E-Mobility in Tanzania:

BUSINESS AND TECHNICAL INSIGHTS ON PRODUCTIVE USE CASES

Business Plan

Report by Green Wheels Tanzania Ltd.

ABOUT GREEN WHEELS TANZANIA LTD.

A Tanzania-based eMobility company, Green Wheels Tanzania Ltd. is working to transform Africa's local consumer markets through clean mobility, providing local businesses with sustainable, affordable, and efficient transportation solutions powered by 100% electric mobility, digital tools and access to clean energy.

At 47%, Africa is the fastest urbanizing region in the world, estimated to reach an urban population of 1.34 billion people by 2050, but its road and public transport infrastructures are underdeveloped, inefficient and can not keep pace with the growth resulting in congested cities and inefficient movement of goods and people.

Faced with slow-moving, unreliable and initially expensive transportation solutions, Africans have turned to affordable, mostly petrol-powered motorcycles, but they can be costly to run and also emit huge amounts of pollutants in comparison to cars.

Green Wheels Tanzania Ltd. mission is to lead Africa's transition to clean mobility, empowering local businesses to go green and work more efficiently by providing smart mobility services powered by 100% electric vehicles.

INTRODUCTION

In this brief paper, we present the existing business cases for a motorcycle to be leased by its owner and operated by a rider as a taxi. Alongside this, we compare it with a business case for electric motorcycles to be leased and operated in the same model. Data from this report was collected from interviews with local motorcycle owners and riders as well as suppliers and technicians.

MARKET ANALYSIS

Motorcycles (piki-piki) are a common means of transport in both rural and urban areas of Tanzania and their prevalence is growing.

Revenue in the Motorcycles market is projected to reach US$240.50m in 2023.

Revenue is expected to show an annual growth rate (CAGR 2023-2027) of 4.22%, resulting in a projected market volume of US$283.70m by 2027.

The market's largest segment is On-road Motorcycles with a projected market volume of US$113.70m in 2023.

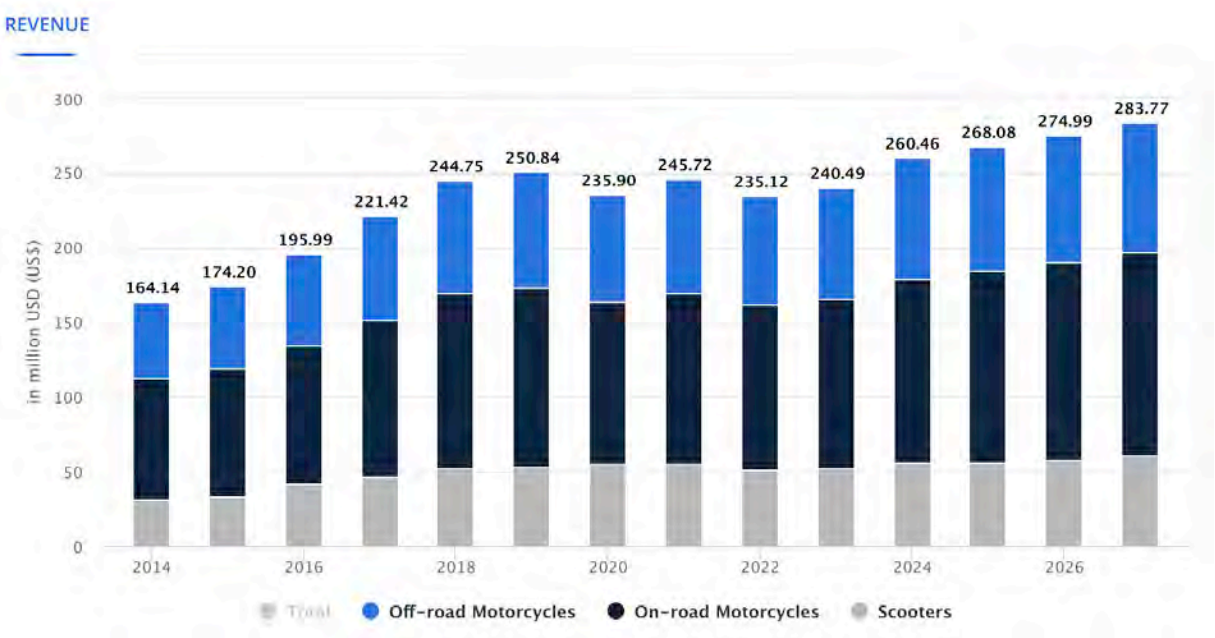
Motorcycles market unit sales are expected to reach 136.70k motorcyles in 2027.

The volume weighted average price of Motorcycles market in 2023 is expected to amount to US$2.03k.

BACKGROUND

The motorcycle industry’s sales are closely connected to economic stability, and dramatic fluctuations, like the financial crisis of the late 2000s, force manufactures to reexamine their strategies and adapt to new market trends.

Additional factors are currently driving changes in the industry such as environmental concerns and a surge in fuel prices. This is influencing an increased demand for electric motorcycles.

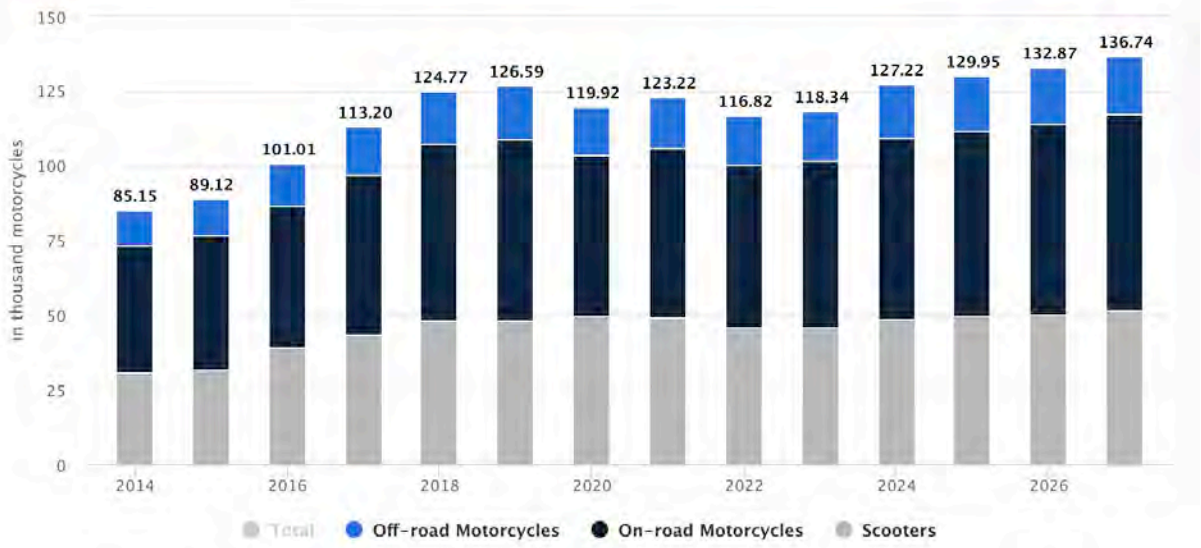


Notes: Data shown is using current exchange rates. Data shown does reflect market impacts of Russia-Ukraine war.

Most recent update: Nov 2022

Source: Statista Market Insights

UNIT SALES

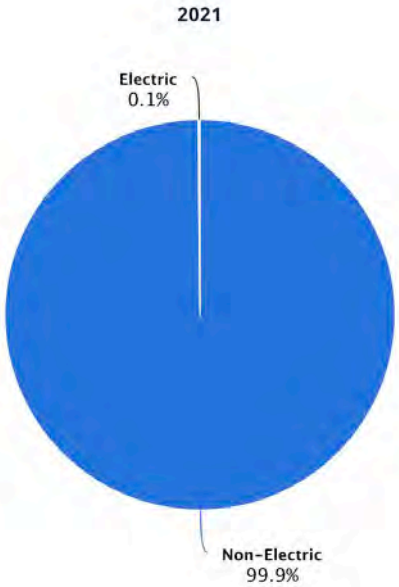


Most recent update: Nov 2022

Source: Statista Market Insights

FUEL SHARE

in percent



Most recent update: Nov 2022

Source: Statista Market Insights

BUSINESS MODEL CONSTRUCTION: MOTORCYCLE TAXI LEASING AND RENTAL BUSINESSES

BUSINESS MODEL OVERVIEW

Motorcycle taxis, called “boda-bodas” in Swahili, are commonly seen throughout Tanzania. Boda-bodas typically have designated areas that they are assigned to collect passengers from, resulting in frequent one-way trips from the same location without a return passenger.

In most instances, boda boda riders do not own their motorcycles but instead rent them for a daily rate, due to the high cost of purchasing. The motorcycle owners pay for all maintenance costs and typically own multiple bikes that they rent to the same riders on a recurring basis.

OPERATING ASSUMPTIONS

For the business model, we modeled that the riders travel a maximum 80 kilometers per day and earn a revenue of 50`000 - 80`000 Tsh (20$) based on surveys conducted with riders. The riding frequency was modeled at 7 days a week, 50 weeks per year as riders typically work six to seven days per week and take few breaks. In Arusha, the local rental fee for boda boda riders to rent a petrol powered motorcycles is 25`000 Tsh (10$) per day (Bajaj Boxer 150).

For the electric motorcycle case, we present a model with a rental fee of 30`000 Tsh (12.20$) per day. The increased rental fee is including the insurance, maintenance and electricity (battery) fee for 80km. replacing the fuel costs the riders have using petrol powered bikes.

ENERGY ASSUMPTIONS

Fuel consumption varies based on terrain, bike condition, and driving, but riders interviewed bought an average of two liters of fuel each day at 3`000 Tsh ($1.22) per liter. In our business model the rider pays for the fuel as it is normal in Tanzania.

For electric bikes, Green Wheels Tanzania’s operational data found that double battery packs that had a combined 4.062 kilowatt-hours of usable energy were able to power an electric motorcycle for an average of 160 kilometers. Grid electricity can be used to charge the batteries at a rate of 357.00 Tsh ($0.145) per kilowatt-hour. The lifespan of the battery packs is about 2000 cycles. In our business model the electricity costs are covered by the owner.

MAINTENANCE ASSUMPTIONS

The regular maintenance costs for petrol motorcycles are usually covered by the owner of the motorcycle, which need to be done every 400 kilometers and cost about 5,000 Tsh ($2.00).

The maintenance costs for electric motorcycles is substantially lower since there is no combustion engine to service, no oil changes, no fuel filters, no chain etc. resulting in a higher income for the owner.

EQUIPMENT ASSUMPTIONS

For our model, we priced a new petrol motorcycle at 3.1M Tsh (1`262.00 $), which is in the middle range of models commonly used by boda-boda riders. For the electric model, we included the approximate cost our electric motorcycle EV60 with one battery of 4`164`907 Tsh (1`696.50 $).

Assuming regular maintenance, the motorcycle is expected to depreciate by 50% after 4 years. A similar rate was used for the electric motorcycle. Lastly, a 75/150$ yearly insurance fee was added in.

BUSINESS MODEL SUMMARY

USISS MODEL TYPE:	Leasing model 1 - Revenue split
BUSINESS MODEL DESCRIPTION:	Flat rental fee paid by the motorbike operator to the owner
MOTORBIKE OWNERSHIP:	Motorbike owner maintains ownership
ENERGY COSTS FINANCIER:	Petrol- Motorbike operator. Electricity- Motorbike owner.
MAINTANANCE COSTS FINANCIER	Motorbike owner
CONVERSION RATE	$1.00 USD = 2,455 Tsh

BUSINESS MODEL INPUTS (USD)

	INPUT	UNIT	PETROL MOTORBIKE	ELECTRIC MOTORBIKE	REMARKS / DATA SOURCE
#	**OPERATING ASSUMPTIONS (BUSINESS)**				
1	Average km traveled per day	km/day	80	80	Based off of rider surveys
2	Operation days in a week	day/week	7	7	Based off of rider surveys
3	Operation weeks per year	week/year	50	50	Based off of rider surveys
4	Rental/Leasing fee per day	USD/day	$ 10	$ 12.20	Based off of rider surveys
	OPERATING ASSUMPTIONS (ENERGY)				
5	Energy cost	USD/L or USD/kWh	$ 1.11	$ 0.145	Based off of local fuel and electricity costs
6	Average fuel consumption per day	L/day or kWh/day	2	2	Based off of rider surveys
7	Average battery pack usable energy storage	kWh/pack	0	2	Based off of Green Wheels operational data
8	Average distance traveled per battery pack	km/pack	0	80	Based off of Green Wheels operational data
9	Energy consumption	Km/L or Km/kWh	40	**40**	Petrol: Based off of rider surveys. Electric: Calculated from Inputs 7, 8
10	Energy cost per Km	USD/km	**$ 0.0275**	**$ 0.003625**	Calculated from Inputs 9, 5
	REVENUE ASSUMPTIONS				
11	minimum Revenue per day	USD/day	$ 20.3	$ 20.3	Based off of rider surveys
12	minimum Revenue per Km	USD/km	**$ 0.25**	**$ 0.25**	Calculated from Inputs 1, 11
	CAPITAL EQUIPMENT ASSUMPTIONS				
18	CAPEX Cost	USD	$ 1`262.00	$ 1696.50	Petrol bikr cost based off of average petrol bike cost. Electric bike cost based off of cost for EV60.
19	CAPEX Life Expectancy	Year(s)	4	4	Based off of supplier interviews
20	Salvage Price as Percentage of CAPEX Cost	%	50%	50%	Based off of owner interviews
21	1J comprehensive insurance	fee	$ 75	$ 120	Based off of insurance company interviews

UNIT RIDER ECONOMICS

Per Km	Unit	Petrol Motorbike	Electric Motorbike
Revenue	USD/km	$ 0.25	$ 0.25
Rental Costs	USD/km	$ 0.13	$ 0.15
Driver petrol costs	USD/km	$ 0.03	$ 0.00
Gross Profit (Driver Profit)	**USD/km**	**$ 0.09**	**$ 0.10**

Per Day			
Revenue	USD/day	$ 20.36	$ 20.36
Energy Costs	USD/day	$ 2.44	$ 0.00
Rental Costs	USD/day	$ 10.00	$ 12.20
Gross Profit (Driver Profit)	**USD/day**	**$ 7.92**	$ **8.16**

Per Week			
Revenue	USD/week	$142.52	$142.52
Energy Costs	USD/week	$17.08	$0.00
Rental Costs	USD/week	$70.00	$85.40
Gross Profit	**USD/week**	**$55.44**	**$57.12**

OPERATION FINANCIAL SUMMARY

OPERATOR	Petrol Motorbike	Electric Motorbike
Minimum Main Revenue (Service Fees)	$ 6840.96	$ 6840.96
Other Revenues	$ -	$ -
Total Net Revenue	**$ 6840.96**	**$ 6840.96**
Direct Costs - Fuel (Petrol/ Electricity)	$ 819.84	$ 0.00
Gross Profit	**$ 6020.16**	**$ 6840.96**
Expenses		
Rental Fee	$ 3 360	$ 4099.20
Insurance	$ -	$ -
Maintenance		
Other Expenses	$ -	$ -
Motorbike Depreciation (1st Year)	$ -	$ -
Total Expenses	$ 4179.84	$ 4099.20
Earnings Before Taxes	**$ 2661.12**	**$ 2741.76**

OWNER	Petrol Motorbike	Electric Motorbike
Main Revenue (Leasing Fees)	$ 3 360	$ 4099.20
Other Revenues	$ -	$ -
Total Net Revenue	**$ 3 360**	**$ 4099.20**
Direct Costs - Fuel (Petrol/ Electricity)	$ -	$ 106.15
Gross Profit	**$ 3 360**	**$ 3993.05**
Expenses		
Rental Fee	$ -	$ -
comprehensive Insurance	$ 75	$ 1 20
Maintenance		
Frequently & Must Do Maintanance	$ 180.00	$ 45.60
Total Maintenance Costs	$ 180.00	$ 45.60
Other Expenses	$ -	$ -
Motorbike Depreciation (1st Year)	$ 157.75	$ 215.52
Total Expenses	$ 412.75	$ 381.12
Earnings Before Taxes	**$ 2947.25**	**$ 3611.93**

DISCUSSION OF RESULTS

When viewing the unit economics, we find that electric motorcycles have operating energy costs eight times less than their petrol equivalents, which is a benefit to the owners. In our modeled scenario, the reduced fuel costs are offset by an increased rental fee, resulting in no net benefit to the rider.

The owner of the electric motorcycle is expected to save on maintenance costs but have higher depreciation and insurance costs, such that their overall costs over five years are similar. In our modeled scenario, we project higher revenues and a better ROI with electric motorcycles as a result of the increased rental fee and lower maintenance costs.

Overall, the electric motorcycle is shown to be more cost and energy effective than the petrol motorcycle. The owner reaps the benefit and increases the earnings by 22%.

CONCLUSIONS

electric motorcycles are compatible within the existing, local renting model used by many motorcycle taxis in Tanzania and offer financial incentives for riders and owners to switch. Since many motorcycle owners already have multiple bikes that they purchase and rent out. It is also clear that there are individuals with the financial capacity to purchase a higher cost asset, such as an electric motorcycle.

We see a lot of potential for this segment to transition from petrol to electric, as it is familiar to what currently exists, but offers better returns.
From here, we see that the market stand to benefit from this change, and so too the environment.

Our e-Motorcycles and battery-swap system

We chose the EV60 for our fleet. It is the perfect tool for the boda-boda business and offers great value for future applications. With a reach of up to 200km, speed of max. 80kmh and two exchangeable battery packs it is everything we could have hoped for and offers far more then any motorcycles of the competition.
The addition of available charging stations, smartphone apps, digital battery pack analysis tools, GPS, 4g, fleet control etc. are the cherry on top we could only dream of. The battery swap- and charging stations provide instant delivery of power for the riders and offer the possibility for future expansion in the sector of energy-providing for Green Wheels Tanzania ltd.
After initial equipment tests and good experience with a responsive supplier we knew to have found our perfect business partner and product solution.

BATTERY SWAPPING PRODUCT

- Electric Motorcycle

EV60 Ideal for Express Delivery

EV60R Special for Motor Taxi

80KM/h	120N.M	100/200KM	SMART
MAX SPEED	MAX TORQUE	MAX RANGE	BMS

√ Intelligent high-speed electromotor
√ Fast power swapping/super long range/excellent handling
√ High Loading Capacity
√ Lithium battery cycle life over 2000 times

EV60R

- LFP Lithium Battery

4G+GPS Module with Independent Communication Protocol

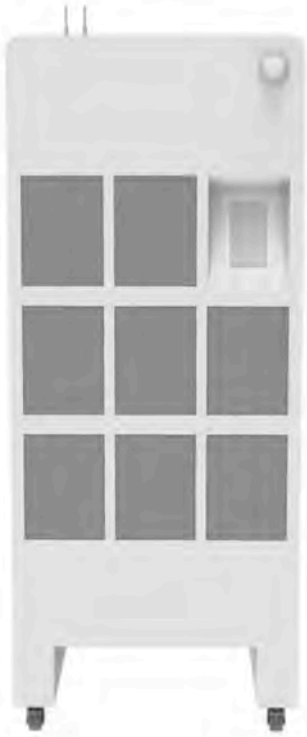
The battery can transmit data to platform in time to receive instruction in purpose of optimizing BMS logic for better performance.

BMS - Patented Battery Management Module

Safe charging and discharging with protection for overcurrent, overvoltage, high temperature charging, disconnection, short circuit and fault alarm based on high-precision core algorithms of SOC and SOH.

Topnotch Power Cell Supplier

IP67 protection, aluminum shell explosion-proof, cycle life more than 2000 times.



BATTERY SWAPPING PRODUCT

– Smart Swapping Cabinet

Independently Developed Modules for Charging and Management

With function of charging identification, charging control and timely detection.
Protection for overcharge and voltage gap.

Support for Self-service Swapping and Remote Swapping

3 Seconds quick swapping, in compliance with outdoor installation standards.
support battery status alarms and automatic processing, remote upgrading and on-time management.

Customizable Appearance

Appearance and cabinet specifications can be flexibly customized.

Independently Developed Main Control System

Receive platform instructions to optimize BMS logic

Temperature Control Device

Meet the charging needs under different ambient temperatures

DISTRIBUTED BATTERY SWAPPING SYSTEM

The battery swapping cabinets are distributed outdoors in communities, streets, and commercial centers, to avoid unexpected risk caused by indoor charging.

Over 2000 full cycles, around 6 years of service life

BMS-Battery Management System

High-precision core algorithm for setting SOC and SOH guarantees a safe charging and discharging, available with protection functions as overcurrent, overvoltage, high-temperature charging, disconnection, short circuit, fault alarm, etc

First-class power lithium iron phosphate battery

IP67 (dustproof and waterproof), aluminum shell with super heat dissipation

BATTERY SWAPPING SYSTEM

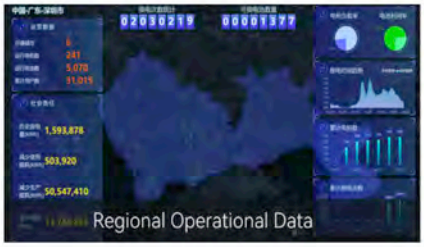
– SaaS Platform

√ Big data management platform, architecture design of megascale data concurrency, multi-level and multi-page database structure.

√ Full coverage of alarm management based on complete SOC and SOH algorithms.

√ Complete display of real-time data or past record on demand.
Coupling of the charge-discharge curve for the same batch battery is realizable.

√ Management of full life data, comparison of Battery SOH and pre-judge of big data failure.



MOBILE ENERGY LOT SAAS PLATFORM

The entire battery swapping process and data can be monitored by the SaaS platform through the user's APP and operator program

Operating Management

Provides operation and management functions for battery swapping, battery rental and e-motorcycle rental, which greatly facilitates service sites and operators.

Maintenance Management

Manage swapping stations and batteries, and perform remote maintenance and troubleshooting, enabling operators to maintain more efficiently.

Assets Management

Assets can be managed for batteries and cabinets, and scan code for on-site ordering, and delivery confirmation.

BATTERY SWAPPING

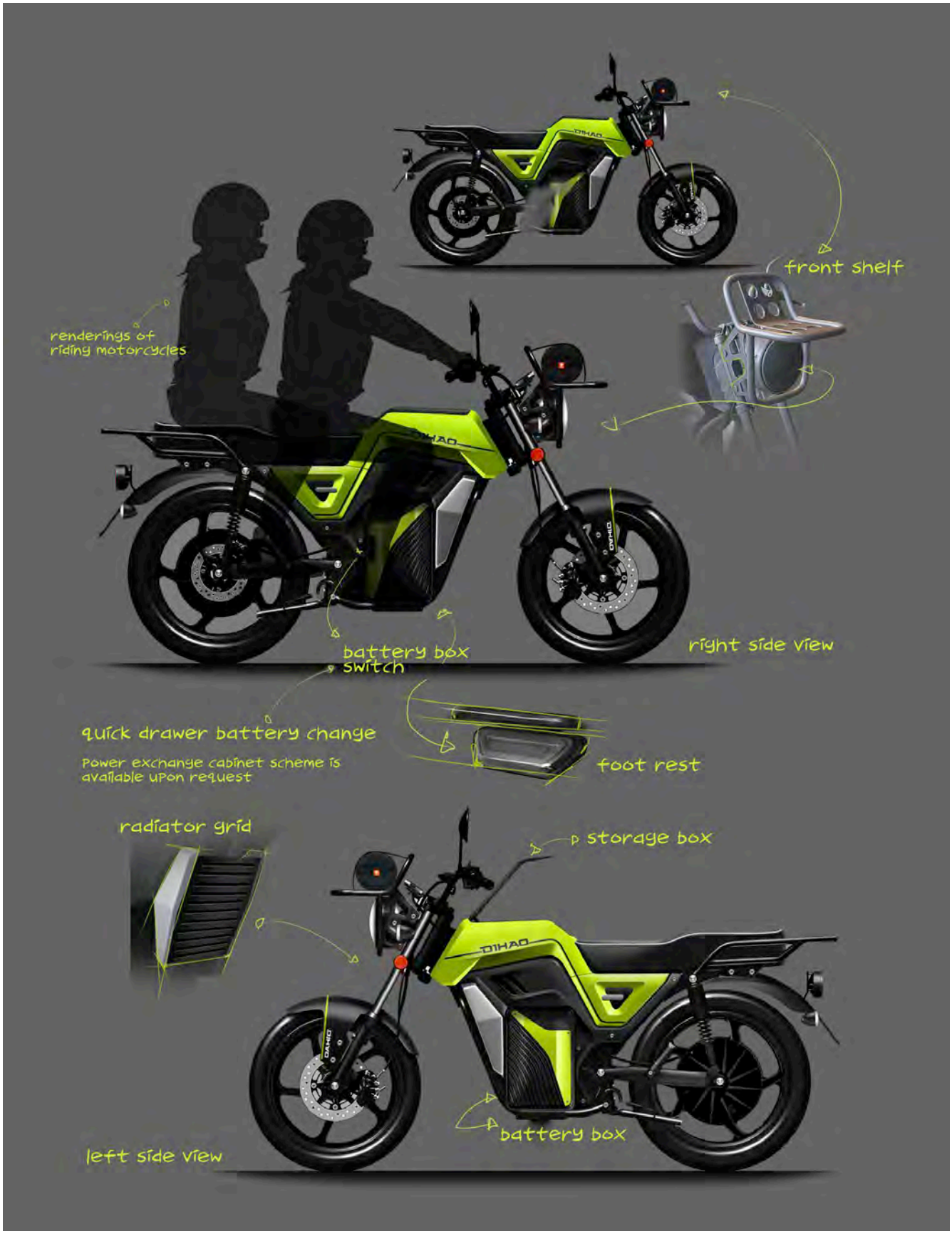
Nearby Stations
Battery Rental
Scan to Swap
Scheduled Swap
Offline Swap
Battery Return

USER

User Info
Real-name Authentication
My Package
My Deposit
Customer Service

BATTERY

Battery Remaining
Battery Position
Route Tracking
History Record


front shelf
renderings of
riding motorcycles
battery box
switch
right side view
quick drawer battery change
Power exchange cabinet scheme is
available upon request
foot rest
radiator grid
storage box
battery box
left side view

DIHAO EV60

Most professional high speed motorcycle for Delivery / Motor Taxi

60s fast charging Drawer-type one-pull power exchange, applicable to special power exchange cabinet/individual household charging

All-inclusive frame-type lockable battery anti-theft design assures a worry-free using experience

Unique high trafficability easily copes with various road conditions

Adapted to various road conditions with a ground clearance up to 200MM, matching with deep-tooth tires, Excellent climbing ability of 15°

Strong load capacity, both for delivery and motor taxi

Specially designed for delivery – Strong carrier can be equipped with super-large capacity side/tail boxes, available with extra front shelf with more loading space

Specially designed for motor taxi - lengthened and thickened long seat cushion, high strength rear shock absorber provides a more comfortable riding experience.

PARAMETER EV60R :

Length	1800mm	Motor modes	2 levels (Eco+ Sporty)
Height	1050mm	Max speed	70Km/h
Width	710mm	Max range	190km
Seat height	760mm	Peak torque	140n.m
Wheel base	1260mm	Gradient	14°
Min ground clearance	200mm	Charger	80V 10A
Net weight	120kg	Charging time	3.0h (one battery)
Display	LCD Display	BMS	Smart BMS
Lithium battery	55.2Ah / 4062Wh (27.6Ah*2)	Cell type	LFP lithium
Motor	72v 2000w DC hub motor	Driving mode	Direct drive
Controller	FOC controller	Brake modes	Hydraulic Fr./Rr. Disc
Fr. & Rr. Lights	LED	Suspension mode	Standard type
Tyre size	Fr 2.75-18 Rr 90/90-17 Vacuum		

Above data is under laboratory testing and factory reserves the right for explanation and modification.
(Warnings: Patent products, do not imitate.)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STARTUP BUDGETING

INITIAL START-UP BUDGET OVERVIEW	BUDGET	ACTUAL	UNDER/OVER
EXPENSES			
BIKES 35 (20 DUAL , 15 SINGLE BP)	$ 74,337.50		
SPARES	$ 2,000.00		
MARKETING	$ 2,120.00		
INVENTORY	$ 4,000.00		
COMMUNICATION	$ 100.00		
EMPLOYEES	$ 690.00		
RENT	$ 1,100.00		
PRE LAUNCH LABOUR EXPENSES	$ 800.00		
INSURANCE	$ 840.00		
DIGITAL WEB	$ 250.00		
LICENCES AND PERMITS	$ 1,500.00		
BATTERY SWAP STATION	$ 5,250.00		
OTHER	$ 1,000.00		
TOTAL INITIAL EXPENSES	$ 93,987.50		
FUNDING			
LOANS		$ 100,000.00	
	$ -	$ 100,000.00	
FUNDING LESS EXPENSES			$ -

START-UP FUNDING	BUDGET	ACTUAL	UNDER/OVER
INVESTORS			
OWNER 1 0% Interest Loan	$ -	$ 100,000.00	
OWNER 2		$ -	$ -
			$ -
			$ -
	$ -	$ 100,000.00	
TOTAL	$ -	$ 100,000.00	$ 100,000.00

PROJECTED AVERAGE MONTHLY COSTS			
START-UP BUDGET OVERVIEW	BUDGET	ACTUAL	UNDER/OVER
EXPENSES			
INSURANCE	$ 350.00		
EMPLOYEES SALARY	$ 690.00		
TRANSPORT	$ 34.00		
RENT	$ 1,100.00		
COMMUNICATION AND INTERNET	$ 100.00		
ELECTRICITY	$ 152.00		
MISCELLANEOUS EXPENSES	$ 150.00		
TOTAL	**$ 2,576.00**	**$ -**	**$ -**

ESTIMATED REVENUE - 1ST YEAR	YEARLY EARNING	80%OF 35 UNITS	TOTAL YEARLY
Revenue per Bike per year	3677.93	28 units	102982
Yearly expenses			-30912
Earning before taxes			72070

SUMMARY

Green Wheels Tanzania ltd. will offer the boda-boda riders a package that in many ways exceeds their current business model. We will introduce a rental flat-rate that includes not only a perfectly serviced and clean superior e-motorcycle, but also the insurance, energy costs, protective clothing, and a brand they can represent with pride. This will be very appealing, not only to the riders, but also to the end-client - the guest on the back seat.

Our environmentally friendly business concept will be appealing to investors in green-tec, government branches, national parks, golf courses and where ever silent and clean modes of transportation are in demand. Additional, our battery swapping stations will offer the option to expand in to the very lucrative energy supplier market. For Tanzania this means less import of fossil fuels while spending foreign exchange and results in cleaner and quieter environment. Our business model is extremely scale-able, introducing a new advanced technology solution to an already existing market.

- Rico Rosenberger, Director

- Zainab Rosenberger, Director