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# SIMBARIDE – PILOT PROJECT FOR HYBRID SOLAR CONVERSION OF BODABODAS IN TANZANIA



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# **1.Project Overview: SimbaRide**

SimbaRide is an innovative conversion and electrification initiative targeting the East African motorcycle sector, with a focus on **bodaboda riders**—the most numerous and



Figure 1 Boda Boda

economically vulnerable transport operators in the region.

Rather than replacing entire vehicles with imported electric motorcycles, SimbaRide proposes a **modular retrofit system** that transforms a conventional motorcycle into a **hybrid, solar-assisted e-moto**. The core of the innovation lies in a **single electric wheel** (front or rear), which can be installed on an existing motorcycle and connected to:

a **lithium battery system** (48V/20Ah),

a **solar panel** for autonomous off-grid charging,

a controller and display unit, and

a charging interface for both solar and AC current.

This kit is designed to reduce fuel consumption by up to **30–40%**, extend the operational range of the vehicle, and provide riders with **partial energy independence**—particularly important in regions with erratic fuel supply or rising costs.

Beyond the technology, SimbaRide introduces a **new ecosystem**: one based on **localized transformation workshops**. These workshops will be responsible for:

- Installing conversion kits on used motorcycles.
- Training technicians in electric mobility systems.
- Providing after-sales service, repairs, and upgrades.

Each workshop functions as both a **technical hub** and a **community space**, a place where riders can access support, diagnostics, and eventually, even microfinancing options or lease-to-own programs for the kit.

SimbaRide's business model relies on three pillars:

Affordability: Riders pay a fixed, subsidized price (or staggered payments) with an expected ROI within 6 to 10 months, based on fuel savings.

**Scalability**: The system is modular and can be replicated across regions with minimal capital investment.

Sustainability: The entire system runs on solar energy, enabling operation in areas with limited grid access.

In summary, SimbaRide is not just a product—it is a platform for **energy justice**, **local industrial development**, and **inclusive mobility** in East Africa.

# 2.Context: The Challenge of Mobility and Energy in East Africa

East Africa is experiencing a period of rapid urbanization, population growth, and economic transformation. In cities like Dar es Salaam, Nairobi, Arusha and Kampala, transportation systems are under growing pressure to provide affordable, reliable, and sustainable mobility for millions of people. Among the most critical actors in this ecosystem are **bodabodas**— motorcycle taxis that have become the backbone of short-distance transport across the region. It is estimated that in Tanzania alone, there are over **1.5 million active bodaboda riders**, most of whom operate informal, cash-based businesses. These vehicles play an essential role in both passenger transport and last-mile delivery, especially in underserved peri-urban and rural areas. However, their economic model is increasingly under strain due to two major issues: **the rising** 



cost of fuel and dependency on imported fossilpowered vehicles.

The average bodaboda rider spends between 6,000 and 10,000 TZS per day on petrol. Given that many riders earn more than no 20,000-25,000 TZS/day, fuel expenses can absorb up to 40-50% of their income. leaving

little room for savings or reinvestment. Moreover, the global volatility of fuel prices, exacerbated by geopolitical shocks and supply chain disruptions, makes their livelihoods highly

Figure 2 Regular city in Tanzania, full of Boda Boda

insecure.

At the same time, the region faces serious **energy and climate challenges**. Transport emissions in East Africa are increasing, driven by the proliferation of inefficient two-stroke motorcycles. Electrification of transport is a growing priority, but efforts so far have largely focused on largescale, urban EV systems—buses, fleet vehicles, and private cars—leaving **low-income**, **informal operators behind**.

SimbaRide was born as a response to this gap: an initiative designed to **electrify the bodaboda economy** not through complex imports or full vehicle replacement, but through **localized**, **modular conversion kits**. These kits combine **a solar-charged electric wheel** (installed on the front or rear) with a **battery system**, **controller**, **and user interface**, allowing existing motorcycles to be upgraded without discarding them.

This approach addresses multiple layers of vulnerability:

- Economic vulnerability: by reducing fuel dependence, riders can **cut operational costs by up to 30–40%**.
- Energy vulnerability: the system is off-grid capable, powered by solar panels included in the installation pack.
- Structural vulnerability: by supporting the emergence of **local conversion workshops**, SimbaRide creates new jobs and technical training opportunities.

In this context, the SimbaRide project is not just a technological solution. It is a **social innovation**, a **sustainable mobility strategy**, and a **resilient industrial model**. It proposes to shift East Africa's transportation sector from dependency to autonomy—one wheel at a time.

# **3.Technical Description of the SimbaRide**

# **Retrofit Kit**

The SimbaRide retrofit kit is designed to electrify existing motorcycles with minimal structural modification, allowing conventional bodabodas to be partially converted into hybrid electric vehicles. The system combines core components sourced through local or regional partners, assembled and installed in local transformation workshops.

Component	Specification	Function	
Electric Wheel	48V, brushless DC, 1.2–1.5kW	Converts either front or rear	
(Hub Motor)	output	wheel into a motor	
Battery Pack	48V, 20Ah (LiFePO4 preferred	Energy storage with 60–80 km	
	for durability)	range	
Controller	Smart sine wave, 25A max	Regulates motor output and	
	current	safety logic	
Display Unit	LCD screen + throttle module	User interface: speed, voltage,	
		diagnostics	
Solar Panel	300W monocrystalline, flexible	Recharges battery autonomously	
	or framed	off-grid	
MPPT Regulator	48V solar charge controller	Optimizes solar input for battery	
		charging	
Charger (AC)	(AC) 48V/5A smart charger Allows overnight charging		
		the grid	
Battery Mount &	Custom welded frame +	Ensures secure and weather-	
Cabling	waterproof connectors	resistant integration	



### 3.1 System Features

- **Dual-charging capability** (solar + AC)
- **Plug-and-play architecture** for rapid installation (<2h)
- **Dust-proof, waterproof connectors** (IP65 minimum)
- Safety features: over-voltage protection, thermal cut-off
- Manual override for hybrid operation in case of failure
- Optional telemetry module for usage tracking and micro-leasing

### 3.2 Installation Requirements

- Compatible with most 125–150cc motorcycles with 18" or 17" wheel diameters
- Requires removal of original wheel + adjustment of brake system
- Battery and controller fixed in lockable side box or seat cavity
- Optional rear rack mount for solar panel when parked

# **4. Pilot Deployment Strategy**

# 4.1 Target Location: Arusha, Tanzania

The initial pilot of SimbaRide will be deployed in **Arusha**, a mid-sized Tanzanian city strategically located near major transport routes, rural communities, and tourist centers. Arusha has a **high density of bodaboda riders**, a growing demand for affordable mobility solutions, and access to technical labor and training institutions. The region also benefits from **strong solar irradiation**, which supports the off-grid nature of SimbaRide's hybrid energy system.

### 4.2 Local Partners

The pilot will be implemented in collaboration with a network of local stakeholders, including:

- **Bodaboda associations** (e.g., Arusha Riders Union) for user engagement and early adoption
- Vocational training centers (e.g., VETA) for technician upskilling and certification
- Local garages/workshops for physical transformation and maintenance

Figure 3 Example of an electric wheel? A MPPT Regulator and a solar panel • Solar energy NGOs or cooperatives (e.g., PowerCorner, Rafiki Power) for system integration

• **Municipal authorities** for legal clearance, pilot authorization and monitoring An exploratory phase has already identified **three potential garage partners** and one training center willing to co-host the transformation hub.

# 4.3 Deployment Phases

Phase	Duration	Description
Feasibility &	1 month	Site assessments, stakeholder meetings, adaptation of kit
Planning		to local specs
Training & Setup	1 month	Technician training, import/assembly of first kits,
		workshop outfitting
First Conversions	1 month	Installations on 5–10 test motorcycles, user monitoring,
(Beta)		bug fixing
Evaluation &	1 month	ROI monitoring, feedback loops, system improvement,
Scaling Prep		funding pitch updates

# 4.4 Deliverables at End of Pilot

- **10+ fully operational converted motorcycles** (eBodaboda Light)
- Impact assessment: cost savings, user satisfaction, system performance
- A fully equipped and trained workshop capable of independent conversions
- Trained technicians certified in electric mobility basics
- A refined deployment protocol for regional replication

# **5. Business Model and Financial Projections**

# 5.1 Revenue Model

SimbaRide operates on a **modular pay-as-you-convert system**, centered around three revenue streams:

1. Kit Sales or Leasing

Customers (bodaboda riders or cooperatives) can either:

- Purchase the full kit outright for ~2,660,000 TZS~1,043 USD
- Or enroll in a **lease-to-own plan** over 8–12 months, with optional solar panel add-on

#### 2. Workshop Installation Fee

Each kit includes a flat fee (~80,000 TZS~**31,37 USD**) paid to the certified workshop for installation and initial setup.

#### 3. After-Sales Services and Upgrades

Workshops can generate recurring revenue through:

- Maintenance (battery, motor, controller)
- Upgrades (higher-capacity battery, improved display)
- Battery recycling and resale programs

# 5.2 Customer ROI and Value Proposition

#### **Assumptions:**

- Rider travels 80 km/day, 26 days/month
- Consumes 3 L/100km, fuel at 2800 TZS/L
- Estimated **30% fuel savings**

#### Monthly figures:

Indicator	Value
Monthly fuel spend (before)	~17,500 TZS × 26 ≈ <b>455,000</b>
	TZS
Monthly savings (30%)	≈ 136,500 TZS
Kit + install cost	≈ 2,660,000 TZS
Estimated ROI	~ <b>19.5 months</b> (if 30% savings)
With subsidies/leasing	ROI < <b>12 months</b>

The system becomes **profitable within the first year**, especially if subsidized by NGOs or financed through micro-credit.

### 5.3 Financial Forecast (First Year Pilot – 50 Units)

While SimbaRide is designed to be financially sustainable through local kit sales and services, its core ambition is not profit maximization, but **environmental regeneration and equitable access to clean mobility**. Every wheel converted is not just a unit sold—it is a small climate intervention, a reduction in fossil dependence, and a step toward a decentralized, human-centered energy transition.

Item	Value	
	(TZS)	
Revenue (50 kits full price)	133,000,000	
Workshop payments (50 x	4,000,000	
80k)		
Logistics & panel costs	24,000,000	
Technician training & setup	8,000,000	
Gross margin estimate	~27–30%	

With modest volume, SimbaRide can become **positive cash-flow within one year**, assuming local assembly and gradual scaling.

#### **Risk Analysis and Mitigation Strategies**

Like any technological and social innovation deployed in emerging contexts, SimbaRide faces a variety of risks. These are categorized as **technical**, **financial**, **human**, and **structural**. Below is a detailed analysis of each, along with strategic measures to mitigate them.

### 5.4 Real Value for Riders: Economic, Social, and

### **Environmental Returns**

The SimbaRide model is not primarily built around profit—it is built around resilience.

Even when considered from a purely financial standpoint, the numbers hold: With an average bodaboda rider spending **455,000 TZS** (~**178.43 USD**) per month on fuel, the system's estimated **30% savings** translates to around **136,500 TZS** (~**53.53 USD**) per month. This means that the full kit cost—**2,660,000 TZS** (~**1,043.14 USD**)—is recovered in less than **20 months**, even without external support.

But the real strength of the model emerges when **financing support is introduced**:

- Through **mobile money leasing**, repayments can be spread over 10–12 months, with minimal upfront cost
- For example, with an initial deposit of **300,000 TZS** (~**117.65 USD**) and monthly payments of **230,000 TZS** (~**90.20 USD**), the system becomes financially manageable for most riders
- NGO co-financing or municipal subsidies covering 20–30% of the kit reduce the break-even point to under a year
- With **group-based microloans** or cooperatives, repayment rates improve and social pressure ensures responsibility

This means that from the very first month, a rider **experiences financial relief**, paying less per week than they would for petrol—**while progressively owning a cleaner, smarter vehicle**.

But SimbaRide's benefits are not only financial:

- ~2.5 tonnes of CO<sub>2</sub> avoided per year, significantly lowering the climate footprint of informal transport
- Less noise and mechanical fatigue, improving rider well-being
- A new job economy: local technicians, installers, solar maintainers
- New roles for riders: ambassadors, trainers, micro-distributors

And perhaps most importantly, it gives riders something fuel cannot: **control**. Control over when they move, how much they spend, and how much they pollute. Control over their own trajectory in a changing energy landscape.

In that sense, SimbaRide is not just profitable, it is **transformative**. It redefines what value means at the base of the pyramid: not more revenue, but more freedom.

Risk	Description	Mitigation Measures	
Component failure	Risk of early malfunction	Use robust IP65+ hardware,	
(motor, battery)	due to rough terrain or	partner with quality-certified	
	humidity	suppliers	
Incompatibility with	Some bodaboda frames may	Offer multiple wheel sizes,	
older motorcycle models	not accommodate the kit	develop a <b>compatibility</b>	
		checklist	
Solar charging	Limited sunlight, improper	Provide training on solar	
inefficiency	panel orientation	optimization, offer dual	
		AC/solar charging	

# **6. Technical Risks**

# 6.1 Financial Risks

Risk	Description	Mitigation Measures
Riders unable to	Financial barrier to	Partner with MFIs, SACCOs, or
afford upfront kit cost	adoption	develop <b>leasing models</b> with grace
		periods
Fluctuating import	Increases in hardware	Encourage local assembly, negotiate
costs (tax, shipping)	costs	customs waivers through
		NGOs/government
Unpredictable	Workshops may	Train mechanics in <b>preventive care</b> ,
maintenance costs	struggle to price long-	include annual maintenance package
	term services	

# 6.2 Human Risks

Risk	Description	Mitigation Measures
Resistance to	Some riders distrust electric	Launch early adopter program with
new tech	systems	demos and testimonials
Lack of skilled	Electric conversion requires	Partner with <b>VETA</b> and technical
technicians	specialized skills	schools for training and certification
Gender	Women may be excluded	Develop inclusive training modules
imbalance	from riding or repair roles	and target female-led workshops

# 6.3 Structural Risks

Risk	Description	Mitigation Measures	
Lack of public policy	No legal framework for	Engage with municipal transport	
support	conversion kits	authorities for pilot licenses	
Competition from	Low-cost Chinese e-motos	Focus on <b>retrofitting</b> , <b>local</b>	
imported e-motos	could flood the market	employment, and off-grid	
-		advantage	
Policy inconsistency	Sudden regulation changes	Work with local policy advisors	
		and maintain <b>public-private</b>	
		dialogue	

# 7. Financing Scenarios and Mechanisms

Because SimbaRide targets low-income informal workers, affordability and flexible access are essential. The financing strategy must balance **economic viability for riders** with **financial sustainability** for local partners and workshops. Below are four viable financing models.

# 7.1 Scenario A – Outright Purchase

- The rider pays for the full kit at once ( $\approx 2,660,000$  TZS, 986,86 \$)
- Best suited for cooperatives, early adopters, or riders with personal savings

Pros: Immediate ownership, no debt

Cons: Excludes lower-income riders, slower scaling

### 7.2 Scenario B – Lease-to-Own Model

- Riders pay a **monthly installment** over 10–12 months
- First payment covers installation + battery rental deposit
- The system becomes theirs once paid off

#### **Example terms:**

- Initial deposit: 300,000 TZS 111,30\$
- Monthly payments: 230,000 TZS, 85.33 × 12 months

**Pros:** Affordable, scalable, no interest

Cons: Requires monitoring system and recovery in case of default

### 7.3 Scenario C – Microfinance Partner Model

- Riders obtain a **loan from a microfinance institution (MFI)** (e.g., FINCA, BRAC, Pride)
- SimbaRide partners with the MFI to pre-approve loans for certified riders
- Reimbursement in 12–18 months, with possible group guarantee mechanism

Pros: Shared risk, promotes financial inclusion

Cons: Interest rates may be higher (15–20%), needs institutional partnership

### 7.4 Scenario D – Pay-as-You-Save (PAY Save)

- Riders pay weekly via mobile money (e.g., M-Pesa)
- The weekly amount is fixed at a % of their estimated fuel savings
- Payments are paused when the motorcycle is inactive (flexible repayment)

Example:

- Estimated fuel savings: 140,000 TZS/month 51.94\$
- Weekly PAYSave: 30,000 TZS,11.13\$ × 52 weeks = 1,560,000 TZS, 578.76\$/year
- Pros: Behavioral alignment, easy mobile integration, scalable

**Cons:** Requires backend platform for tracking and payment logic

Model	Target Users	Setup	Default Risk	Speed of
		Complexity		Adoption
Purchase	Middle-income	Low	None	Slow
Lease-to-Own	Informal riders	Medium	Moderate	Fast
Microfinance	Group	High	Low-	Medium
Loan	borrowers	-	Moderate	
PAYSave	All	High (tech)	Low	High

# 8. Estimated Environmental Impact

Beyond economic empowerment, SimbaRide contributes to a critical goal: **decarbonizing local transport systems**. In a region where motorcycles account for a growing share of CO<sub>2</sub> and particulate emissions, partial electrification represents a realistic and scalable path toward climate mitigation.

#### Per-unit impact (per converted motorcycle)

- Estimated fuel consumption reduction: 90 L/month
- CO<sub>2</sub> emission factor (petrol): **2.31 kg CO<sub>2</sub>/L**
- → Monthly CO<sub>2</sub> reduction: ~208 kg CO<sub>2</sub>
- $\rightarrow$  Annual CO<sub>2</sub> reduction: ~2.5 tonnes CO<sub>2</sub> per motorcycle

#### Pilot phase impact (first 100 kits)

- → Total annual CO<sub>2</sub> saved: **250 tonnes**
- $\rightarrow$  Equivalent to:
  - Offsetting the annual emissions of 55 average Tanzanian cars
  - Planting ~4,000 trees
  - Avoiding ~700 round-trip domestic flights (Dar–Arusha)

#### **Additional gains**

- Reduced particulate pollution from inefficient combustion
- Decreased fuel demand and import pressure

• Promotion of **solar literacy** and decentralized clean energy

This carbon reduction model positions SimbaRide as an ideal candidate for:

- Carbon credit certification (Gold Standard or VERRA)
- CSR partnerships with climate-aligned corporations
- Integration into climate adaptation and resilience strategies

# 9. Conclusion and Call to Action

SimbaRide is more than a technical solution—it is a vehicle for structural transformation. By targeting the heart of East Africa's informal mobility economy, the project offers a tangible pathway toward energy resilience, economic empowerment, and localized green innovation.

The model is scalable, modular, and inclusive. It does not ask for a complete reinvention of infrastructure, but rather a **re-purposing of what already exists**—the motorcycles, mechanics, the sun.

At its core, SimbaRide is a tool for economic liberation. With up to 30–40% savings on daily fuel costs, and a payback period of under one year, riders can regain control over their financial margins. By anchoring the solution in local workshops and training hubs, the project seeds not only savings, but skills and opportunity.

To succeed, however, SimbaRide must be backed by an ecosystem:

- Visionary local partners
- Public-private cooperation
- Microfinance facilitators
- Technology providers
- Policy champions

We invite all stakeholders, governments, NGOs, development agencies, and private investors—to join us in this mission. Whether through funding, field testing, technical support, or policy alignment, **your involvement can accelerate the deployment of SimbaRide at scale**.

Together, we can electrify not just wheels, but entire communities—quietly, sustainably, one ride at a time.