

Scale-Up Concept Note

Project Title: “Scaling up sector coupling solutions in Kigali to reinforce the mobility-energy-resources nexus”

Kigali, Rwanda

Purpose	Leverage takeaways from the SOLUTIONSplus demonstration action in Kigali to accelerate the adoption of solutions coupling advancements in energy, mobility and waste management
Coordination	Urban Living Lab Center (WI)
SOLUTIONSplus partners	City of Kigali, UNEP, UN-Habitat, ITDP Africa, DART, DLR
Contributors	Emilie Martin (WI), Moise Bitangaza (UEMI)

1. Background

1.1. National context and urban mobility in Kigali

Kigali serves as the capital of Rwanda and its political, economic, and cultural center, home to numerous government institutions, businesses and industries. In the last decades, it has experienced **significant population growth and economic and spatial development**. The city reached ca. 1.5 million in 2018 and is expected to grow to 3.8 million in 2050 (City of Kigali, 2020). In 2017, more than half (around 52%) of the 2.4 million trips were undertaken using non-motorised modes, 17% by public transport modes, 16% by moto-taxis and 15% by cars. Continuous growth will translate into a further increase in mobility demand, particularly of motorised trips. In a business-as-usual scenario, the share of total trips made using a car or a motorcycle-taxi is expected to increase to 52%, whereas non-motorised trips are likely to reduce to around 28% (ibid).

Recognising these trends, Rwandan institutions decisively planned to **support low-carbon transportation through advancements in efficient public transport systems, active mobility and electric mobility**. The City of Kigali aims to support transit-oriented development, public transport through dedicated bus lanes and BRT and non-motorized transport measures, detailed in its 2050 Transport Master Plan (ibid). Similar efforts are made in to develop green areas, digitalisation and enhance public spaces. These combined objectives are manifested in initiatives such as Car-free Sundays - a monthly event taking place in the city since 2016 or the establishment of several car-free zones in the city centre. High-density walkable cities

have been a priority for several years, as reflected in the Rwanda Green Growth Strategy (Ministry of Environment, 2011) and subsequent national and city-level policies and strategy papers.

Electric mobility is positioned as one of the crucial components of the ongoing efforts to reduce carbon and air pollution. In its updated Nationally Determined Contribution (NDC), the Government of Rwanda identified that the usage of electric vehicles can help cut energy-related carbon emissions by 9% by 2030. Consequently, the government set ambitious electrification targets in its National Strategy and Policy for Rwanda, aiming for 25% of vehicles introduced in 2022/23 to be electric, 30% in 2023/2024, and 70% in 2034/3035 (Ministry of Infrastructure, 2021a). Critically, Rwandese institutions indicate that electric mobility should not happen as a standalone technological evolution but should be accompanied by measures facilitating a shift from personal motor vehicles to walking, cycling, and public transport.

To achieve its ambitious e-mobility targets, Rwanda's Strategic Paper on Electric Mobility plans for frontrunning fiscal and non-fiscal measures to support the uptake of electric mobility (Ministry of Infrastructure, 2021b). These include electricity tariffs for charging stations at the industrial tariff level; exemptions in import and excise duties on EVs, spare parts, batteries, and charging equipment, rent-free land for charging stations for land owned by the Government, or also a 15% reduction of Corporate Income Tax and tax holiday for companies manufacturing and assembling EVs, among others.

In addition to these measures progressively implemented, the 2021 National Transport Policy and Strategy for Rwanda lists further actions to accelerate the e-mobility transition, including the development of technical standards for EVs, batteries, and waste; the documentation of experiences from demonstration projects; the development of sound business models for charging infrastructure and vehicles; plans for the efficient placement of charging infrastructure; efforts to improve the reliability of the grid, and a protocol of cooperation with countries and companies to facilitate technology transfer related to EVs (Ministry of Infrastructure, 2021a).

Lastly, at the city level, the Kigali 2050 Transport Master Plan updated in 2020 foresaw the deployment of charging stations at fuel stations in the city. Within SOLUTIONSplus, the City of Kigali prepared a draft E-Mobility Strategy across various types of EVs and transport modes, which is being validated.

1.2. Main achievements from the SOLUTIONSplus demonstration action

The SOLUTIONSplus demonstration action in Kigali supported various forms of electric mobility to address the main mobility and transportation-related problems identified, in order to reduce air pollution and carbon emissions, decrease fossil fuel imports, and increase economic benefits for transport operators.

The demonstration supported **light electric two-wheeled vehicles** in the form of electric motorcycle taxis and a bikeshare system. The demonstration project supported shared two-wheeled companies in developing business models, provided technical advice on vehicle and battery design, and corresponding policy and regulatory advice to public authorities.

A first area of intervention tackled the transition from fossil-fuel to **electric motorcycles**, with a strong gender inclusive focus. Supporting the shift to electric motorcycles is relevant in a context where

motorcycle taxi services play a significant role in Kigali's urban mobility (16% of trips in 2017, forecasted to significantly increase). A lifecycle analysis had showed a 75% reduction of greenhouse gas emissions of electric motorcycle taxis by 2030 as compared to a business-as-usual scenario (Gustavsson et al., 2019). At project inception, full electrification of the motorcycle taxi fleet was deemed to reduce total city transport-related emissions by 10% (Sudmant et al., 2020). The project intended to support the development of robust electric motorcycles, with vehicles and batteries locally designed and assembled, an innovative re-energising model of battery swapping adapted to local needs and conditions, and to support scale and industrialisation. In addition, proactively using the transition to increase the involvement of women in the provision of transport services was a critical component of the project, achieved through the support for women to become drivers of electric motorcycle taxis.

In addition, to facilitate the integration of feeder services with the public transport system, a **bike share system** with conventional bicycles was deployed along the most widely used bus corridors. The company deploying this system received training on shared systems, redistribution schemes, and parameters for the long-term introduction of pedal-assist electric bicycles in the fleet. This integration was not possible during the lifespan of SOLUTIONSplus due to a combination of barriers on the side of the e-mobility company (impact of Covid on supply chains, challenges of Asia-based imports, iterations of the initial model, communication issues) and the lack of an enabling environment (regulatory challenges in the partnership between the company and the City, absence of subsidies, pedal-assist electric bicycles not exempted from taxes, unlike larger electric vehicles). Subsequently, key learnings have been gathered to identify financial and operational conditions to deploy a viable system in the future.

Completing this activity on light electric vehicles, the project decisively supported preparing the transition to **electric public transport**. Following several capacity-building in-person and online sessions training stakeholders on modalities for successful public transport electrification, a pilot implemented by the company BasiGo enabled the introduction of **electric buses** in Kigali with support from city authorities, transport operators and bus companies. In particular, the originality of this pilot lay in the specific financial model, providing an innovative pay-as-you-drive leasing model to address the identified barrier of high upfront costs. The pilot showed very positive results, paving the way for rapid uptake. Lastly, the data collected during the pilot enabled the development of a Kigali E-Bus Master Plan to support scaling up.

1.3. Key metrics

- **Electric motorcycles**
 - 35 women trained to become drivers of electric motorcycle taxis
 - 24 women successfully taking the exam and receiving electric motorcycles
 - Environmental impacts: considerable GHG emission reduction of 73% (well-to-wheels calculation, i.e. including CO₂ emissions in electricity production) from electric motorcycles replacing ICE motorcycles
 - Environmental impacts: NO_x and PM_{2.5} emission reduction of 100% from the base case since EVs have no tailpipe emissions (tank-to-wheel calculation). However, the absolute NO_x and PM_{2.5} reductions decline with time since there is improvement in the emission standards for ICE vehicles as well e.g., NO_x emission reduction in a year from 24 e-motos in Kigali declined from 113.6 kg in 2023 to only 68.9 kg in 2033.
 - Financial impacts: Internal Return Rate (IRR) of 17.5%, based on a daily mileage of 157 km/day, a 3 kWh li-ion battery, and a typical 2.23 battery swaps per day on average. This represents an IRR improvement by 5.3 percentage points, compared to ICE motorcycles
 - 1 city-wide research on the parameters to scale the inclusion of women in the moto-taxi male-dominated transport industry
- **Conventional and electric bicycles**
 - 1 bike share system with two corridors established in 2021
 - 80 bike racks deployed at strategic locations
 - 80 conventional bicycles made available through the bike share system in the city
 - 1 study identifying the financial conditions for a viable shared system with electric bicycles
 - 1 policy advice paper on enabling tax conditions for pedal-assist electric bicycles
- **Electric buses**
 - 4 electric buses deployed with 3 different operators
 - 1 innovative financial model (pay-as-you-drive leasing), providing a new and facilitated scheme for operators to access rolling stock, while transitioning to electric buses
 - 51,795 km completed over the consecutive 111 pilot days
 - 224,144 commuters served
 - 19 tonnes of CO₂ and 12,944 liters of diesel avoided
 - 1 Kigali E-Bus Master Plan based on the pilot data collected
 - 142 e-bus reservations made with 10 bus operators having expressed interest
- **Policy and institutional coordination**
 - 1 E-mobility Technical Committee established in the city
 - 1 City roadmap on electric mobility
 - 3 Policy papers on recommendations for EV charging infrastructure in Kigali, tax conditions for electric bicycles, and integration of gender inclusion in e-mobility projects
 - 1 Booklet on African E-Bicycle Start-ups providing an overview of various solutions and applications of pedal-assist electric bicycles on the continent

1.4. Detailed activities and results

Electric motorcycles

Multidimensional **financial and technical support** was provided to Ampersand over the course of four years. Seed funding was granted by UN-Habitat to support a cohort of women in getting access to electric motorcycles. Technical advice support was provided by EU companies – consortium members of SOLUTIONSplus or external companies selected through EU matchmaking calls – on various aspects such as battery sizing, battery design, drivetrain, and industrialisation strategy. Key support was provided by the German company PEM Motion, selected through SOLUTIONSplus' second EU matchmaking call to review Ampersand's new battery design and battery industrialization strategy to establish a new assembly line. This EU-local cooperation holds significant promise, as Ampersand experiences rapid expansion with a fleet and leads the transition to electric motorcycles in East Africa with 1,350 motorcycle taxis and more than 10 swapping stations in Kigali (Rwanda) and Nairobi (Kenya).

The project had a **strong focus on gender inclusivity**.

- SOLUTIONSplus conducted a preliminary assessment in 2021 identifying success and failure factors for gender-inclusive projects in Kigali.
- In 2022, 35 women were recruited and trained under ad-hoc conditions by a partnership consisting of Ampersand, SOLUTIONSplus (City of Kigali, University of Rwanda, UN-Habitat, UEMI, Wuppertal Institute), the GIZ and Jali Asset Finance. The success rate of 68% at the driving exam is unprecedented in Kigali.
- On the 15th of November 2022, 24 electric motorcycles from Ampersand financed by SOLUTIONSplus were handed over to the women having passed the exam, in the presence of government officials and of the City of Kigali.
- The SOLUTIONSplus team keeps monitoring their activities and challenges faced. In addition, it conducts research to understand perceptions of trained women and all women in Kigali on barriers to become a moto-taxi driver. The purpose of this research is to help scaling up gender-inclusive e-mobility efforts in the long run. To that aim, the SOLUTIONSplus team has been in constant discussion to provide recommendations to future e-mobility projects, such as the proposal to the Mitigation Action Facility (MAF).



Figure 11. Handing over E-Motorcycles to trained women in Kigali



Figure 22. Gender-inclusive e-mobility Checklist

Bicycles

The second area of intervention addresses the introduction of pedal-assist electric bicycles, tested for different applications.

- A **bikeshare system** comprising both conventional and electric bicycles was supported. Financial support was provided by the SOLUTIONSplus partner UN-Habitat to Guraride, a company collaborating with the City of Kigali through an MoU to deploy a bike share system. Technical advice support was provided by the Urban Electric Mobility Initiative (UEMI), ITDP Africa, Goodmoovs on various aspects of bikeshare systems, such as technical advice on the redistribution of bicycles, the operation of shared systems, as well as technical and financing options to charge e-bicycles batteries. A large peer-to-peer training involving more than eight cities worldwide facilitated the exchange on electric bikeshare systems in 2022.

On 9 September 2021, Guraride's bikeshare system was launched with 80 conventional bicycles, deployed on two pilot corridors (eastern neighbourhood near a major bus terminal, and in the central business district). The SOLUTIONSplus team provided monitoring and advice. Despite support, the company faced a combination of multiple financial, supply chain, and institutional challenges and was not able to introduce electric bicycles during the project's lifespan. A study on the financial and operational parameters for a viable bikeshare system integrating electric bicycles provided recommendations for the future.

- In addition to the bikeshare system, cycling and intermodality is supported through 80 bike racks deployed by the City at strategic locations in July 2022.

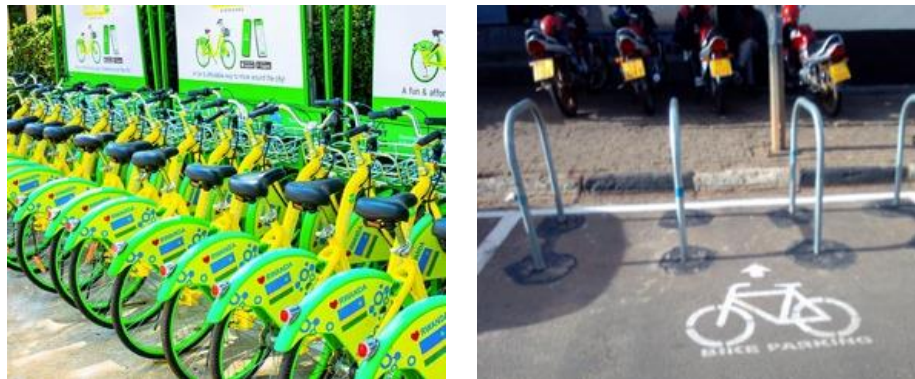


Figure 3. Bikeshare scheme and bike rack deployment in Kigali

Electric buses The third area of intervention addresses **electric buses**. A pilot allowed the introduction of four electric buses by the Kenya-based company BasiGo in December 2023. These buses are operated by three separate public transport operators. BasiGo provides an innovative mileage-based operating lease of the entire electric bus, to overcome the hesitancy of local banks to provide asset finance to bus operators for the purchase of a new technology vehicle. This model reduces the upfront capital required and removes the uncertainty of residual value.

During the pilot, the four electric buses completed a total of 51,795 km without any major reliability issues, serving a total of 224,144 commuters. 10 bus operators in Kigali have expressed their interest in acquiring electric buses with BasiGo.

Results from the project informed the development strategy and financing model for scaling electric buses, resulting in a Kigali E-Bus Master Plan initiated by the City of Kigali and ITDP in the second half of 2023. This study explores factors influencing the operations of electric buses, such as daily range, topography, and demand along each route. It incorporates a model to determine the routes which can go electric in the short and long terms, the energy required to power the electric buses, and the charging infrastructure technology to be adopted.



Figure 4: Electric buses piloted in Kigali



Figure 5: Electric bus charging station

Policy and institutional e-mobility framework

The City of Kigali initiated the **E-mobility Technical Coordination Committee** as part of SOLUTIONSplus, providing a well-recognised platform for information sharing and alignment between public and private organisations.

SOLUTIONSplus provided **multidimensional policy support** to deploy an EV charging infrastructure, recommendations for fiscal conditions for pedal-assist electric bicycles, and a City roadmap on electric mobility.

Planning support was provided by the Technical University of Berlin with a dedicated master module and Design Studio between 2022 and 2023 in partnership with the University of Rwanda and the City of Kigali, focusing on the development of design solutions for public transportation, e-mobility, and road safety in the city.



Figure 6: Design recommendations to improve non-motorised transport infrastructure, intermodality and charging infrastructure in Kigali (TUB, University of Rwanda)

Awareness raising

Partners of the SOLUTIONSplus Kigali Living Lab were **informed through numerous tools and guides** on the various forms of electric mobility supported in Kigali. Knowledge products on vehicle technologies, charging strategies, and relevant policies for in East Africa were incorporated into the SOLUTIONSplus online toolbox, (for instance, 'Electrifying motorcycle-taxi fleets - Illustrative examples from East Africa ', 'Electric Vehicle Charging Infrastructure - Kigali Demonstration Action', 'Electric Bicycles in Rwanda: Fiscal and Regulatory Framework,' and 'Improving Gender Equality Through Electric Mobility: Learnings from the SOLUTIONSplus pilot in Kigali, Rwanda.').

Additionally, the project conducted several **research activities** on the integration of transport operators into e-mobility processes, a review of digitalization and electrification trends for motorcycle taxi services in East African capital cities, the potential for Mobility-as-a-Service applications across the pilots and in Kigali, and research on women's intentions to work in male-dominated professions through the case of motorcycle taxis in Kigali.

Capacity building

Capacity-building activities addressed the training needs expressed by the African demonstration partners at the inception of the project in 2020, dedicating two full weeks of training on EV Charging Infrastructure in 2021, before shifting to the topic of EV battery technologies and end-of-life management in 2022, and public transport electrification in 2023.

Peer exchanges were organized on the vehicle types deployed in the African demonstration actions in 2022, on electric bicycles in shared environments and on the deployment of electric three-wheelers in urban environments. Numerous training and peer exchange events were organised in 2023 and 2024 including Kigali partners: the regional E-Mobility Forum in Dar es Salaam in March 2023, trainings during the Walk21 conference in October 2023, workshops at the Africa E-Mobility Week in Nairobi in November 2023, and the second E-Mobility Forum in Dakar in May 2024.

1.5. Addressing further needs to scale

The important progress achieved via SOLUTIONSplus over the course of the last four years on policy, institutional coordination, and introduction of electric fleets, must be fastened. Based on knowledge generated between 2020 and 2023, the SOLUTIONSplus team has identified 6 areas that need to be further addressed to scale electric mobility at national and local levels:

- 1) **From limited fleet sizes to mainstream e-mobility:** although Ampersand is one of the three most important e-motorcycle companies in East Africa, its fleet remains limited with 1,350 motorcycle taxis and 10 swapping stations in Kigali (Rwanda) and Nairobi (Kenya) as of the end of 2023. Going forward, the stake is to move from early-stage fleet sizes to mainstream electric vehicles.
- 2) **Remaining challenges for e-mobility companies.** Several obstacles identified at the inception of SOLUTIONSplus have been lifted through dedicated efforts from partners, such as the lack of an enabling e-mobility policy and planning environment (see supra), or the lack of financing. Ampersand succeeded in raising grants, equity, and debt financing (e.g. USD 19.5 million raised in December 2023, adding to previous equity funds raised). Yet, limitations persist with regard to:
 - **the ecosystem:** electric mobility innovators have often had to cover a multitude of responsibilities due to the absence of a supportive ecosystem, which hampered their growth in the early years (2016-2022). These responsibilities span vehicle design and manufacturing; importation of vehicles, batteries, charging infrastructure, spare parts; software development; vehicle assembly; charging infrastructure deployment; asset financing; sales; and aftermarket services. Companies also had to secure finances for the company setup and convince governments to improve regulatory clarity and incentives. The situation in Kigali is improving with the presence of asset financing platforms such as Bboxx, but e-mobility companies still remain responsible for most activities.
 - **supply-chain related challenges:** Ampersand locally designs and assembles the electric motorcycles, as well as the battery packs composed of imported cells. Despite the efforts to localise manufacturing as much as possible, Kigali-based companies still heavily depend on importing components produced in Asia, such as the motor, battery cells (or battery packs for companies other than Ampersand). Regional access to key components is challenging too due to the lack of standardization. Each company develops its own vehicle with specific battery sizes and shapes, and its own charging scheme, which leads to individualised supply chains and reliance on international imports. Lastly, Asian manufacturers typically require upfront payment, which leads to cashflow challenges or limited assets e.g. pool of batteries.
 - **recruitment of the technical workforce:** companies based in Rwanda have faced difficulties in recruiting trained engineers and mechanics for their activities in Rwanda or in attracting European staff to Kigali. This led Ampersand to create a research lab in Berlin, Germany. Going forward, assessing existing curricula and current gaps, proposing enhanced Technical and Vocational Education and Training (TVET) short-term offers and enhancing curricula in the longer-term is needed to support local job creation.

- 3) **Completing the regulatory and planning landscape:** Rwanda is the most advanced country in East Africa when it comes to national targets for e-mobility, as well as policy, fiscal and non-fiscal incentives. This creates a supportive environment for companies, which also benefit from the integration of services at the One Stop Center of the Rwanda Development Board (RDB). However, a couple of regulatory uncertainties persist. There is a lack of clarity on the types of electric vehicles covered by the tax exemptions. In particular, it is unclear whether light electric vehicle solutions, including pedal-assist electric bicycles, are integrated, which creates uncertainty for companies. This led SOLUTIONSplus to advise to integrate pedal-assist electric two-wheelers in this scope. In addition, the implementation of some non-fiscal incentives is yet to be done, e.g. the process to access governmental land in order to deploy charging infrastructure. Lastly, the process for charging infrastructure deployment, the corresponding requirements and standards should be clarified.
- 4) **Scaling up institutional cooperation structures:** SOLUTIONSplus enabled the creation of an E-Mobility Technical Committee, co-chaired by the City of Kigali and the Ministry of Infrastructure. This structure allowed discussion between governmental institutions, as well as between governmental institutions and e-mobility companies. Going forward, the Government of Rwanda has expressed the intention to scale this structure, enlarged to key enabling players such as RDB.
- 5) **Further sector coupling mobility-energy-resources (focus of this scale-up concept)**
SOLUTIONSplus identified the sustainable end-of-life management of EV batteries as a vital dimension to reduce environmental impact, enable economic benefits from the recovered economic value of second-life EV batteries used as energy storage systems, and promote a circular economy. The 2022 regional training focused on this topic, collectively brainstorming challenges and opportunities with sub-Saharan African companies working on these topics, local and national governments, and international advisory organisations. Rwanda can lean on a promising landscape with several e-mobility companies, a company involved in collective batteries and recycling (Enviroserve Rwanda), and a company using second-life EV batteries for energy storage systems (SLS Energy). This nascent ecosystem should be decisively supported and scaled.
- 6) **Increasing female drivers' cohorts and business cases**
In Kigali, supporting the first cohort of female drivers enabled the identification of 5 principles to implement gender-inclusive e-mobility projects, and facilitated the SOLUTIONSplus replication work across four other sub-Saharan African countries (Kenya, Uganda, Sierra Leone, Togo). Several clear recommendations were identified for scale-up projects in Kigali such as: apply recommendations on the suitable cohort size and qualifications of the driving school; put specific care into identifying safe operations and into ensuring safe exchange spaces; enable institutional dialogue on gender through a platform or committee under the co-sharing of the City and the Ministry of Gender and Family Promotion; increased awareness-raising and media communication to work on cultural norms and reinforce a positive image of women in transport; and discuss policy implications.

2. Scale up project: Co-prodUSE -Co-producing productive USE of energy and resources (IKI funding)

2.1. Goal

Co-prodUSE will support a circular economy by facilitating high-potential, integrated decarbonization solutions that link buildings, transportation, and energy generation. The Co-prodUSE project aims to contribute to Rwanda's decarbonization goals by promoting sector coupling in energy, mobility, buildings, and the circular economy. It will enhance climate mitigation, socio-economic empowerment, and social inclusion, creating a reference model for strengthened policies and coordination mechanisms.

Key objectives for Co-prodUSE are:

- To enhance sector linkages at the project, programme and policy level, covering key energy end-use sectors
- To improve capacity for sector integration through skills development and business incubation
- To test solutions based on robust business models that are co-developed in rural and urban living labs demonstrating the benefits of sector integration
- To scale-up impact through national, regional and global validation and replication

2.2. Scale-up Approach

This project will make a direct contribution to the decarbonization goals in Rwanda's NCD by unlocking the potential of sector coupling in energy, mobility, buildings and circular economy with the aim to achieve highest impact on climate mitigation. By efficiently linking the key sectors and working through multi-stakeholder partnerships towards low carbon, inclusive development, additional contributions will be made towards socio-economic empowerment through the creation of decent jobs, as well as social inclusion through participatory, locally relevant implementation approaches.

As the end of the project, strengthened policies and business models have enabled embedding sector coupling into local and national strategies impacting emission reduction in Rwanda and beyond

2.3. About the scale-up project

The project is structured based on four key outputs:

- Output I Enhanced sector link coordination mechanism and enabling policy environment (lead partner: UoR)
- Output II Improved capacity for sector integration through skills development and business incubation (lead partner: Green Fund)
- Output III Tested solutions based on robust business models that are co-developed in rural and urban living labs demonstrating the benefits of sector integration (lead partner: UNH)
- Output IV Scaled-up impact through national, regional, and global validation and replication (lead partner: MIT)

Learnings from the SOLUTIONSplus will be useful in particular for Outputs I and III. Suggestions have been made to integrate and scale SOLUTIONSplus activities within Co-ProdUSE.

Area	SOLUTIONSplus	Co-prodUSE
Living Lab	<ul style="list-style-type: none"> • Network of partners, UNH, ULLC, UoR 	<ul style="list-style-type: none"> • Network extended to FONERWA and MIT (Output I)
Electric two-wheelers	<ul style="list-style-type: none"> • E-motos <ul style="list-style-type: none"> ○ Financial support to new e-motos (Ampersand) + technical support on battery design, and industrialisation strategy ○ Gender-inclusive e-moto project, identification of recommendations for gender-inclusive projects • E-bicycles <ul style="list-style-type: none"> ○ Financial and technical support to Guraride ○ Bikeshare with conventional bicycles deployed along cycling lanes corridors, yet challenges to integrate e-bikes in the remaining SOL+ lifespan due to various issues ○ Procurement CoK for a municipal fleet of e-bikes and e-bikes for urban deliveries 	<ul style="list-style-type: none"> • Sector coupling mobility-energy through energy-efficient mobility in urban labs (WP3.2a): new e-moto cohorts, formalise safe waiting points near PT hubs • Sector coupling mobility-energy-waste by using second-life EV batteries for energy storage systems (WP3.3 Rural labs, also suggested for WP3.2. Urban labs) for back-up and integration of renewable energies, leveraging the existing partnership Ampersand-Enviroserve • Sector coupling mobility-energy through energy-efficient mobility in urban labs (WP3.2a) <ul style="list-style-type: none"> ○ Further exploring e-bikes for deliveries: urban, peri-urban, and rural, with various types of two- and three-wheeled e-bicycles e.g. eBee (small packages), eWaka (larger rack), ThinkBikes (farmers, etc.) ○ Bikeshare around transport hubs/TOD
Electric buses	<ul style="list-style-type: none"> • 4 electric buses deployed (BasiGo) • 1 E-Bus Master Plan 	<ul style="list-style-type: none"> • Sector coupling mobility-energy through energy-efficient mobility in urban labs (WP3.2a) <ul style="list-style-type: none"> ○ Expanding the pilot ○ Explore having electric buses operate on the dedicated bus lanes route CBD-Sonatubes-Giporoso + link TOD
End of life management of EV batteries	<ul style="list-style-type: none"> • 2022 training on EoL management of LIB, SSA companies including Rwanda-based companies, SLS Energy & Enviroserve Rwanda • 2024 policy paper on EoL management in SSA 	<ul style="list-style-type: none"> • Sector coupling Mobility – Energy – Waste in rural labs (WP 3.3c): Solutions will be co-developed around opportunities of second-life electric vehicle batteries that can be used for

	<ul style="list-style-type: none"> • Close connection with SESA – SLS Energy 	<ul style="list-style-type: none"> • energy storage to address the issue of power intermittency in rural areas. • Suggested application in urban labs too as well, WP3.2a
Urban planning and design	<ul style="list-style-type: none"> • TUB Design Studio in 3 topics areas: (1) Last-Mile Connectivity in Kibagaba, Nyabisindu / Amarembo II; Kimironko Bus Terminal; (2) Nyabugogo Bus Terminal;(3) Kinamba Junction 	<ul style="list-style-type: none"> • To be integrated in urban labs within WP3.2 (a) Sector-link: Transport – Energy – Buildings, integrated approach to compact spatial planning, energy efficient buildings and transit-oriented development (TOD).
Gender / economic inclusion	<ul style="list-style-type: none"> • E-moto gender inclusion project with an economic empowerment dimension + deliveries/passenger • Integrate learnings from SOL+ (Cohort 1 and 2) to design safe processes, applications, and enabling partnerships to customer organisations or e-commerce/ride-hailing platforms • Consider other vehicle types based on SOL+ replication cases: see slide 5 • Consider e3Ws cargo for peri urban uses, possibly with a gender dimension, e.g. similar to the SOL+ replication case East African Rural Mobility 	<ul style="list-style-type: none"> • To be integrated in both urban and rural labs, WP3.2 and WP3.3 • Consider extending the network within UoR to the College on Gender Studies at UoR (Liberata) • Sector coupling Energy – Mobility – Water in rural labs (WP3.3 a): Multi-purpose solar hubs will be explored with the aim to achieve an integrated energy system for different use cases of energy such as for shared electric vehicles servicing the local community, filtering drinking water, irrigation • Sector coupling Energy – Buildings – Waste in rural labs (WP3.3 b): consider using three-wheeled e-bicycles or small e-trucks to transport waste in urban settings

2.4. Timeframe

After a 9-month preparation phase, the project is expected to be codeveloped and implemented during 3 years (36 months) from November 2024 to October 2027, followed by a one-year (12 months) scale-up and replication phase, ending in October 2028.

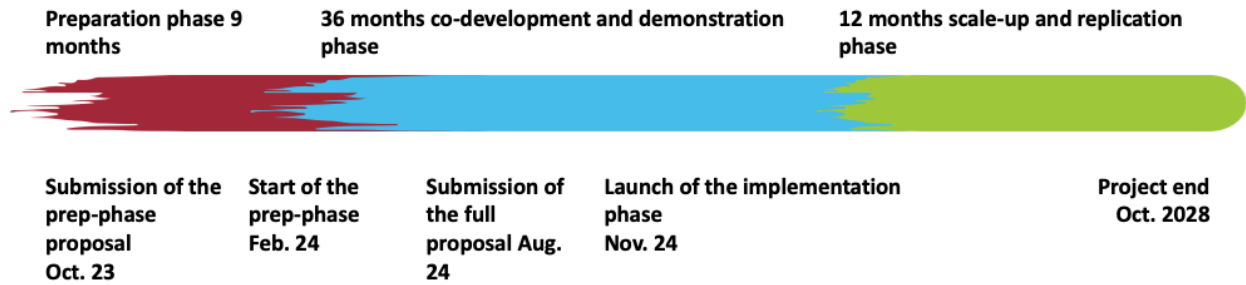


Figure X: Tentative project schedule

2.5. Stakeholder engagement

The United Nations Human Settlements Programme (UN-Habitat), Green Fund Rwanda - FONERWA, University of Rwanda, MIT, Ministry of Environment (MoE), Ministry of Infrastructure (MININFRA), and City of Kigali are all involved in this project.

- UN-Habitat will oversee the preparation phase, ensuring project management, strategic partnerships, and aligning the project with local and national priorities.
- The Rwanda Green Fund (FONERWA) will support stakeholder mapping and seed-funding for startups.
- The University of Rwanda will conceptualize participatory living labs and support the development of thematic living lab concepts, later host the Center of Excellence for capacity building and the Co-prodUSE start-up incubator.
- MIT Energy Initiative (MITEI) will provide international expertise and support for sector integration curriculum development.
- The Ministry of Environment (MoE) will contribute to embed good practices on sector-coupling in the implementation of the National Development Goals (NDG) and other national frameworks.
- MININFRA will provide technical support for sustainable infrastructure development.
- The City of Kigali will support low-emission and climate-resilient development pathways in small and large settlements, ensuring strong links with ongoing initiatives.

2.6. Budget

Up to 15.000.000 EUR from IKI

3. References

City of Kigali (2020). Transport Plan. Kigali Master Plan 2050.

<https://gis.kigalicity.gov.rw/portal/sharing/rest/content/items/20035176446647f68a78ef60d84bb2a8/d ata>

Ministry of Environment (2022). Revised Green Growth and Climate Resilience. National Strategy for Climate Change and Low Carbon Development

https://www.rema.gov.rw/fileadmin/user_upload/Rwanda_Green_Growth__Climate_Resilience_Strategy_06102022.pdf

Ministry of Infrastructure (2021a). National Strategy and Policy for Rwanda.

https://www.mininfra.gov.rw/fileadmin/user_upload/Mininfra/Publications/Policies/Transport/NATIONAL_TRANSPORT_POLICY_AND_STRATEGY_APRIL_2021.pdf

Ministry of Infrastructure (2021b). Strategic Paper on Electric Mobility Adaptation in Rwanda.

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