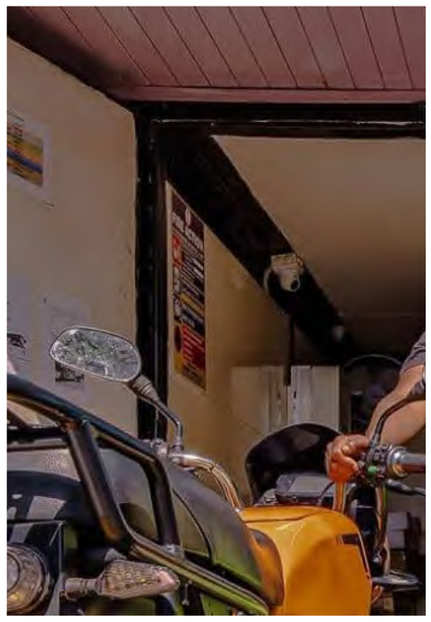

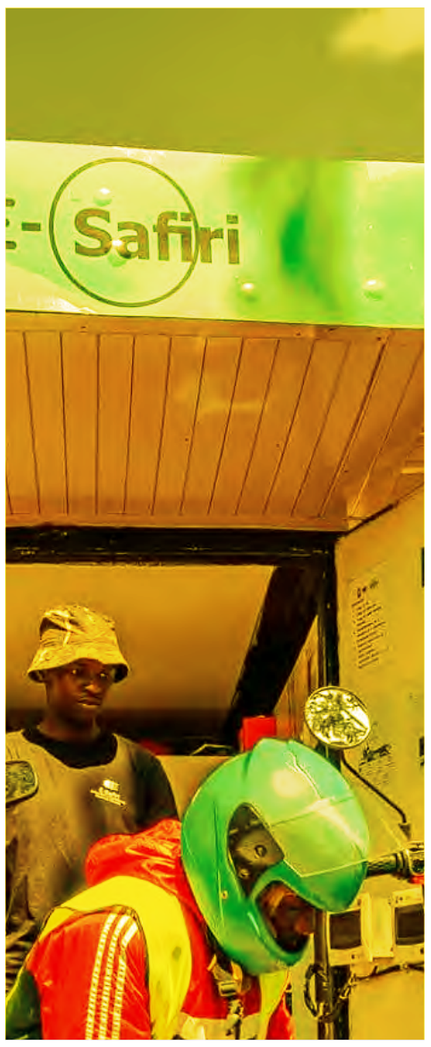

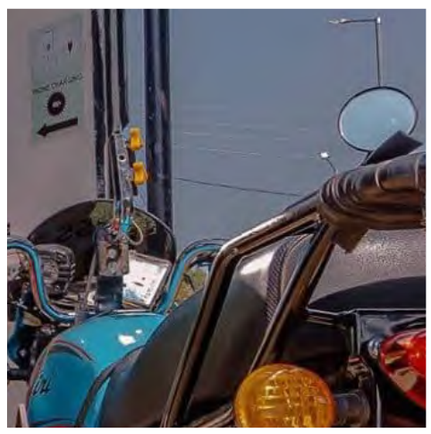

SUNRUN

Powering Africa's Sustainable Future

2025

Contributing Authors

By

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1

Glasgow Caledonian University

Glasgow Caledonian University (GCU) is an academic institution with research at the heart of its mission as a University for the Common Good. GCU's research focuses on three core areas: sustainable environments, inclusive societies, and healthy lives, aligned with its three Academic Schools – the School of Computing, Engineering and Built Environment (SCEBE), Glasgow School for Business and Society, and the School of Health and Life Sciences. This research is underpinned by an inter-sectoral approach to addressing the challenges posed by the United Nations Sustainable Development Goals. GCU's Research and Excellence Framework (REF) performance is unsurpassed by any other Scottish modern university for its level of research, with a score of 72%, which is considered to be world-leading or internationally excellent.

2

E-Safiri Charging Limited

E-Safiri is an early-stage start-up working to drive Africa's transition into sustainable transport by developing solar-powered charging stations for 2- and 3-wheelers and additional energy for productive uses, including cold storage, lighting, and solar drying, among others, in rural and peri-urban communities. Our mission is to accelerate the adoption of sustainable transport by providing reliable, accessible, and adequate charging infrastructure for e-mobility in Africa.

3

Kiri EV

Kiri EV is a technology company that develops, designs, and deploys electric vehicles tailored for the East African market, leading the transition to sustainable transport. Kiri's electric motorcycles are not only sustainable but increase our riders' earnings by up to 60%, making our cities greener, healthier and their livelihoods more sustainable.

4

Sustainable Transport Africa

Sustainable Transport Africa is a Non-Governmental Organization in Kenya with the primary objective of making transport more accessible to the lower income, physically challenged and financially disadvantaged groups while reducing the adverse environmental and health impacts particularly in urban areas where the public suffers from growing serious respiratory illnesses, cancer and premature deaths as a result of harmful emissions from the rapidly expanding transport sector with children suffering the greatest impacts.

Content

Background & problem statement

The global drive towards sustainable and environmentally friendly transportation has led to the ongoing transition to electric vehicles (EVs) as one viable solution to reduce greenhouse gas emissions.

The transport sector is a significant contributor to global CO_2 emissions, accounting for about 24% of direct emissions from fuel combustion [1]. While the aviation sub-sector dominates these emissions, the road transport sub-sector, particularly the fossil-fuel powered 2-wheeler and 3-wheeler vehicles, presents a critical challenge due to their increasing adoption in developing countries. The conventional fossil-fuel powered 2- and 3-wheelers are particularly indispensable in Africa and Asia, where they serve as critical modes of private and public transportation for billions of people due to their affordability, maneuverability in congested urban areas, low maintenance, last-mile connectivity, agricultural support, healthcare access, operational flexibility, and adaptability to local infrastructures.

In Kenya, motorcycles or two-wheelers (commonly known as boda bodas) account for over 70% of new vehicle registrations in some counties in recent years, serving as a vital source of income for thousands of self-employed riders [2].

However, this rapid growth comes with significant environmental costs, as the road transport sub-sector contributed about 12 $MtCO_2e$ out of the country's total of 18 $MtCO_2e$ greenhouse gas emissions in 2019, according to the Kenya National Inventory Document [3]. A viable and sustainable solution to reduce these emissions from domestic transport sub-sector lies in accelerating the transition to electric mobility (e-mobility), particularly for two- and three-wheelers. Without targeted e-mobility transition strategies and models, these lightweight vehicles could significantly increase transport sub-sector's carbon footprint and exacerbate air pollution and associated health hazards, especially in rural and peri-urban regions where they dominate mobility solutions.

From a social perspective, the two- and three-wheeler transport sub-sector remains largely male-dominated in Kenya, with women facing considerable entry barriers due to high licensing fees, limited access to credit, and entrenched cultural perceptions regarding gender roles in the mobility sector. Furthermore, youth who represent over 60% of Kenya's unemployed population often turn to informal boda bodas riding jobs for income due to a lack of viable employment alternatives. Compounding these challenges is the sub-sector's vulnerability to fossil fuel price volatility and the limited availability of alternative income streams during periods of economic uncertainty.

While significant research efforts, business models and policies have been reported on four-wheeled EVs in many countries, similar efforts on electric two-wheelers (E2W) and three-wheelers (E3W) are limited globally, despite these E2Ws and E3Ws offering several advantages and unique challenges that differ from those of electric four-wheeled vehicles. According to recent statistics, the global fleet of two- and three-wheelers as of 2023 was estimated to be about 812 million units, with E2W and E3W accounting for only 8% of this massive fleet, highlighting the enormous scale of both conventional and E2W and E3W [4, 5, 6]. The economic importance and usefulness of these 2- and 3-wheelers will continually lead to significant expansion in the size of fleets to meet demands. However, this growth comes with environmental consequences. In India, for instance, 2- and 3-wheelers were responsible for 92% of hydrocarbon and 74% of carbon monoxide emissions from the transportation sector according to a study reported in 2010 [7].

Thus, the transition to electric models (E2Ws and E3Ws) has a huge potential for reducing these emissions [7]. However, several infrastructural challenges in the dominant regions, where these lightweight vehicles contribute immensely to the economy, hinder this transition to e-mobility despite the clear need to mitigate their environmental and health impacts. China stands as the world transition leader, with its E2W fleet reaching an impressive 420 million units in 2023 [9].

In contrast, Africa's E2W and E3W market is in its early stages, and precise data on electric wheelers is scarce, with fewer than 100,000 units E2W and E3W in operation, primarily in Kenya, Rwanda, Tanzania, and South Africa [10].

The African continent has seen a very low increase in 2- and 3-wheeler electrification, rising from 1.50% in 2022 to 4.65% in 2023. Despite its current small lightweight electric vehicles (LEV) fleet size, Africa's E2W market shows promise, with forecasts suggesting that E2Ws and E3Ws could represent half of all sales by 2040, driven primarily by their lower operational costs. The disparity in current fleet size between Africa and other continents like Asia highlights the urgent need for significant research effort and models into the LEVs ecosystem, where the transition to e-mobility could significantly reduce greenhouse gas emissions, improve air quality and empower communities.

These challenges present a strong justification for developing an inclusive, sustainable electric mobility business model such as E2W and E3W and decentralised charging hubs which can open up new income-generating opportunities for youth and women, reduce dependency on fossil fuels price fluctuation, and enhance equitable access to clean and reliable transport across underserved communities. By shifting to zero-emission LEV and decentralised charging infrastructure, Kenya can significantly cut rural and peri-urban air pollution and transport-related carbon emissions, while unlocking a pathway to inclusive, low-carbon development to achieve part of “The Kenya Vision 2030”.

2. Solution

Addressing the low e-mobility transition in Kenya is essential for developing economies to reduce carbon emissions, improve rural and peri-urban air quality, and create inclusive green jobs for women and youth. SUNRUN directly respond to these imperatives by offering a decentralised E2W and E3W and charging hub tailored to local needs, while also embedding gender equity and local economic empowerment at the heart of the business model.

3. Defined methodolgy

The execution of the SUNRUN project followed a multi-stakeholder, phased business model that integrated technical deployment, community engagement, and capacity building. The methodology ensured alignment with both local contexts and broader sustainable business model goals:

3.1. Partnership Formation: A critical component of the SUNRUN project was the early identification and engagement of key stakeholders. The SUNRUN project adopted a strategic and inclusive stakeholder analysis framework to ensure that all stakeholders critical to the success of sustainable e-mobility implementation were effectively identified, engaged, and empowered. At the core of the partnership were E-Safiri and Kiri EV, two start-ups that provided on-ground technological solutions, including LEV deployment, battery swapping systems, and infrastructure logistics. Sustainable Transport Africa served as the lead administrative partner, coordinating stakeholder interactions and overseeing implementation fidelity across project sites. Glasgow Caledonian University (GCU), UK, played a central role as the research and capacity-building partner, contributing academic expertise in sustainable e-mobility systems, designing and delivering training curricula, and supporting evidence-based policy recommendations through research on current trends.

3.2. Pilot Deployment and Model Evolution: The project was rolled out in two phases

- SUNRUN Phase I tested a symbiotic model, linking LEVs with centralised charging hubs to establish operational feasibility.
- SUNRUN Phase II introduced a decentralised agency model, empowering local entrepreneurs, especially women and youth, to operate SUNRUN e-mobility packages independently.

3.3. Community-Based Implementation: The project adopted a grassroots-led implementation strategy by engaging community groups in Kisumu County, Kenya. These groups played a key role in piloting the e-mobility case study, managing operations, and co-developing the agency business

3.4. Training and Capacity Building: GCU designed and delivered structured workshops covering

- Safe handling of lithium-ion batteries and e-mobility fundamentals
- Solar-powered charging hub installation, operations and maintenance
- Integration of Internet-of-things technology for seamless real-time data collection
- Data collection strategies and analysis

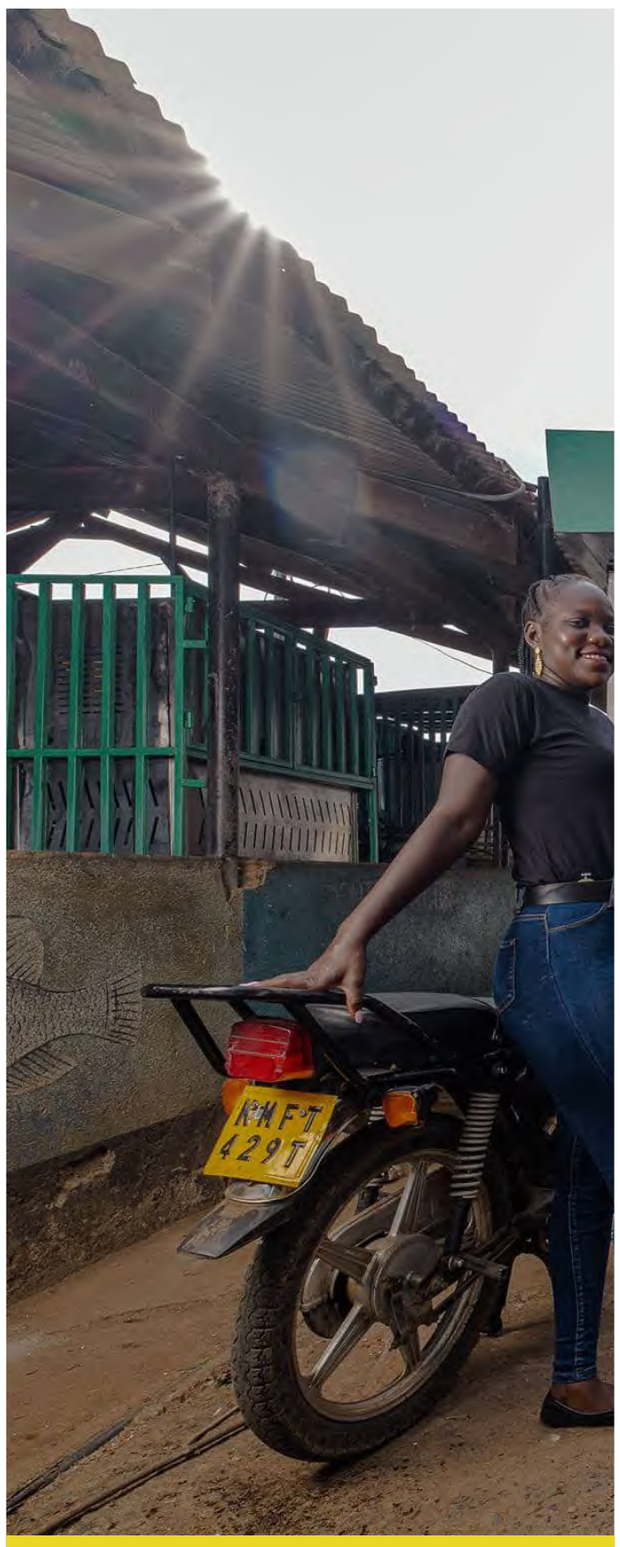
These training sessions ensured local ownership, gender inclusion, and practical knowledge transfer.

3.5. Monitoring, Evaluation, and Learning (MEL): The project used the P4G MEL framework to track progress and impact across key indicators, such as,

- Number of jobs created (with a focus on women and youth)
- CO_2 emissions avoided
- Community adoption rates
- Feedback from agents and riders
- Factors slowing down the e-mobility transition and uptake in rural Kenya

Data from surveys, interviews, questionnaires and site observations informed iterative improvements to both the technical and developed business models.

3.6. Policy Co-Creation: Recognising the importance of a supportive enabling environment, SUNRUN developed a suite of internal policies (e.g., ESG, health and safety) and collaborated with Kisumu County to reduce administrative barriers such as driver licensing fees to facilitate women's entry into the e-mobility sector.



4 Business Model

The SUNRUN project has pioneered a dual-phase business model to accelerate the adoption of e-mobility in Kenya, especially in underserved peri-urban and rural communities. The model evolved in response to local realities, combining infrastructure, clean transport, and inclusive entrepreneurship.

4.1 SUNRUN Phase I: The Symbiotic Model

In its initial phase, SUNRUN operated on a symbiotic partnership between Kiri EV (provider of electric two-wheelers) and E-Safiri Africa (provider of solar-powered charging and battery swapping hubs). The model was built on interdependence: electric motorcycles needed access to charging infrastructure, while charging hubs required a user base of LEVs to be viable. This tightly coupled approach allowed both companies to test technical feasibility, validate market demand, and establish operational workflows. The infrastructure and vehicles were deployed and maintained jointly, creating a robust product-service system tailored for last-mile mobility users. This phase laid the foundation for the next iteration of the model by building community trust and demonstrating proof of concept. However, it also revealed limitations in scale and decentralisation, particularly for expanding access beyond initial pilot areas.

4.2. SUNRUN Phase II: The Agency Model

In SUNRUN Phase II, the project introduced a more scalable and inclusive business model termed the agency model. Under this agency model, community-based entrepreneurs were allowed to own and operate bundled e-mobility businesses. Each "agent" could acquire a SUNRUN kit comprising: a solar-powered charging and battery swapping hub and a small fleet of LEVs.

The Key Components of the Agency Model are:

- Joint Venture Agreement: Kiri EV and E-Safiri formalised a joint venture outlining commercial, legal, and operational commitments.
- Agent Contracts: Agents are required to enter into commercial agreements with the venture, allowing them to operate local charging hubs and lease out LEVs.
- Policy Integration: All agents were required to adhere to SUNRUN's environmental, social, and governance (ESG) policies, as well as health, safety, and training protocols.

The agency model was designed to be replicable and community-led, enabling agents to generate income through LEV rentals, charging services, and fleet maintenance.

5. Results

Environmental Impacts: The integration of solar energy into charging and battery swapping for LEV has significantly reduced the carbon footprint of the transport sector in the rural and peri-urban areas. In these regions, E2Ws play a major role in transporting people and goods from one point to another. Through the SUNRUN project, the introduction and uptake of LEV units has seen a huge reduction in the consumption of petrol and diesel per internal combustion engine (ICE) 2-wheelers per day.

One fossil fuel-powered 2-wheeler utilises an average of 80-120 g/km of gasoline, depending on the engine size and efficiency, which is equivalent to about 100 g CO_2/km avoided. Over the project period, the LEV fleet size has grown from 2 units to 18 units, each covering an average of 200 km per day. This has seen a total of 218 t/CO2e of emissions avoided through the introduction of LEVs over the SUNRUN project period. This is expected to increase with continued adoption and use among the rural and peri-urban communities.

Social Impacts: The SUNRUN partnership has created 13 direct jobs (7 men and 6 women) among the two commercial partners - E-Safiri Africa and Kiri EV. The project has indirectly provided job opportunities to 26 youths and women as operators E2W vehicles for day-to-day operations and as a livelihood source.

Through the development of off-grid power systems, two communities in Dunga and Nyamasaria have had increased access to clean energy. The integration of additional productive uses, such as community lighting, phone charging, and solar lamp charging, has enhanced night security for the Dunga beach community. Provision of cold storage solutions has enabled 120 fish vendors to access reliable and affordable ice blocks from the solar-powered ice-maker with a capacity of producing 60 ice blocks per day.

The support technology adoption and community engagement, SUNRUN was also keen on capacity building for locals through organised groups of women and young people. The partnership worked with five community groups (Awuoth Widows and Orphans CBOs, Dunga Beach Management Unit, Kiumba Beach Management Unit and Kalasa Riders Sacco).

SUNRUN organised workshops to train the group members on electric mobility, cold storage solutions, battery swapping and charging activities and safely handling lithium-ion batteries. This supported knowledge transfer to the women's groups and riders on the benefits of electric mobility, renewable energy and on the agency business model.

SUNRUN partnered with the Angaza Project to inspire underrepresented groups in rural Kenya to engage with STEM (Science, Technology, Engineering and Mathematics). Through this engagement, the project engaged with over 1200 pupils and students across a range of primary and secondary schools and Maseno University.

Customer Experience: To capture user perspectives, SUNRUN documented testimonials from early adopters of the electric mobility solution. In a featured video, riders share how access to electric motorcycles and charging hubs has improved their daily work, reduced operating costs, and provided a more sustainable alternative to traditional fuel-based transport. One rider, Richard Agutu highlighted the benefits with enthusiasm and says *"Urahisi katika kazi - Making work easier!" as he expresses his enthusiasm from the support this experience has offered him, making his work more beneficial thanks to easier access to clean, renewable energy."*

Please watch the full customer experience video here: **https://youtu.be/1CscUoQrSQ0?si=4N7Za2kaW7wQCYYh**

Funds raised during the SUNRUN Phase II period: During the SUNRUN Phase II period, Kiri EV successfully raised a total of $240,000 through a combination of debt and grant financing. This funding has been instrumental in supporting the company's efforts to scale its electric motorcycle financing and adoption platform targeting bodaboda riders in Kenya. In addition to the monetary funding, Kiri EV also received $50,000 worth of non-monetary support, which includes technical assistance, business development services, and access to strategic networks. This blend of financial and in-kind support has strengthened Kiri EV's operational capacity, enhanced its visibility among stakeholders, and positioned the company for further growth and investor engagement.

6. Challenges and Solution

Despite high interest from potential agents, uptake of the agency model was constrained by the high upfront capital costs of the bundled product. Many organisations were interested but lacked access to affordable finance.

A key recommendation is to develop inclusive financing mechanisms, such as microfinance or asset leasing, tailored for e-mobility.

Policy Misalignment: Kenya's proposed Finance Bill would favour fully assembled vehicle imports through tax reductions, inadvertently disincentivising local assembly, job creation, and skills transfer. A more stable policy environment would also help companies in the sector plan long term investments better.

Investor Interest: Local venture capital engagement remains limited. SUNRUN's model highlights the need for blended financing and catalytic capital in early-stage e-mobility ventures.

7. Lessons Learnt

The lessons learnt include:

1. Bundling infrastructure and mobility services provides operational efficiency but needs targeted financial innovation for uptake.
2. Community engagement and local capacity building are critical for grassroots adoption.

8. Recommendations

1. National e-mobility policies should support local assembly and provide tax incentives for agents to invest in charging infrastructure and fleets.
2. Development partners and DFIs should support structured loan products for e-mobility agents, tied to ROI-based repayment plans.
3. Supportive financial instruments such as microfinance loans, asset-leasing, or government-backed credit guarantees are essential to make the agency model viable at scale. Regulatory support should also allow bundling of LEVs and infrastructure into a single financed product to improve affordability.

The SUNRUN business model demonstrates how integrated, locally grounded partnerships can unlock the potential of electric mobility. By aligning product innovation with inclusive ownership and environmental standards, SUNRUN offers a pathway to scalable, community-driven e-mobility across emerging markets.

9. Annexes

9.1 Annex 1: Data comparison on ESG and Financial Data

This section presents a comparison of baseline and current data for key indicators. It highlights SUNRUN's progress and impact across the financial and ESG data

Financial Metrics	Before P4G Funding	After P4G Funding	Notes
Revenue	$12,600	$186,355	Total revenue
Gross Profit	$-4,338	$136,069	Revenue minus cost of goods sold (COGS)
EBITDA	$-18,865	$87,555	Earnings before interest, taxes, depreciation, and amortization
Net Income	$-18,865	$61,288	Profit after all expenses and taxes
Operating Expenses	$-14,795	$48,494	Total expenses for operations
Cash Flow	$-15,158	$32,159	Net amount of cash inflow/outflow
Number of Consumers	3	80	Number of clients
Number of Offtake Agreements	0	5	Number of purchase agreements signed
Client Growth Ratio YoY	$12,600	$186,355	Increase of clients in the last year
Gross Margin Ratio	-34%	73%	Gross Profit / Revenue x 100
Gross Ebitda Ratio	--%	--%	Ebitda / Gross Profit x 100
Debt-to-Equity Ratio	0	0	Describe financial leverage in the last FY
Customer Acquisition Cost (CAC)	$30	$150	Cost of acquiring a new customer
Lifetime Value (LTV)	$250	$540	Total revenue expected from a customer
Investment Achieved	$80,000	$600,000	Investment achieved through equity, debt and mixed instruments

ESG Metrics	Before	After	Notes
Carbon Emissions (tonnes CO2e)	28 tonnes	241.5 tonnes	Total CO2 emissions in the last 1Y
People positively affected	10	100	These are individuals directly and indirectly positively affected by climate resilience or adaptation related to the climate business commercial partner product or solution.
Jobs created	1	12	Jobs created outside of the commercial partner
Gender Diversity (% female employees)	0%	20%	Percentage of female employees
Compliance and Risk Management	none	EPRA license, KEBS license, Certificate of Conformity,	Compliance Report (Laws and Regulations) Risk practices (processes and responsibilities) Risk management documentation (identification, mitigation and control) Audit policies (internal - external)
ESG Reporting and Transparency	none	Kilometres covered for CO2 emissions, no. of people trained in emobility, no. of employees M/F %	Frequency of ESG reporting (# reports per year), Adherence to Standards (GRI, SASB, TCFD) Clear governance structure Integration with financial reporting
Board Diversity	0%	0% no board	% of Women of the board members

The SUNRUN project team gratefully acknowledges the generous support of P4G (Partnering for Green Growth and the Global Goals 2030) for funding this initiative through their Partnership Fund. We extend special appreciation to Kisumu and Homabay County Government through the Department of Trade, Tourism and Industrialisation for their collaboration in pilot site selection and community engagement and the Awuoth Widows CBO and women rider groups who embraced this e-mobility transition framework.

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