

The background of the entire page is a photograph of a person riding a motorcycle away from the camera on a paved road. The rider is wearing a dark helmet and jacket. The road is lined with tall palm trees on the right side, and the scene is bathed in bright, natural light, creating long shadows on the pavement.

KIGALI, RWANDA

SOLUTIONSPLUS | LIVING LABS UPDATE



PROJECT PARTNERS



ABOUT

This is a summary of the paper, submitted to the journal ‘Sustainable Earth Review’ developed under SOLUTIONSplus project. Currently the paper is under peer review.

TITLE

Capacity and market potential for local production and distribution of electric two-wheelers in Southeast Asia, focused on Thailand, Indonesia, and Vietnam

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DISCLAIMER

The views expressed in this publication are the sole responsibility of the authors named and do not necessarily reflect the views of the European Commission.

LAYOUT

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PICTURES

All the pictures are provided by the ITDP

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KIGALI, RWANDA

The SOLUTIONSPlus project aimed to accelerate the transition to sustainable urban mobility through innovative and integrated e-mobility solutions. To this end, the consortium partners created Living Labs at city level to test different types of innovative and integrated e-mobility solutions. Living Labs reach beyond the implementation of technological innovations and also include elements of information, inspiration and initiation to achieve a stronger and sustainable impact of the project activities.



INFORM

Boost capabilities of local and national authorities, public transport operators and entrepreneurs about innovative urban e-mobility solutions across various transport modes by **informing them about tools** to plan, assess, implement and operate e-mobility solutions.



INSPIRE

Foster the take-up of e-mobility innovations by businesses, start-ups, local and national governments and transport operators by **inspiring** officials, operators, industry and businesses through peer-to-peer exchange on innovative e-mobility products and services.



INITIATE

Strengthen policy and business **collaboration** by **initiating** partnerships between local and national governments and local and European entrepreneurs and supporting the development of new e-mobility models business implementation plans.



IMPLEMENT

Create reference models for e-mobility innovation by **implementing** demonstration actions to test innovative e-mobility technologies and services, foster their **replication** and ensure their long-term **sustainability**.



IMPACT

Contribute to global **sustainability and climate goals** by boosting the **impact** of this project through the integration of the innovative concepts into policy, funding, operation, research and business practice.

Kigali serves as the capital of Rwanda and its political, economic, and cultural centre. The city is home to numerous government institutions, businesses, industries, and international organisations. In the last decades, it has experienced significant growth both in terms of population as well as economic and spatial development. The city reached ca. 1.5 million in 2018 and is expected to grow to 3.8 million in 2050 (Kigali Transport Master Plan, 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 (City of Kigali 2020). 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 realised in the city from 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). To achieve its ambitious e-mobility targets, Rwanda's Strategic Paper on Electric Mobility plans for frontrunning fiscal and non-fiscal measures, including 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, among others (Ministry of Infrastructure, 2021b). The 2021 National Transport Policy and Strategy for Rwanda also lists further actions to accelerate the e-mobility transition.

DEMONSTRATION ACTION IN KIGALI

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. 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). The project supported 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 the support for scaling to maturity. In addition, 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, a bike share system with conventional bicycles was deployed along the most widely used bus corridors to facilitate the integration of feeder services with the public transport system. 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.

Completing this activity on light electric vehicles, the project decisively supported the

transition to electric public transport. Following several capacity-building activities training stakeholders on modalities for successful public transport electrification, a pilot implemented by the company BasiGo enabled the introduction of electric buses in Kigali. 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.

RESULTS - KIGALI



INFORM

Tools and guides on shared systems and their application in various cities were incorporated into the SOLUTIONSplus online toolbox, along with knowledge products on specific vehicle technologies and charging strategies for electric motorcycles in East Africa (for instance, 'Electrifying motorcycle-taxi fleets - Illustrative examples from East Africa', 'Supporting the Shift to Electric-Wheelers in Uganda', 'Supporting the Shift to Electric-Wheelers in Kenya'). In the context of Kigali specifically, these included Policy Advice Papers concerning crucial aspects relevant to the promotion of e-mobility in the country. The key publications included: '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 research activities conducted in connection to the SOLUTIONSplus project contributed to numerous publications concerning the integration of private operations into e-mobility transitioning process, 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.



INSPIRE

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. These training sessions addressed both regional cross-cutting topics and peer exchange, and city-specific sessions.

In 2022, two peer-to-peer trainings were organized on the vehicle types deployed in the African demonstration actions. A large peer-to-peer training involving more than eight cities facilitated the exchange on electric bikeshare systems. Peer-to-peer exchanges on the deployment of electric three-wheelers in urban environments were facilitated by the SOLUTIONSplus and the Decarbonising Transport in Emerging Economies (DTEE) projects in July 2022.

2023 saw the participation of Kigali's partners in the Dar es Salaam E-Mobility Forum, a major local and regional event on East African e-mobility developments and training on the electrification of public transport. Further capacity-building and exchanges occurred in October 2023, including a series of events during the Walk21 conference organized in Kigali. These discussions concentrated on the overlapping issues of road safety and e-mobility development. Additionally, activities took place on an academic level with a dedicated master module at the Technical University of Berlin realized between 2022 and 2023, focusing on the development of three speculative design solutions for public transportation, e-mobility, and road safety in the city. In November 2023 at the Africa E-Mobility Week in Nairobi, SOLUTIONSplus trained regional workshop participants on the five principles for gender-inclusive e-mobility project identified during through the Kigali demonstration action.

Building upon the success of the first edition in 2023, a second E-Mobility Forum was organisation in Dakar in Mary 2024, extending the training on public transport electrification to electric Bus Rapid Transit systems.



INITIATE

Three startups received financial support in Kigali through UN-Habitat and UEMI: Ampersand (electric motorcycle-taxis), Guraride (bikeshare), and BasiGo (electric buses). In addition, 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 the operation and maintenance of shared fleets, in particular shared bicycles. Critical support was provided by the German company PEM Motion, selected through the second EU matchmaking call to review both Ampersand’s new battery design and battery industrialization strategy. This EU-local cooperation holds significant promise, especially 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).



IMPLEMENT

The local living lab concentrated on three key areas: electric motorcycle taxis, shared bicycles, and electric buses.

The first area of intervention in Kigali covers motorcycle taxis, to support the transition from fossil-fuel to electric motorcycles. Alongside the financial and technical support to Ampersand, the project had a strong focus on gender inclusivity. Following an assessment of success factors for gender-inclusive projects, recruitment and ad-hoc driving training, 24 electric motorcycles were handed over to local women in November 2022. The SOLUTIONSplus team kept monitoring their activities and challenges faced. In addition, it conducted research to understand perceptions of the trained women as well as potential women-drivers in Kigali.



Figure 1. Women trained and receiving electric motorcycle taxis

The second area of intervention for two-wheeled vehicles in Kigali addresses **conventional and electric bicycles**. 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). In order to facilitate the deployment of an electric bikeshare 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. 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. Recommendations were identified on suitable financial and operational parameters for a viable bikeshare system integrating electric bicycles in the longer run. 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 2. Guraride's bikeshare system

Regarding **electric buses**, a pilot allowed the introduction of four buses deployed 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 3. Electric buses piloted in Kigali



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.

SOLUTIONSplus supports scaling-up the projects, for instance, with recommendations to mainstream the gender inclusive approach given to the upcoming Mitigation Action Facility e-motorcycles project, or proposal to scale pilot in the IKI-funded Co-ProdUSE project on sector coupling. The ex-post evaluation found, based on the UNEP e-Mob calculator, a significant reduction potential for GHG emissions, if ICE vehicles are replaced with electric counterparts.

