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# Final Report: Mass-Market Electric Motorcycle Taxis

# **MASS-MARKET ELECTRIC MOTORCYCLE TAXIS**

**REDUCING POLLUTION, IMPROVING COMMUNITY HEALTH, AND  
SUPPORTING ECONOMIC AND FUNCTIONAL NEEDS FOR BODA DRIVERS IN  
EAST AFRICA.**

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## **DISCLAIMER**

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## ACRONYMS

ADS	Automated Directives System
DEC	Development Experience Clearinghouse
FY	Fiscal Year
SOW	Statement of Work
USAID	U.S. Agency for International Development
DFC	Development Funding Corporation (USAID)
AFP	Asset Finance Partner
CNC	Computer Numerical Control
ODM	Original Design Manufacturer
OEM	Original Equipment Manufacturer
MOU	Memorandum of Understanding
LOI	Letter of Intent
SACCO	Savings and Credit Cooperative Organization
EAC	East African Community
SAFE	Simple Agreement for Future Equity
RTO	Rent To Own (finance lease contracts)
ICE	Internal Combustion Engine (petrol bikes)
UN	United Nations

## **ABSTRACT**

Ampersand is an energy distributor to taxi motorcycle drivers (boda bodas). Ampersand operates in Rwanda and Kenya with goals to be the energy provider for motorcycle taxis across East Africa. The following report discusses the impact, business, and financial goals, successes, and lessons of this grant period starting in May 2020 and highlights the future of Ampersand and its impact on community health, the planet, and boda drivers in the region.

## **EXECUTIVE SUMMARY**

Ampersand launched commercial operations in 2019 with a pilot of 20 bikes and 3 battery swap stations in Kigali, Rwanda. With the support of USAID over this grant term, Ampersand now has over 700 bikes and 12 swap stations primarily in Kigali and a small pilot in Nairobi and has become the largest electric motorcycle taxi and battery swap network in East Africa. The impact of this work is directly reducing harmful emissions, enhancing local economies, and improving lives across the region. With investment into research and development and a model proven to be both commercially viable and scalable, Ampersand is now prepared to scale to reduce even more of the 80m tons of CO<sub>2</sub>e stemming from motorcycle transportation and improve livelihoods.

For Ampersand some goals at the times of starting the project were; to demonstrate the solution works for commercially operating bodas, to prove the business model works enabling further capital raises, to invest in research and development to ensure safety, efficacy, impact, and scaling potential, and to prepare for expansion into new markets and new strategic partnerships.

During the grant period, Ampersand has developed a model to efficiently assess and expand operations leading to significant expansion within Kigali as well as a launch in Nairobi. It has also developed local and national relationships with Rwandan governments to inform and support energy transitions. This work has led to more supportive policies and regulations as well as ambitious decarbonization targets. With limited data at the outset of the project, additional investment into climate and urban health benefits research shows that with the largely renewable grids in both Rwanda and Kenya, there is direct improvement in emissions and pollution by using Ampersand's motorcycles.

Climate and environmental impacts are central to electrification but Ampersand has found that financial benefits are greater than expected and drastically improving lives in Kigali. With rising fuel prices and heightened reliance on foreign fuel sources due to international conflict, the economic benefit of Ampersand's electric motorcycles for drivers continues to increase. Analysis shows that drivers are conservatively taking home 35% more income as offset by lower energy costs and fewer service and maintenance needs. As fuel costs continue to be unpredictable, Ampersand shows much less volatility in energy prices giving drivers a sense of income security and more ownership over their income.

As part of this project, Ampersand sought to further develop strategic partnerships to enable focused and efficient scaling going forward. The company has established relationships with key asset finance partners (AFPs) to eliminate the rent-to-own model previously managed internally by Ampersand. Between the 5 existing AFPs, more than 50,000 bikes have already been requested over the next 2 years. Due to proven zero-to-minimal default rates on Ampersand bikes, asset finance partners are also offering lower rates to Ampersand motorcycle owners, bringing monthly payments on bikes down to cost parity with ICE vehicles and eliminating barriers to access for drivers. Ampersand is now working to fulfill a waitlist of over 7,000 drivers.

Additionally, Ampersand has developed a regional partnership with TotalEnergies for expansion in Kenya. This partnership expedites the facilities selection and clearances process when looking to open a new charging station in the country. This opportunity for a more turn-key model for swap stations has been extremely valuable as Ampersand expands in this market which is significantly larger than Rwanda's.

The project has demonstrated that Ampersand can:

- Reduce pollution – Each bike on the road reduces 5 net tons of GHG/year compared to petrol bikes
- Reduce reliance on foreign fuel – Replacing petrol with grid electricity largely supplied with geothermal and hydro renewables (Rwanda and Kenya)
- Improve and help stabilize driver income – Proven savings on energy costs and maintenance
- Maintain functional and strategic partnerships – Asset finance partnerships (Watu, M-Kopa, Jali, Tugende, BBoxx) and strategic partnerships (TotalEnergies)
- Efficiently and effectively expand – Successful local expansion in Rwanda and country expansion to Kenya

### **A. Key Objectives**

The key objectives of the project focused on areas that Ampersand needed to prepare for growth, expansion, and scaling. Objectives were centered on the following:

- **Software Product Roadmap** – The software product roadmap was Ampersand's technical blueprint to ensuring bikes, batteries, and customer software be reliable and meet customer needs and that backend software (AmperOps) support operations and meet the needs of our asset finance partners. The Ampersand technology is key to success and impact and investment in research and development in the area was crucial to catapulting Ampersand to the top of the market.
- **Finance Partnership Strategy** – Ampersand explored whether it should manage Rent to Own (RTO) contracts or work with established AFPs to outsource loan management. The AFP strategy guided Ampersand in its approach to establishing commercial AFP partnerships and reducing company liability as well as allowing Ampersand to more directly focus on its strengths; technology and energy network creation.
- **Charging Interoperability Specifications** – Ampersand is prioritizing interoperability for our batteries as well as charging stations to help expedite the transition to electric motorcycles especially in East Africa. As the electric motorbike market expands, Ampersand can continue to grow and lead by providing the energy network to other electric motorcycle platforms. The roadmap for interoperability is an important strategy and has been a key input to the ongoing next-generation battery development as well as a focus point of strategic partnerships.
- **Increased Customer Volume** – Ampersand needed to demonstrate successful operation management at commercial scale by; adding more bikes to the fleet, expanding the charging station network, validating the technology at commercial volumes, and establishing and executing a scaling model.
- **Private Capital** – In order to meet growth objectives, Ampersand needed capital funding including both debt and equity to meet hardware, operational, and tech needs. A goal in this period was to raise at least \$1M in private funding while optimizing use of existing funds and continuing operations and prepare for ongoing fundraising.

- **Expansion Framework** – Ampersand planned to make its first expansion beyond Kigali during the grant period. The Expansion Framework was developed and implemented as Ampersand expanded into Nairobi, Kenya. The framework will also act as a guide to facilitate expansion to other countries and secondary cities in Rwanda moving forward.

## **B. Key Results and Lessons**

- **Software Product Roadmap** – Ampersand learned it needs to serve customers’ needs while building functional and flexible systems in order to scale and serve different markets and use cases. Customers care deeply about both the range of the vehicle (km per full battery charge) and about reliability. Any extended time drivers spend off the road means they are unable to earn income. Ampersand designed, developed, tested, and introduced a new battery with accompanying software that is more reliable with significantly longer range than the original pilot batteries. The new improvements maintain the power needed for a demanding, high-use drive cycle while providing a low-cost LCOE (levelized cost of energy).

The software was improved to meet multiple needs. It better optimizes battery health through adjustable charging, accepts quick, cashless payments as is standard for the motorcycle taxi industry, and has an asset finance partner portal for AFPs to communicate on loans.

Unfortunately, though not uncommonly, Ampersand experienced significant issues with supply chain and switched bike suppliers to ensure a reasonable turnaround time between purchase and delivery. Going forward, Ampersand will seek to address continued supply chain issues with our next generation bikes and batteries by diversifying supply chains, manufacturing more of the battery supplies on site, and working to establish stronger partnerships to ensure timelines on delivery.

- **Finance Partnership Strategy** – At the end of evaluating this objective, Ampersand learned that the complexity of setting up loan financing would have been an obstacle to growth and would have diverted focus on impact. It has, therefore, retained 50 RTOs with some initial customers but now has relationships with 5 AFPs. During the rapid growth phase, cash flows were significantly improved by working with AFPs and allowed Ampersand to get over 700 bikes and 1000 batteries in operation. AFPs are also experts in the market and have had decreasing rates of interest for Ampersand customers due to factors including low default rates and increasing government incentives for electrification. Also, in a UN funded gender equality project, we have sold 15 bikes to new women bodas in Rwanda and have maintained those loans in house under preferential loan rates to help those new female bodas establish themselves in what is a very male dominated profession.
- **Charging Interoperability Specifications** – A key learning during this period was that while interoperability is crucial to curbing transport-based emissions in the region, the role Ampersand can play now is to ensure systems are best setup for interoperability and that waiting for active collaboration from OEMs at this stage will only delay the transition. Ampersand attempted to engage multiple OEMs (e.g., TVS, Bajaj, Hero) in a project to provide them with Ampersand technology and batteries for use in their motorcycles. However, while the OEMs voiced interest in working with Ampersand, they estimate being at least 2 years from producing an electric motorbike for the region. The OEMs have not shared specifics on this timeline but one assumption is that priority lies in other regions like India. In the meantime, Ampersand will continue to include interoperability considerations in research and development. One example is inclusion of expanded testing and safety standards for the new battery which is currently in development. This will allow for greater and more seamless operability in wider range of platforms.

- **Increased Customer Volume** – In order to continue to increase credibility in this emerging market and in order to maintain leadership and momentum in the space, Ampersand learned that timely and ongoing production and handoff of bikes is crucial. The project targeted 200 motorcycles in commercial operation in Rwanda by the end of the project. As of October 2022, Ampersand has over 700 bikes in operation in Kigali and Nairobi, 300 currently being manufactured in Rwanda, and the materials for 400 more ordered and arriving this year end for production in Q1 2023. With these estimates, Ampersand will have over 800 bikes in operation by the end of 2022 and 1,400 in operation by the end of Q1 2023.
- **Private Capital** – The new financial model, developed with the support of DIV Venture Assistance, supported that the company needs significantly more private capital over the next 5 years to meet growth targets. Previously, Ampersand raised \$6M in equity and \$9M in debt during the award period. It closed \$4M Series A equity in Q1 2021 from Ecosystem Integrity Fund, Factor[e] Ventures, and TotalEnergies Ventures as well as \$2M SAFE in May 2022. At the end of 2021 Ampersand closed a \$9M loan facility from DFC.
- **Expansion Framework** – Key learnings in this area were that each region and country in Ampersand’s expansion may have different pathways to growth and that Ampersand can both have a framework model and be flexible to launch and scale in different markets. During this time, Ampersand developed a roadmap for expansion which was put into practice for expansion into Kenya. This document outlines Ampersand’s considerations, conclusions, and current strategy for business expansion across geographies and services. The framework is a main reference point for expansion considerations together with any new information and learnings gathered. During expansion into Kenya, Ampersand set up a new subsidiary in the country, is building a team, and developed a strategic partnership with TotalEnergies to build swap stations at their existing petrol station locations in Nairobi. This model is new for Ampersand and is an example of building in flexibility because while it is successful for Kenya, it is not the only option for expansion and Ampersand remains open to adaptations.
- **Strategic Partnerships** – A learning from this period that enhances many of the objectives of this grant is that Ampersand can further develop its strategic partnership opportunities. The first example is the successful launch of a Kenya-based partnership with TotalEnergies. The partnership with Total includes putting Ampersand charging swap stations at existing Total petrol stations. Given the natural alignment between energy needs for drivers and the turn-key opportunity for expanding the charging network in Kenya, this is a successful partnership and accomplishment. Because of this partnership, Ampersand has been able to expand the charging network more quickly than expected in Nairobi and, as Kenya is a larger market, it is encouraged by the opportunity to drive impact in the country sooner.

Ampersand has also developed training and driver-launch programs for women during this period. There was unexpected interest from potential female drivers that now has 24 women driving Ampersand motorcycle taxis in a market so small there were iteratively less than 30 registered female drivers prior to the Ampersand program. Because of this interest, Ampersand is also expanding partnerships with local and international programs focused on female representation in traditional male industries in East Africa including manufacturing, engineering, motorcycle operation, and other relevant skills. These partnerships include technical training schools and programs, educational organizations, and funders focused on equity and diversity.

Lastly, Ampersand has been focused on building relationships with local and national government agencies and departments to expand the opportunity for electrification in East Africa. Already these relationships have contributed to changes in taxes and tariffs as well as other electrification incentives. Ongoing conversations show that Ampersand’s perspective and input are valuable in informing clean transportation ambitions in the regions Ampersand works.



Ampersand will continue to be open to new and unexpected partnerships to drive growth and impact.

### C. Next steps

In the next stages of the business, Ampersand will be focusing on a few major priorities. These priorities include:

- **Market Growth** – Growth for Ampersand includes scaling in existing markets (Rwanda and Kenya) and expansion to a new country (either Uganda or Tanzania). Ampersand aims to have 5,000 bikes in operation by the end of 2023 and 20,000 bikes in operation by the end of 2024.
- **Fundraising** – In order to reach growth goals, Ampersand needs more capital. The company is raising a Series B fund as well as concurrent debt and has an open SAFE.
- **Technology Improvement** – A new (MK2) battery is in development and expected to be in operation by the end of 2023. This battery will have expanded safety standards as well as expanded interoperability across platforms. The MK2 will also use more widely available battery cells that will significantly de-risk the supply chain by allowing Ampersand to diversify its sources. At the same time, this new technology will bring more manufacturing capabilities in house that will rapidly shorten development and testing cycles and will provide high value jobs and skills locally. Ampersand also aims to introduce self-designed electronic components that consolidate the functions of multiple expensive components that we now have to buy separately. Not only will this improve production time, but can also ensure more predictable costs for component production. We are also exploring producing our own ODM bike using top tier motorcycle manufacturers. Again, this will improve quality, reliability, and applicability to our markets' use case and at the same time reduce costs and simplify the supply chain as described below.
- **Supply Chain Improvement** – As mentioned above, the technological improvements also have considerations across the supply chain. As global buyers struggle with supply chain reliability, Ampersand aims to improve issues by diversifying sources and bringing more production on-site. While Ampersand can currently buy from the few sources that produce the exact components needed, with the intended improvements, the potential sources expand considerably. This expansion of potential sources opens not only opens competitive markets for cost negotiation but also ensures greater reliability on delivery times by having materials coming from different sources. Instead of being held to the timelines of one source, deliveries from multiple sources can mean that partial needs can be met in the meantime. With these improvements, bikes and batteries can be produced quicker, reducing the wait time between purchase and delivery for customers and improving scaling speeds with greater reliability.
- **Operational Optimization** – A key component of Ampersand's success is an efficient and highly effective system across hardware and software. Ampersand will continue to invest in technology research and development to get the bike to battery ratio to an ideal 2:3 or less and ensure swap stations and apps are highly efficient. A goal is to have most stations operating without attendants while ensuring an excellent customer experience.
- **Impact** – Ampersand was created to drive positive impact for the climate and the communities it works in. This continues to be a priority moving forward. One area Ampersand aims to improve is in operational and customer gender diversity and opportunities. This includes expanding programs to educate, train, and support more female drivers, bringing more women in to manufacturing, engineering, and technical roles at Ampersand, and ensuring growth and leadership opportunities for women. Ampersand is also working to evaluate full lifecycle opportunities for batteries and looking into other operational sustainability improvements. Lastly, Ampersand wants to contribute to the research around community health improvements by reducing emissions from transport and is exploring partnerships and technologies to lend to

the research and improving the data around reduction in emissions and the impact on community health especially from air pollution.

## BACKGROUND

### The Market and the Problem:

UN Environment (formerly UNEP) estimates there are 5 million motorcycle taxis, known locally as motars or boda bodas, in 5 of the core East African Community countries (Kenya, Uganda, Tanzania, Rwanda, and Burundi). Extended to Sub Saharan Africa, it is estimated that there are over 30 million motorcycle taxi drivers. The drivers are generally hard-working, low-income individuals taking home on average a few dollars per day, supporting on average 4-5 person households.

Nearly all of the motorcycles sold to and used by motars in Sub Saharan are 100cc to 150cc ICE vehicles and are produced without standard European regulations on emissions. The 150cc ICE motorcycles used in Rwanda likely produce 16x worse air pollution than Euro 3 standard cars. They are dirty and noisy and emit nearly as much carbon per km as a car and are travelling an average of 160km per day, six days a week. As Africa's population grows from 1.4 billion today to an estimated 2.5 billion by 2050, viable and sustainable decarbonization plans are crucial to curbing the approximate potential 7.1 Gt of CO<sub>2</sub>e. Further, this assumption of 3 tons of CO<sub>2</sub> emissions per person is largely driven by motor vehicle fuel emissions. Electrification of this fleet is vital to meeting greenhouse gas reduction targets.

In Rwanda there are 100k commercial bodas, with at least 25k of them operating in Kigali making 60% of urban traffic motorcycle taxis, a key component of the transport ecosystem across the continent. Due to the high use and high volume of motorcycle taxis, they are also significant contributors to urban air pollution which have documented negative effects on community health. Though studies on air pollution in the region are minimal, it can be inferred that the boda-preferred ICE motorbikes that lack basic mechanics and technology used to reduce emissions have an outsized negative impact on air quality. Even then, current data shows that electrifying all East Africa's motorbike taxis by 2030 would reduce motorbike greenhouse gas (GHG) emissions by up to 93%.

Beyond the climate, environmental, and health impact, drivers in the motar industry are also suffering financially due to high gas prices. Even before the soaring prices, it is estimated that drivers spent approximately 90% of their pay on fuel and maintenance for their fuel motorbikes. That estimate is even higher with increasing fuel prices and decreasing supply options from foreign suppliers. This volatility is especially impactful for motorcycle taxis which are the largest consumers of fuel in the country of Rwanda. It is hurting drivers and their families. Without cleaner, more affordable options, motorcycle taxi drivers and their families have no choice but to remain on this unpredictable trajectory.

Despite the market being ready for and in need of electrification, historically, there have been four challenges raised by motorbikes taxi operators:

- **Low quality batteries:** Widely available, off-the-shelf electric motorbike batteries are low quality and their power and reliability do not meet the needs of motars.
- **High upfront costs:** The cost of high-quality batteries that could meet this market's needs are very expensive, more than doubling the cost of the motorcycle if sold together with the vehicle. Most customers are unwilling or unable to pay that cost, or to take on that level of debt with a lender (if they could obtain such a loan).
- **Long charging time:** Motorcycle taxi drivers who work 13-hour days, 6 days a week cannot afford to wait hours for batteries to recharge. Even fast charging solutions, which are still slower

than fueling, are costly and degrade the lifespan of batteries to the extent that it is not possible to recoup the battery costs of production and still offer cheaper power than fuel.

- **Minimal energy network availability:** Even with the battery type, battery cost, and charging time solved, a user still requires a sufficiently extensive, conveniently-located, user-friendly and reliable network of locations to obtain energy approaching or exceeding the comparable options offered by gas stations which did not exist.

### **Ampersand - The Solution:**

Ampersand addresses all four of the challenges to electrification while putting money back into the pockets of drivers and fueling local economies, fighting climate change and improving community air quality, and building a scalable, adaptable energy business.

The Ampersand solution includes:

- A proprietary smart battery pack designed and developed on the ground in Rwanda which has been uniquely specified for Africa's commercial motorcycle fleet serving the needs of the market with high durability and high performance, and a low overall energy cost per km.
- Battery-as-a-Service (BaaS) model providing customers access to quick and easy battery swaps from an extensive network of swap stations located conveniently across service areas.
- Proprietary technology, including AmperOps, allowing Ampersand to constantly improve batteries and operational efficiency with less waste.
- A uniquely easy and functional electric motorbike adapted to the needs of Ampersand drivers with convenient options for financing.
- Cost parity on vehicle purchase by maintaining ownership of the batteries and enrolling Ampersand motorbike owners in the battery swap network,
- A cheaper energy option for 25% less per km than petrol but charged according to the amount of power used similarly to fuel.
- Reduced need for service like oil changes and engine maintenance but with trained and certified local and in-house mechanics when a need arises.

A few points make Ampersand especially unique in the market. Ampersand was the first company to create an affordable electric motorbike option for the 100-150cc motorcycle taxi market in East Africa. The Ampersand electric motorbikes are unique in the match of speed, acceleration, and power compared to current petrol motorcycles at the same price point. However, the motorbikes exceed incumbents in ease of use, need for service, and value proposition.

While Ampersand currently produces and sells the full electric motorcycle system, it is leading the market with the battery and software integration. Successfully operating a fleet of batteries relies heavily on key metrics which we developed a proprietary operations software to address. AmperOps provides data points to understand several parameters around battery health and life. Currently, batteries have a lifespan in excess of 7 years. Our software backend constantly monitors battery performance, manages deployment, and assess maintenance needs in real time. This is key to tracking batteries, enabling swaps that take less than 2 minutes, and keeping costs low on battery replacement.

AmperOps data also allows Ampersand to optimize swap operations' needs. It allows for quick and easy cashless swap transactions and enables the company to communicate useful information to customers and asset finance partners. Ampersand is exploring opportunities to share and distribute relevant data for maximum economic, community, and environmental impact.

Ampersand is providing drivers with affordable electric motorcycles and charging station infrastructure. Swap stations utilize the predominantly clean grids in East Africa creating immediate climate and air quality impact. Switching to Ampersand saves drivers at least 35% of their income. Drivers are using less income on fuel with Ampersand's lower energy cost and also spending less on maintenance and service so are saving more of their money for what matters to them: family, education, and improved livelihoods. It is changing lives and protecting the planet.

### **Ampersand – The Company and Organization:**

Ampersand was founded in 2014 just as e-mobility was starting to take off globally. The dominant paradigm, then and now, has been that electric vehicles would be adopted first in Western Countries gradually cascade down to general adoption. But as things played out, it would take many decades for the progression of this to actually replace the bulk of fuel vehicles, especially in developing countries.

The founding of Ampersand began with a search for that product-market fit and by 2016 it had become clear that the greatest opportunity, despite technical challenges, was within the vast fleet of 100-150cc motorcycle taxis in East Africa. These vehicles could be replaced by offering an electric motorcycle and swappable lithium-battery: a vehicle and energy solution that did everything petrol motorbikes did, for the same group of customers, without requiring behavior change. A motorbike and fuel solution that is better and cheaper, and just happens to be electric.

Ampersand raised seed financing in 2018 and developed a business pilot offering electric motorcycles and battery swap network for motorcycle taxi drivers in East Africa. Now Ampersand's focus is scaling as a transport energy provider which is driving impact across the region.

As of November 2022, we have over 700 motorcycles on the road (in Kigali and Nairobi), a network of 18 swapping stations (7 in Nairobi), and collectively our bikes drive over 3,000,000 km per month. Ampersand plans to have over 800 motorbikes in operation by the end of 2022 and 5,000 by the end of 2023.

### **Overview of the Project:**

At the inception of the DIV project in May 2020, Ampersand had a pilot of 20 e-motos in commercial operation with 3 swap stations in Kigali, Rwanda. With the \$500k of grant funding from DIV the intent of the project over the following 3 years was to develop the technology and demonstrate adoption and commercial viability of Ampersand's e-motos and swap station network in Rwanda, and build a plan for expansion in Rwanda and into other East African countries. Because of this investment, Ampersand is set up for even greater expansion with better technology and systems, and is ready to scale.

In addition to the \$500k grant from DIV, Ampersand also received a grant from Shell Foundation in 2020 for \$600k to further support the project. A Series A private equity round in April 2021 of \$4M followed by a debt facility of \$9M from Development Finance Corporation ("DFC") has launched the growth that the project was designed to spur.

## **PROGRAM DESIGN & IMPLEMENTATION**

### **Project Plan - Goals and Targets:**

The project focused on proof of concept and validating the impact, technology, and business plan in preparation for scale. The below milestones were agreed upon:

- Project Implementation Plan (MS 1)
- Software Product Roadmap (MS 2)
- Asset Finance Partnerships (MS 3)
- Updated Implementation Plan (MS 4)
- Technical Specification Document (Interoperability) (MS 5)
- Verification of Additional Private Capital (MS 6)
- Commercially Operational Motorcycle Milestone (MS 7)
- Implementation Report - Asset Finance Learnings (MS 8)
- Expansion Framework and Software Product Roadmap Execution (MS 9)

**Project Plan - Implementation:**

Ampersand’s main customer demographic is the existing commercial petrol motorbike drivers (boda drivers) in its current operating cities of Kigali, Rwanda and Nairobi, Kenya. Nearly all Ampersand e-moto drivers were formerly petrol-bike boda drivers with the exception of the 29 female drivers who are new to the industry. This is a scalable and open market for electrification with a direct impact in emissions reduction directly improving air quality and reducing air pollution for drivers and the community, and a direct financial impact for drivers (customers) who are bringing in greater income for themselves and their families either by reducing their outgoing costs and therefore retaining more of their earned income.

The beneficiaries of Ampersand expansion and success, however, can be expanded beyond just the drivers to also include other community members who benefit from less air pollution and greater consideration of the climate impact of the transport sector in East Africa, as well as those who are employed throughout Ampersand’s expansion. Ampersand strives to create a highly competitive job offering with top-of-market benefits for employees.

To implement the project while tracking and evaluating impact, the following summarized KPI’s were developed at the start of the project. The table below provides an indication of cumulative impact from the start of the grant to November 2022:

<b>Indicator Name</b>	<b>Indicator Definition (Summary)</b>	<b>Grantee Definition (Summary)</b>	<b>Result (Nov 2022)</b>
<b>Number of innovation units deployed</b>	The number of product/service/process deployed/implemented through USG assistance.	Innovation Unit: Ampersand e-motos in operation	750 Units
<b>Number of direct beneficiaries</b>	The number of individuals that benefit directly from USG-funded product/service/activity. Direct beneficiaries include those who purchase, use (paying or non-paying customers), or directly benefit from USG-funded product/service/activity.	A direct beneficiary is a moto taxi driver who has transitioned from a petrol-powered motorcycle to an e-moto and is in possession of an operational e-moto at the time of the reporting cycle	770 Units (20 more than those deployed during grant as they were already operational prior to grant period)

<b>Amount of follow-on funding</b>	The awardee should report all financial or in-kind contributions by non-USAID partners against a USG award. At baseline, i.e. at time of award, the awardee should report external funding received until that point. Post-baseline, follow-on funding will include <b>additional</b> contributions made after the start date of the award. Follow-on funding should only include <b>*Received*</b> funds (not Committed). Follow-on funding should be reported at time of award, and incrementally from then on (i.e. new Follow-on funding only).	[Custom definition not required]	Equity: \$4M DFC Loan: \$9M total
<b>Number of new resource providers contributing additional investment in USG award</b>	The count of <b>new</b> resource partners identified that provide follow-on funding (in-kind or financial) to support the USG award. Please only count partners who have never provided funding to the innovation before.	[Custom definition not required]	3: Public (Debt) - DFC (USAID)  Private (Equity) - Ecosystems Integrity Fund - TotalEnergies
<b>Demonstrated uptake</b>	<b>Demonstrated uptake</b> includes any support for, or adoption by, the public and/or private sectors at any point during the reporting period. This does not include uptake by beneficiaries (i.e. individual customers or end users) or by bilateral or multilateral donor organizations (including adoption by USAID Missions).	[Custom definition not required]	- 5 AFPs
<b>Semi-Annual Sales (Revenue)</b>	The total value of semi-annual revenue (USD) derived from the <b>sales</b> and/or deployment of a USG-funded product/service as a result of USG assistance.	Sales are measured as a combination of revenue generated from battery swaps, bike sales, interest payments, vehicle maintenance, and vehicle "top-up" merchandise sales	
<b>Total cost of operations</b>	The direct expenditures attributable to the sale/delivery of USG-funded product/service/activity to reach each direct beneficiary. The cost should include all project and core costs, costs of purchase, costs of conversion, and other direct costs incurred in	Cost of operations will be defined as the following - 1) Charging station CapEx and OpEx, including batteries 2) S&M costs	

	producing and selling the USG-funded product/service/activity.	3) Vehicle, battery, and charging station maintenance 4) G&A costs 5) Capex of vehicles	
<b>Average household savings</b>	Measures the average household savings in target population where USG-funded award is implemented.	Household average savings will be defined as the additional take home pay of an Ampersand e-moto taxi driver compared to a petrol taxi driver.	
<b>Greenhouse gas (GHG) emissions reduced, sequestered, or avoided, through clean energy supported by USG assistance</b>	This indicator reports the estimated quantity of greenhouse gas (GHG) emissions, in metric tons of CO <sub>2</sub> -equivalent, reduced, sequestered, or avoided supported in full or in part by USG assistance, as compared to a baseline level of GHG emissions.	E-motos: Based on net savings of 2.4 tons CO <sub>2</sub> -e per bike per year (adjusted to recent research).	Cumulative to November 2022: 1,085 tons

The following focus areas were defined to meet the milestones of the project. The implementation and outcomes of the focus areas are described below:

### Technology – Technology Product Roadmap:

Rapid scaling requires a detailed roadmap of the design, development, execution, and implementation of the technology that can sustain expansion. The project targeted the creation, review, and integration of a *Technology Product Roadmap* for Ampersand’s scaling. The *Technology Product Roadmap* and a report on the implementation were submitted during the project.

Further expansion on the *Technology Product Roadmap* and its results are included below:

Focus Area	Objective	Achievements
<b>Batteries</b>	To develop a plan for the design, development, and integration of a battery fit for scaling.	<ul style="list-style-type: none"> <li>Development and integration of over 1,000 batteries supporting over 750 bikes and 70k swaps/month</li> <li>Design for a next generation battery (MK2) to meet scale over 50,000 batteries</li> </ul>
<b>Vehicle</b>	To design and develop plan for the integration of an improved motorbike drivetrain <sup>1</sup> (mid-drive	<ul style="list-style-type: none"> <li>Over 750 vehicles on the road</li> <li>47% hub, 53% mid</li> </ul>

<sup>1</sup> Drivetrain: the system in a motor vehicle which connects the transmission to the drive axles. (Oxford Languages)

	compared to hub-drive <sup>2</sup> ) including supply chain sources. ( <i>Visual 1.1</i> )	<ul style="list-style-type: none"> <li>• New vehicle-part partner, TailG<sup>3</sup> – delivering an order for bikes</li> <li>• Mid-drive motorbike, giving 15-20% improvement in range per dollar of energy, in operation</li> </ul>
<b>Swap Stations</b>	To improve the swap stations for easy replicability and set up and to create software to effectively and efficiently monitor swap data in real time.	<ul style="list-style-type: none"> <li>• Development of a plan, partners, and suppliers for quick and cost-effective creation of new swap stations</li> <li>• 11 stations in Kigali and 7 stations in Nairobi</li> <li>• Integration of AmperOps software for real-time monitoring</li> </ul>
<b>AmperOps (Software Management System)</b>	To create a software program to be integrated across operations including swap stations, customer use, and asset finance partnerships. ( <i>Visual 1.2</i> )	<ul style="list-style-type: none"> <li>• Integration of AmperOps to monitor real-time battery use and health, digital driver payments, efficient swaps, tech updates and charging optimization, driver communications, asset finance payments and communications, and other data tracking for ongoing optimization.</li> </ul>
<b>Asset Finance Partnerships</b>	To integrate AFPs into Ampersand systems and develop strong working relationships with more AFPs moving forward.	<ul style="list-style-type: none"> <li>• Launch of partnerships with 5 AFPs</li> <li>• Lowered interest rates for Ampersand drivers compared to many petrol-bike drivers due to low-to-no defaults on Ampersand bikes</li> <li>• Launch of Ampersand Finance Partner portal for AFPs</li> </ul>

*Visual 1.1*

<sup>2</sup> A mid-drive motor is positioned right in the middle of the e-bike, around what’s known as the bottom bracket area. Essentially, it sits inside the cranks (the arms on which you attach pedals), and it applies force directly to the mechanical drivetrain – the traditional collection of parts that make a bike move forwards. A hub motor however, sits inside the front or the rear wheel hub and while it works in essentially the same way it can feel very different for the rider. ([Pure Electric](#); 2021)

<sup>3</sup> [TailG](#)

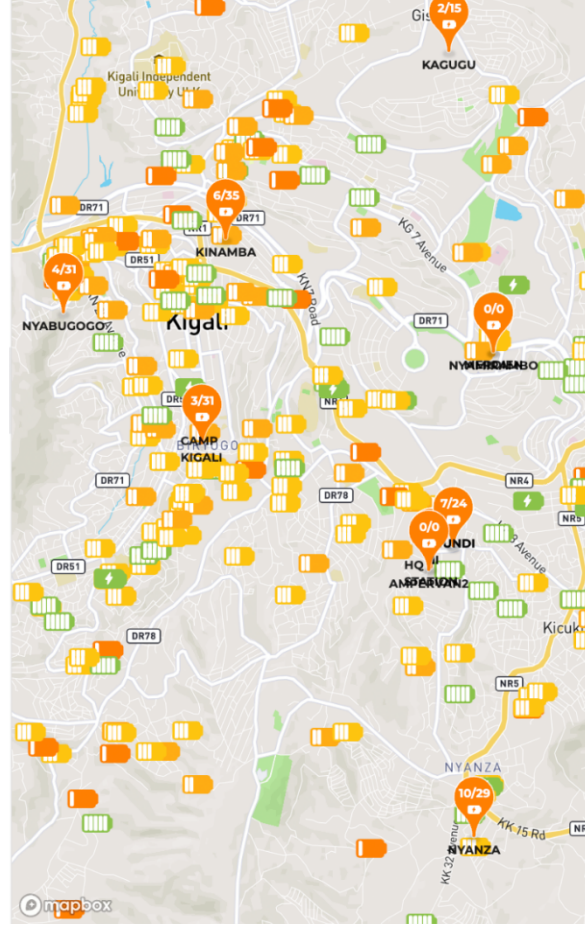
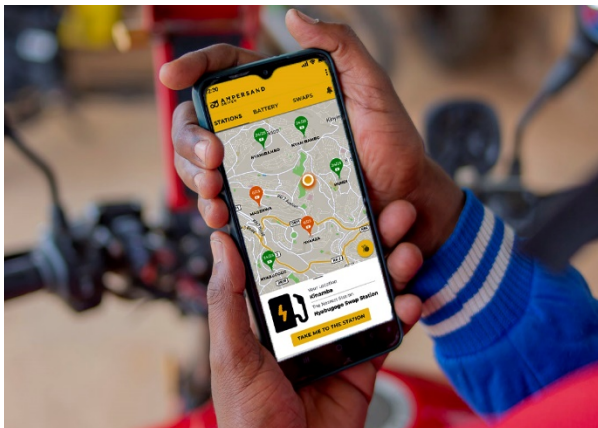
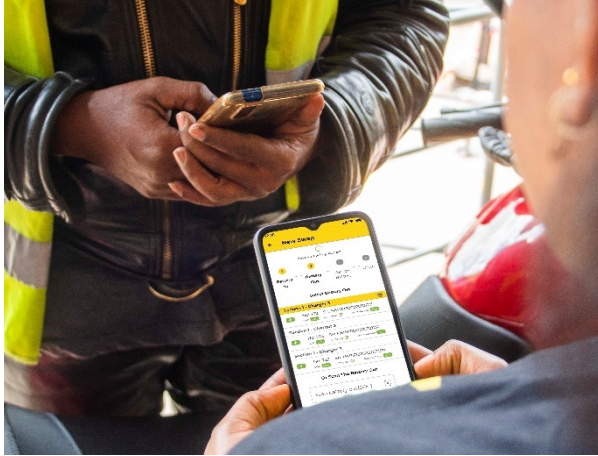


## Vehicle Technology

Visual 1.2



## AmperOps:



Support from DIV has allowed Ampersand to bring on more drivers and catalyze impact quickly by focusing on research and development for scaling. The grant also allowed Ampersand to discover areas in technology expansion that needed to be abandoned and therefore led Ampersand to more feasible paths forward (as expanded below). This support has positioned Ampersand to now focus on the following improvements in technology bringing more efficient vehicles and batteries to customers faster and helping drivers keep even more of their earnings while accelerating the clean energy transition:

- On-site production expansion:
  - New technology and machinery for battery pack production in house
    - Reducing cost of battery pack production
    - Moving less dependency on external suppliers leading to quicker battery production and faster delivery of bikes
  - New technology for in house safety testing
    - Further improving safety standards
    - Increasing opportunity for interoperability across platforms with safety and production guarantees
  - New technology for mechanical and engineering in house
    - Reducing reliance on supply chains and reducing long-term costs while improving deployment times on bikes and batteries
- Battery pack improvement:
  - New battery pack development to meet long term scaling goals (leader in commercial e-motorbikes for East Africa)

## **Asset Finance Partnerships:**

Most commercial use motorcycles in East Africa are sold through asset finance providers (loans). In Rwanda there are no established large asset finance organization or banks that do this, so most loans are informal or through small local Savings and Credit Co-Operatives (“SACCO”). However, in other East African countries asset finance partners are prevalent. In Kenya, WATU Credit has sold over 500k bikes to bodas. Through this project, Ampersand determined that the best path forward was to work with asset finance partners to manage the loans for Ampersand vehicles.

Ampersand first signed an MOU with JALI Finance (Kigali based AFP) followed by WATU Credit Rwanda. WATU set up a subsidiary in Kigali purely to finance electric motorcycles primarily in support of Ampersand, though it is not exclusive to Ampersand. With the success of these partnerships, additional AFPs have approached Ampersand and it now has the following AFP partnerships representing the main participants in the East African asset finance providers outside of small local SACCOs for all motorcycle loans:

These AFPs have collectively requested over 50,000 bikes within the next 24 months in Kenya and Rwanda. Through this grant we have met the challenge of developing AFP partnerships and now need to address the challenge of meeting their demand.

Looking ahead, Ampersand will only keep a limited number of bikes under its own financing Rent to Own contracts (between 50-100 active loans) to maintain an understanding of customer needs. The company has decided to outsource all future bike loans to AFPs because it:

- Provides a significant short term cash flow advantage allowing Ampersand to put funds back into growth and expansion;
- Removes the need to develop an internal lending institution incurring significant process, regulatory requirements, and overhead while not being Ampersand’s core business nor expertise.

## **Debt Facility:**

Ampersand closed \$4M in an equity investment (\$3.5M Ecosystems Integrity Fund; \$0.5M TotalEnergies) in a Series A funding raise in Q1 2021. Introductions from the DIV Grant Support Team helped Ampersand close a \$9M debt facility with the Development Fund Corporation (DFC) Pi-Squared program in December 2021.

## **Charging Interoperability Specifications:**

In beginning this project, Ampersand wanted to explore opportunities for interoperability. One key priority was exploring opportunities to partner with OEMs. In this exploration, Ampersand learned that while OEMs express interest in a partnership, they are years away from providing either a commercially viable chassis to sell Ampersand or launching their own bike for Ampersand to provide energy for that meet the needs of the East Africa. One hypothesis for the long timeline is that their current focus is on their existing home markets (India and China). Another, perhaps parallel, reason is that they are waiting to see what emerges as the biggest priority area for Africa’s transport electrification.

While this outcome wasn’t ideal, this discovery was significant and necessary to allow for effective development of an expansion plan as well as technology roadmap.

This learning allowed Ampersand to pivot to focusing on new options for interoperability. As part of the *Technology Product Roadmap*, Ampersand has built in flexibility in its approach to enable one or more of the following opportunities for interoperability:

- Provide its proprietary drivetrains to motorcycle manufacturers (OEMs);
- Provide or license its technology to allow other motorcycle manufacturers to incorporate Ampersand drive train technology into their bikes;
- Sell batteries to other OEMs while maintaining the charging on Ampersand's energy network;
- Allow charging of other batteries on Ampersand's energy network.

As part of DIV's Venture Assistance support, Ampersand updated its Financial Model in Q2 2022 to specifically include these possibilities in future revenue streams. One step included the creation of a brochure for the sale of drivetrains. Ideally, Ampersand will first focus on its higher margin charging revenue and its technological strengths: charging station network and battery swap operations. In doing so, it will still leave space for OEMs with the existing expertise, infrastructure, and networks to lead motorcycle manufacture, sales, and maintenance. It is anticipated that this will be a viable opportunity in the coming years.

### **Putting Commercial E-Motos on the Road:**

As of December 2022, Ampersand had 782 customers on the road including 60 new customers in Nairobi. There are 11 swap stations now in Kigali and 7 in Nairobi.

### **Additional Funding:**

Ampersand raised \$4M in April 2021 in a Series A and a further \$9M debt facility from DFC in December 2021.

Ampersand launched a Series B fundraising round in September 2022 and aims to leverage funds to draw additional debt investment.

### **Expansion Framework – Next Steps for Growth:**

An *Expansion Framework* (Annex 2) was developed and has begun to be implemented with support from the DIV grant. The *Expansion Framework* outlines Ampersand's considerations, conclusions, and current strategy for business expansion across geographies and services. The framework is a main reference point for expansion considerations together with any new information and learnings gathered.

Target markets, which Ampersand is at varying levels of evaluation of, include: scaling in Rwanda (moving forward), scaling in Nairobi (moving forward), expansion in Kenya beyond Nairobi (evaluating next steps), new presence in Uganda (evaluating next steps), new presence in Tanzania (early evaluation).

From June 2021 to July 2022 Ampersand put much of this framework into practice with the following outcomes:

1. June 2021: Initial scouting visit from leadership to discuss with active industry stakeholders.
2. July 2021: Hired Expansion Manager on a contractor basis.
3. August - September 2021: Data collection and customer surveying.
4. October 2021: Confirmation on expansion and registration kick-off.
5. November 2021 - January 2022: Initial team building and administration planning.
6. February - June 2022: Charge station construction and partnerships.
7. July 2022: First customers on the road.

## **Challenges:**

### **Fundraising:**

At the inception of the grant, Ampersand was working towards a Series A investment. Ampersand had developed a term sheet with a potential investor throughout Q1 of 2020 but when COVID hit, its impacts uncertain, the investor withdrew the term sheet citing the need to focus on and support the existing portfolio. The fundraising efforts during 2020 after the withdrawal of that investor were incredibly challenging. It was difficult to get traction with any potential investors. Ampersand was left scrambling and it was only through the grants from DIV and Shell Foundation that the company to continue to make progress through 2020.

In December 2020 a San Francisco based VC firm (Ecosystems Integrity Fund) took notice after a Bloomberg article came out featuring Ampersand “fueling a carbon free future”. By the end of Q1 2021, EIF had invested \$3.5M in the Series A followed by \$500k from TotalEnergies. At the end of 2021 Ampersand secured a \$9M debt facility from the US Development Finance Corporation.

During this grant period, Ampersand worked to spread brand awareness including speaking at COP26, being recognized by WEF, being featured in TechCrunch, Bloomberg, the BBC and Fast Company, and being nominated and a runner up for a “Nobel Prize for Impact” (Norrskan Foundation) as among 100 global most promising impact companies, tackling environmental and social problems. Though expansion during the early period was slowed due to funding constraints, effort was put into ensuring the company continued to gain momentum. When Ampersand was able to sell bikes in Rwanda, no marketing dollars have been needed to gain traction and sell out with an ongoing waitlist.

Fundraising will remain one of Ampersand’s key challenges. East Africa, along with most of the continent, is still considered an emerging market for investors and accurate valuations are historically difficult. This makes access to the traditional VC markets based in the US and Europe for startup and scaling funding more challenging. However, it is noteworthy that the investment in e-mobility companies is garnering increasing interest and momentum and has been a notable topic across major climate conversations.

### **COVID:**

Beyond the delay to Ampersand’s Series A round caused by the early uncertainty when the COVID pandemic, the impact on the company and its customers throughout 2020 and even through 2021 was quite severe. The Rwandan government approached the issue by locking down the country multiple times. The first lockdown in May 2020 lasted 10 weeks. All local movement was restricted severely, places of business outside of vital services (e.g., groceries, pharmacies, hospitals) were shut down, and motorcycle taxi drivers (Ampersand customers) were banned completely.

During these lockdowns, Ampersand’s R&D activities were severely curtailed and the uncertainties about reintegration made progress difficult. Recognizing that customers had lost their source of income, Ampersand decided to provide them a weekly stipend to support themselves and their families. At the time this decision was made because it was the right thing to do, however, it also built unintended company loyalty and a recognition generally that Ampersand takes care of its employees and customers.

### **Hiring:**

Following the Series A funding in March 2021, Ampersand had the important goal to accelerate its product roadmap by building its R&D capabilities and, in particular, needed senior electrical, mechanical,

and software engineers. This proved very challenging since engineers with deep experience in eV and battery technology were needed which was very quickly found to not exist in easy access in East Africa.

Though Ampersand recruited an excellent Senior SW Engineer from Kenya who relocated to Kigali, it quickly pivoted its search to Europe and Asia. Searches included visits to Europe for both the CEO and CTO and ultimately secured a team based in Europe. To accommodate this growing R&D team, Ampersand reactivated its German based subsidiary, Ampersand UG, as an R&D satellite and established an office in Berlin where there are now 4 employees.

### **Supply Chain:**

An additional problem that COVID either caused or highlighted has been supply chain issues. Initially COVID directly caused supply chain disruptions, particularly in China where Ampersand sources most bike and battery components. This resulted in approximately 2-3-month delays in deliveries for new bikes and batteries over the past year, especially with electronic chip components which has been an eV industry wide problem in 2022 and is still causing issues. For example, suppliers of key microchips used in Ampersand batteries, and commonly used by auto manufacturers all over the world, went into hibernation with ongoing repercussions of that slow down as of November 2022 as production of those components is struggling to catch up with a backlog of demand. Furthermore, travel restrictions to and from China in particular have made sourcing new components and testing samples very challenging.

To address testing challenges, Ampersand has engaged China based consultants who are able to understand component requirements and quality standards, and to a large extent have helped to overcome issues. Ampersand has also diversified its supply chain and is finding ways to source and produce a greater degree of components locally and on-site wherever possible. These changes include investment in a laser bonding welder to quickly source and test alternative battery cells from different suppliers as well as to bring greater manufacturing capabilities in house. This greatly shortens, potentially by over 6 months, our battery development and test cycle, gives us more supplier options, and pays for itself within 1-2 years through eliminating transport certification and shipping fees of welded cell packs as well as cutting the inflated cost of welding from a supplier. Another benefit is that we will be training Ampersand personnel to use the machine and creating skilled jobs in Rwanda.

## **COST-EFFECTIVENESS & COMPETITIVE LANDSCAPE**

### **Competitive Advantage:**

Ampersand is already ahead of the competition: first, farthest, and fastest. The company has a demonstrated value proposition for customers, saving them over 35% in income (approximately \$500) and improving livelihoods for themselves and their families. Ampersand currently has a waitlist of over 7,000 in Kigali alone. What sets Ampersand apart is an enormous depth of experience, focus on R&D and DFM (Design-For-Manufacturing), and an internally developed software battery and operations management platform. Additionally, being the first, Ampersand has strong network and customers connections and is constantly optimizing for use and efficiency. The resultant superior battery pack and charging/operational capabilities, proven to be cost competitive with fuel and extremely reliable, is a key competitive and technical advantage.

Ampersand intends to keep this competitive edge, widening the moat and continuing to lead the market with a focus on R&D into technology, network expansion, and building a strong team:

### **Technology:**

Technology is a key part of Ampersand’s history and future evolution, which has demonstrated the importance of maintaining market lead and scalability. Series B investment will support R&D efforts to accelerate focus on:

**Battery Technology:** The current battery pack is based on a prismatic cell that has a single top supplier in China. However, reliance on a single supplier is not ideal for scaling and the next generation (MK 2) pack will be based on more common and widely available cylindrical cells. Beyond diversifying supply chain options and bringing down costs, this topology offers more flexibility in design options for different pack sizes and weights, and is a key part of the product road map. Ampersand has also invested in significant battery manufacturing ability which puts it at the top of the industry in Sub Saharan Africa, including but not limited to the first CNC laser bonding equipment on the continent.

**Software:** Internally developed AmperOps backend software is a key competitive advantage and the data collected is essential for managing the swap station network, swap operations, and batteries, as well as providing valuable information to customers and optimizing User Experience. Asset finance partners also benefit from functionality, which Ampersand can eventually monetize, through our AmperOps partner portal.

AmperOps provides over 40 data points every 5 seconds over the air from batteries and vehicles. It optimizes the end-to-end energy flow from the stations to the batteries and vehicles and, through AI, Ampersand is to maximize optimization and scaling of the network. Not only does this telemetry allow Ampersand to ensure equipment function and internal costs but the optimization of the bikes and batteries also lowers cost in maintenance and increases rate of product reliability for customers. This increased reliability reduces maintenance costs for drivers, letting them keep more of their income for what matters to them.

**Motorcycle:** Ampersand’s latest e-moto is based on a partial “Complete Knock Down” kit from a China based electric motorbike manufacturer, TailG. Added to this, Ampersand builds and sources components separately resulting in a somewhat complicated ordering, manufacturing, and assembly process. Ampersand owns several key points of IP on the vehicle such as the drivetrain and user display. This ensures the optimal user experience for the customers and has been key in ensuring the Ampersand product leads the market.

## **Network:**

Market presence is visible through Ampersand’s swap stations presence and network growth. A barrier to entry into the market would be the need to develop charging or swap stations or systems. Ampersand has developed a unique turn-key model for swap station expansion that facilitates quick station creation. This is because the model costs relatively little for the materials, the software and technology already exist, and existing partnerships (including with TotalEnergies) allow for quick integration into existing real estate.

## **Competitive Landscape:**

### **General Background:**

Ampersand was the first electric two-wheeler company in East Africa and it was there years before the next competitor. Since then, it has grown the fastest, invested the most in development, and integrated the deepest into the market and relevant networks. Even with a clear market lead, Ampersand does not



see the competitive landscape as a zero-sum game. The electric motorcycle industry in Africa is still at a very early stage. Given the large size of the market and the fact that companies can be break-even at relatively low volumes, there is room for multiple players to be profitable. Politically, there is a common need to influence policymakers and the public towards greater adoption and support. Financially, there is some competition for grant and equity capital. However, this competition is exceeded by the opportunity to draw new capital into the sector from larger and more capable equity investors with the proof that light-vehicle e-mobility in Africa is a viable and commercially attractive investment.

A great failure of the early solar PV industry was infighting over a small percentage of market share and investment, and allegations of IP theft, resulting in protectionism and trade wars. Ampersand aims to continue to lead the market but to do so while pushing electrification forward through thoughtful focus, community integration of maintenance and repair needs, and interoperability across platforms. Ampersand remains flexible and willing to work with partners (like a potential OEM) to focus on building a software supported and battery-led energy network while allowing others to lead in their respective expertise. The goal is to make all of East Africa's commercial motorbike industry electric and to do so as the leading energy network provider.

### **Cost Effectiveness, Scaling, and Impact:**

#### **Cost Effectiveness:**

Ampersand focuses on electrifying two-wheeled transport in East Africa by building efficient and effective energy networks with integrated multi-use software systems and proprietary motorbike and battery technology. Any one of these factors is a new and developing market. As such, it is difficult to assess comparative impact per dollar. Ampersand, though, was the first to do this work in East Africa and is a few years ahead of the closest competition. The points of impact across climate, air quality, accessibility, and livelihoods for the industry didn't exist or have active solutions before Ampersand.

Some points of improvement during this grant period made possible with support from DIV:

- Ampersand has grown from having 20 bikes in operation in Kigali to having over 750 in two cities.
- Staffing at Ampersand has grown from approximately 42 employees to over 250.
- A network of 3 battery swap stations has grown to 16.
- Purchasing costs for Ampersand bikes are now at parity with petrol motorbikes and the cost savings as an Ampersand driver average around 35% and are only increasing over time.
- Ampersand has developed and implemented a unique and highly effective software system across multiple apps and functionalities.
- Multiple iterations of motorbikes with proprietary component structures have been developed by Ampersand to meet the needs and wants of the customers.
- Ampersand has continued to improve batteries and energy network function to maintain market leadership in East Africa.
- New technology and equipment are being brought to Africa to support novel on-site manufacturing and engineering.
- Asset Financing Companies have started operations in Rwanda to meet the needs of the boda industry.
- Investors are seeing potential and making investments in these emerging markets.

Without a significant investment of time, capital, and energy in the R&D and expansion planning at Ampersand, enabled by DIV's investment, these accomplishments may not have been reached.



## Scaling:

DIV Venture Assistance, that initiated with an Overall Business Assessment from Open Capital, led to a full update of the Financial Model. This model confirmed the scalability of Ampersand's business plan into markets beyond Rwanda. The focus of expansion in the model is the approximately 5M motorcycle taxis that currently operate in East Africa, although could be extended beyond to the estimated 25M operating over the whole of sub-Saharan Africa.

## Impact:

This grant ultimately helped to support and expand Ampersand's impact by supporting the expansion and development of the company. While Ampersand was founded to become the dominant provider of 2-wheeled electric vehicles and electric vehicle charging infrastructure in East Africa, it is making a significant impact on carbon emissions and air quality, and strengthening livelihoods and working conditions for African communities. With support from DIV, Ampersand has been enabled to more quickly and effectively reduce greenhouse gas emissions and improve lives in the following ways:

**Carbon Emissions:** The climate community generally refers to a 75% carbon emissions reduction for electric motorcycles compared to petrol. This assumes 20% transmission losses, and well-to-wheel emissions of 11.78kg CO<sub>2</sub>-e per 100km for the petrol motorcycles<sup>4</sup>. According to a recent World Bank study, however, current Rwandan grid emissions account for just 137kg CO<sub>2</sub>-e per mWh<sup>5</sup>. This means that Ampersand motorcycles actually produce over 93% reduction in emissions compared to petrol motorcycles.

These considerations also do not include other harmful emissions like carbon monoxide, a short-lived climate pollutant<sup>6</sup> that, though less than CO<sub>2</sub> in quantity at the tailpipe, has a very significant multiplier effect (5X) on climate warming. The more petrol motorcycles are replaced with electric motorcycles, the more this improves.

**Air Pollution:** The 150cc motorcycles as used in Kigali produce 16x worse air pollution than Euro 3 standard cars<sup>7</sup> and similar results were found by UC Davis in partnership with the 'Mythbusters' TV Show. Electric motorcycles have zero tailpipe emissions. Research examining the use of coal-powered electricity to power electric scooters and e-bikes and still found an approximate 9x reduction in pollution exposure and health impacts for urban dwellers relative to a petrol motorcycle.

Reduction in air pollution can have a significant impact on community health. There is currently limited research on air pollution in Rwanda specifically but studies show that air pollution is the 2nd leading risk factor for premature death, accounting for more than 8% of deaths in Rwanda in 2017 alone<sup>8</sup> and that road traffic is the leading cause of air pollutants in Rwanda and the ratio is even greater in Kigali<sup>9</sup>.

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<sup>4</sup> Ji, Cherry et al; Figure of 2.5 liters per 100km adjusted for superior moto taxi fuel economy of 2.33 liters per 100km

<sup>5</sup> World Bank, 2019

<sup>6</sup> Short-lived climate pollutant – Short-lived climate pollutants are powerful climate forcers that remain in the atmosphere for a much shorter period of time than carbon dioxide (CO<sub>2</sub>), yet their potential to warm the atmosphere can be many times greater. ([Climate & Clean Air Coalition](#))

<sup>7</sup> *The Guardian* newspaper, Dec 2005; Ana-Marija Vasic, Swiss Federal Laboratories

<sup>8</sup> [State of Global Air/2019: Rwanda](#)

<sup>9</sup> "[Inventory of Sources of Air Pollution in Rwanda](#)"; Rwanda Environment Management Authority, 19 January 2018

**Livelihoods:** Ampersand customers and employees are generally the primary financial supporters of their families with the average household in Kigali having 4 members. All employees are well paid, have secure jobs, are offered 100% health insurance for them and their families, and provided training as well as real opportunities for advancement. Motars are also provide training as well as two free, quality motorcycle helmets to ensure greater safety. As the company expands, so does the employee and customer base.

The Ampersand model also saves drivers money on energy and maintenance, letting them keep more of their income for what matters to them: family, education, and livelihoods. Petrol motorcycle drivers spend approximately \$4.8 per day on fuel, and petrol prices are only increasing. Ampersand drivers spend \$3.6 per day. This saving, coupled with savings on the lease payments and service (no oil changes or engine tune ups), is at least a 35% increase in net earnings for our customers. Where the median annual income is below \$1000, \$500 provides significant value.

Ampersand e-motos are also easier, lighter, and nicer to drive. Feedback from drivers with varying physical barriers is that they are able to drive more easily or start driving again with Ampersand bikes compared to petrol bikes. Similar feedback comes from new and female drivers who say that Ampersand bikes are both easier and more accessible to drive. This means that the market has the opportunity to expand to reach more beneficiaries because of Ampersand's offering.

## **FINANCIAL RESULTS AND SCALING PLAN**

### **Financial Outcomes and Plans:**

At the inception of the grant mid-2020, Ampersand had a pilot program of 20 bikes and one swap station in Kigali. COVID lockdowns then slowed fundraising and growth plans. It was after a Series A \$4M equity round in early 2022 that Ampersand refocused on ramping up sales. However, it was this grant, that supported Ampersand to continue driving motorcycle taxi electrification in Rwanda, improving lives and the climate, and alongside the DFC \$9M loan facility closing in late 2021, preparing Ampersand to take the work to scale in 2022.

During this time, Ampersand was able to direct resources to research and development. Ampersand's goal is to provide the best, most accessible, reliable, and affordable energy system to boda drivers improving community health, protecting the planet, and ensuring better livelihoods. R&D is crucial to this mission and has allowed Ampersand to create a business model, bike, battery, swap station model, and technology that can be scaled to meet the needs of the East African motorcycle taxi market.

At the end of 2021, Ampersand had 50 bikes on the road in Kigali. With the ramp up to commercial scale operations in 2022, and the opening of an expansion pilot in Nairobi, Ampersand now has over 700 bikes with 11 swap stations in operation in Kigali and 60 bikes with 7 swap stations in Nairobi. Though the financial goalposts for Ampersand changed during COVID, the company is now holding a strong position and is reaching financial goals as projected.

### **Lessons:**

As the first to enter and furthest along in the electric two-wheeler market in East Africa, Ampersand knows it is crucial to participate in and contribute to relevant networks globally and in the region. Building brand and mission awareness, taking a customer-centered approach to service and product

development, enabling cross-sectoral relationships, and ultimately driving mass-market adoption all require steady integration into existing networks. This means that companies, like Ampersand, can benefit from building in both goals and focus, as was demonstrated in this project, while ensuring a degree of flexibility to take the lessons shared in the networks to improve and meet the greatest and highest needs of the communities and lead the market.

For example, there are strong local networks in place in both Rwanda and Kenya where information is shared with other enterprises on a routine and regular basis. These networks have been valuable, not only for Ampersand to learn from, but also for Ampersand to contribute to and be a reliable resource in the region. For example, Ampersand is an active member of the Rwandan chapter of the American Chamber of Commerce, and in Kenya is deeply engaged with the Kenya National Chamber of Commerce and Industry (KNCCI). E-mobility companies are well represented at the KNCCI in particular.

## **FEEDBACK FOR USAID**

### **A. Please describe your interactions with DIV, and how have they impacted the program?**

The interactions with the DIV team have been very positive throughout the program.

### **B. What was the value-add of DIV's financial support? What would have happened without this support from USAID?**

The DIV financial support, especially during the first 18 months of the program before we were able to raise our Series A equity round in March 2021, was invaluable. It allowed us to continue our R&D development plans and to continue testing new batteries and packs in the field as we built up our operational capabilities.

### **C. Aside from financial support, were there other benefits received from DIV? How does DIV compare to other funders?**

Ampersand received Venture Assistance from DIV. Initially a Business Assessment was conducted and it was very useful in helping us determine which priorities were critical to focus on to pursue our scaling objectives. It also identified key next steps, one of which was to build a new Financial Model. This financial model has allowed us to analyze the impact of pursuing different growth strategies, such as:

- Working with OEMs to provide battery swap services;
- Selling or licensing our drive trains to other eV companies;
- Determining the impact and additionality of carbon credit markets;
- Setting up franchises or SPVs to broaden expansion.

We have not received such direct (and paid for) technical assistance from funders as part of other grants.

The DIV team also provided advice during early 2021 when we were looking for debt financing. Up to that point we had been struggling to get debt financing for our batteries from commercial banks and had reached the conclusion that Loan Guarantees would be needed. The DIV team introduced us to the DFC/Pi-Squared program from which we ultimately closed a \$9M loan facility at the end of 2021.

### **D. How can DIV remain involved in understanding and supporting your activity after the end of our formal relationship?**

Working with DIV to set clear goals and KPIs helped to keep Ampersand focused. We would like to work with DIV again we continue to expand in our business and our impact to support Ampersand with a focused lens on impact opportunities. DIV's support with funding opportunities, either through their own grants on expansion projects, or introductions to other USAID agencies (like with DFC) were monumental to reaching Ampersand's current standing.

Additionally, as Ampersand expands into new markets, and especially new countries, support around working with governments to inform or guide eV incentives and policies are incredibly helpful. This could include helping to structure suggestions for incentive programs or providing introductions to teams and organizations helping to craft supportive electrification policies in the region.

**E. How can DIV improve? What were the strengths and weaknesses of your experiences working with DIV? You may wish to comment on some of the following: the application process, the reporting requirements, feedback you received on deliverables, the payment process, other interactions with USAID, or whether the fixed obligation grant /cooperative agreement allows the appropriate level of flexibility.**

The application process was quite long and involved and the reporting requirements at times took effort and time to prepare, although understandable for the grant amounts involved. In retrospect and in fairness, on the reporting requirements side subsequent grants and funding providers have requested similar reporting KPI's, so the reporting we initially had to set up for the DIV grant has become a basis for those more recent reporting needs. If we were to do this again, we would have hired a grants specialist/manager sooner to help manage the process – we just hired a new Director of Partnerships and Growth to do exactly this going forward.

The deliverables and KPI's themselves were clear and feedback received during the grant has been very useful. Indeed, we believe the staged milestones set have been useful in helping us steer and focus on the objectives. As a company working in a developing market and industry, it would have been easy to be distracted away from priorities but the milestones and KPIs helped to keep us focused on the goals laid out. We also felt there was enough flexibility to open up conversations if priorities changed or goals couldn't be met. This flexibility and focus support is unique to a funder like DIV compared to the private investor and is a significant asset to a startup who could use the additional guidance.

One piece of feedback on the KPI reporting process: Our suggestion is to make the reporting cycle quarterly rather than every six months – DIV is unique in this respect. In particular, the online tool combined with the 6-month reporting requirements was confusing with the starting points of April and October. It would have been easier to report every quarter rather than every 6 months – we have to report to other funders every quarter anyway and it is the standard pulse for a company.

## **Ampersand USA, Inc**

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