratransit into the overall organization of mobility must be clarified before defining the strategy of its electrification. In addition, it will be necessary to involve the utility to ensure that the demand for electricity can be met by the grid.

For instance, relationships with stakeholders and integration of paratransit will be quite different:

- If the current situation is maintained, with a multiplicity of unstructured actors, the development of electrification will be similar to a traditional deployment for individual owners leading to the implementation of charging or battery swapping stations on-street or in parking areas. However, it will be necessary to determine the organization of these stations, and their manager (public or private?). In this case, it will also be possible to offer financial and/or technical support to these players, possibly within the framework of national policies for the development of electromobility
- If, on the other hand, the strategy is to better structure Paratransit by bringing together several actors (EIGs, associations, trade unions, etc.) under a more formal status, the Transport Authority's efforts towards the electrification of vehicles can be more focused on specific needs.

The actions which could be set up to improve the relations and governance with Paratransit operators and facilitate the electrification are related to:

- The identification of main stakeholders to draw a clear mapping of the various practices and organisations, to collect actual and detailed data on the operating modes of drivers and to point out their main requirements. This approach will lead to different categories of operators, each with specific needs and constraints. This could lead to the estimation of energy required for the electrification of all vehicles and the impact on the gird network.
- The organisation of the relationships regarding the categories of actors, the definition of the roles of public and private partners in the deployment of electrification (especially for the management of shared resources like e-hubs), the promotion of women drivers and gender issues. This could lead to the elaboration of a Chart?? agreed by all players.
- The definition of possible collective actions such as procurement, financing (for instance access to loans), guidelines of best practices, sharing resources (e hubs, coordination for charging for instance), education and training, data reliability (automatic reporting, for instance)
- The monitoring of the process and the development of a specific observatory; this will require the definition of specific indicators and measurement methods. The reporting is facilitated since adequate devices can be installed in the electric vehicles.

5. Conclusion and next steps – what do we need?

This roadmap has presented an overview of existing situation in Freetown regarding the utilisation of 2-3 wheelers and their integration int the whole transport system.

The replication project showed the technical feasibility of the deployment of these vehicles in the city as well as a network of battery swapping stations.

However this change towards electromobility must be integrated in the overall transport strategy of the city and several measures have to be taken to facilitate the acceptability among the operators and potential owners.

The first actions should lead to the elaboration of a strategic framework for this deployment which clearly determines the position of the Transport Local Authority regarding the various stakeholders.

A detailed analysis should be conducted to identify the different categories of stakeholders, public, private companies, individuals and to collect data concerning their specificities, practices, constraints and requirements. This analysis must allow to determine the characteristics and performances required for the vehicles and batteries, the standards to be adopted, the criteria for choosing the locations of charging/swapping stations, etc. and in define the strategies (and priorities) for the deployment of electromobility over the city.

On the basis of the outcomes of the replication project and in line with the framework the second step should be to launch a pilot project including both vehicles, e hubs and charging stations over a city area large enough to be representative and scalable for a future extension. This pilot project could be realized with some of the board members of SPLTA which are also paratransit operators. Since an intersectoral approach is required, this project must be conducted as a living lab involving various stakeholders.

To manage the deployment, it will be necessary to:

- Set up a Steering Committee including representatives of the various stakeholders, especially representatives of the different ministries involved in the deployment of 2-3 wheelers such as Ministry of Transport and Aviation, Ministry of Energy, Ministry of Environment as well as representatives from private sectors or academic. This Committee should determine the strategic framework and monitor the deployment on the basis of the outcomes of the pilot project. It would be in charge of finding the funding and financing of the deployment.
- Set up a Technical Committee in order to determine the technical and operational aspects of the deployment ; this committee will manage the pilot project, analyse the progress and point out the learnings and conditions for replicating the pilot over the whole city.

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