



CROSSBOUNDARY

# Appliance Financing 3.0 Innovation Insight

Cheap, reliable power is the catalyst for driving consumption

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# Cheap, reliable power is the catalyst for driving consumption

Appliance Financing is the Innovation Lab's first and most high impact prototype, with analysis conducted from data collected from 25 sites and over 12,000 connections over the last four years.

In our most comprehensive analysis to date, our findings lead to a simple and obvious conclusion – **cheap, reliable power enables income generating activity and this drives consumption:**

1. **Average Consumption Per User (ACPU) is 48% higher** on sites where appliance financing is offered
2. **The top 20% of appliance financing users consume 16x more than their peers** by meeting highly demanded community needs
3. **Reliable power is the bedrock that drives this – high reliability sites consume 10x more than low reliability sites**

4. **At low tariffs, reliable power boosts consumption even further** – sites with this profile have ACPU >6x higher than other appliance financing sites

These findings strengthen recommendations to **expand and scale appliance financing** of income generating machinery. In addition, they call for renewed focus by governments and donors to reframe incentives and regulatory frameworks to **reward reliable power and lower tariffs.**

In line with these recommendations, the Innovation Lab is advocating for the role of distributed renewable power in providing **cheap, reliable power as part of the future grid** that will provide universal electrification across the African continent.

To scale Appliance Financing, the Lab is working with ESMAP and others to implement a consortium driven, **nationwide road-show approach**, starting in Ethiopia.

**01** ACPU is 48% higher on sites where appliance financing is offered

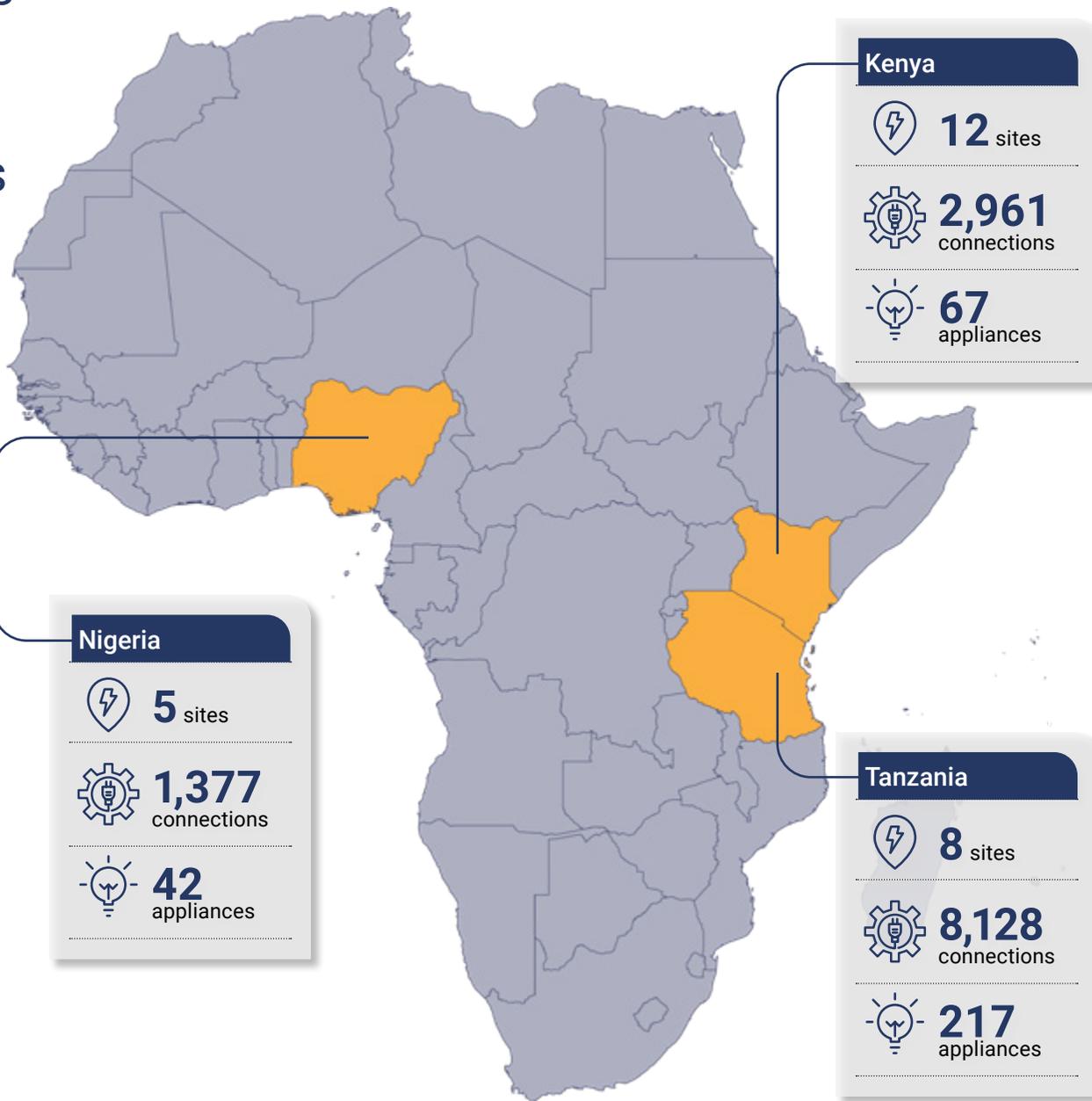
# The Lab funded developers who deployed 326 income generating machines on credit to customers across 25 sites in Nigeria, Kenya and Tanzania

## Appliance selection was developer-led

- Developers conducted technical and financial assessments to determine which appliances to deploy and which customers to provide financing to
- The Lab collected consumption, payment, and loan repayment data from each site on a monthly basis

## Financing terms were benchmarked to SHSs

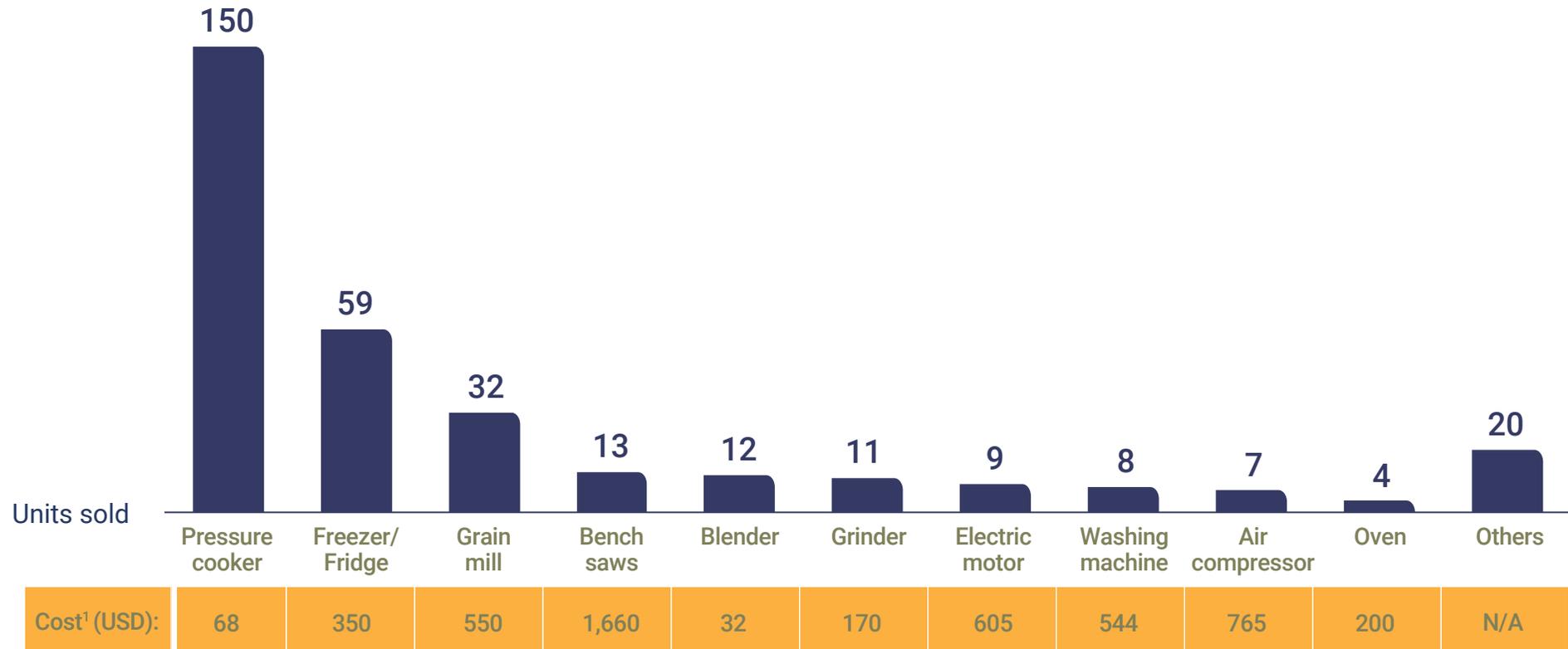
- Set to reflect commercial standards, benchmarked against similar programs offered by solar home system providers
- Financing was offered according to a 12 to 24-month loan term, with a 10-20% upfront deposit and a 2.55% monthly (i.e., 14% p.a.) interest rate<sup>1</sup>



Note: 1 Terms were revised and extended after launch of the program due to feedback from customers

# Appliance financing 3.0 focuses on income generating equipment - electric pressure cookers, freezers/fridges and grain mills were the appliances with highest demand

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Previous iterations on the appliance financing prototype showed that **household appliances do not increase consumption**

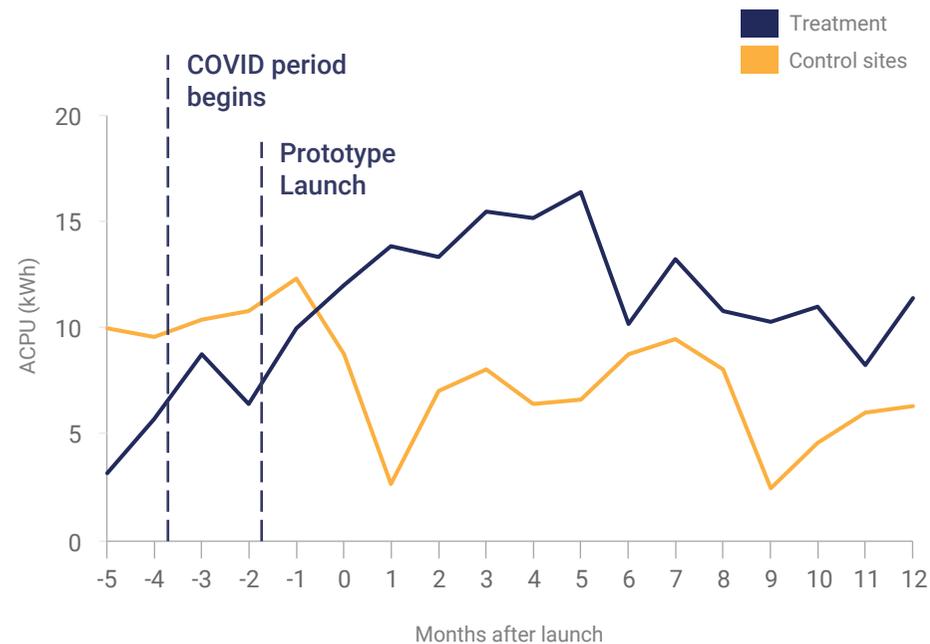
Appliance financing 3.0 therefore focuses on machinery that could be used for **income generating purposes**, and electric pressure cookers (EPCs) that can be used for both

**Electric pressure cookers, fridges/freezers and grain mills** had the highest demand across appliances offered across different sites

Note: 1 Average  
Source: Developer Data

# Average Consumption Per User (ACPU) at treatment sites increased by 48%, while consumption at control sites remained stable or even decreased

ACPU (kWh) by type of site



Change in ACPU (kWh) before and after launching appliance financing<sup>(1)</sup>



Data from 5 sites across Nigeria and Kenya show that consumption is 48% higher where appliance financing is offered to customers

At sites where there was no appliance financing offered, consumption decreased 39% over the same period

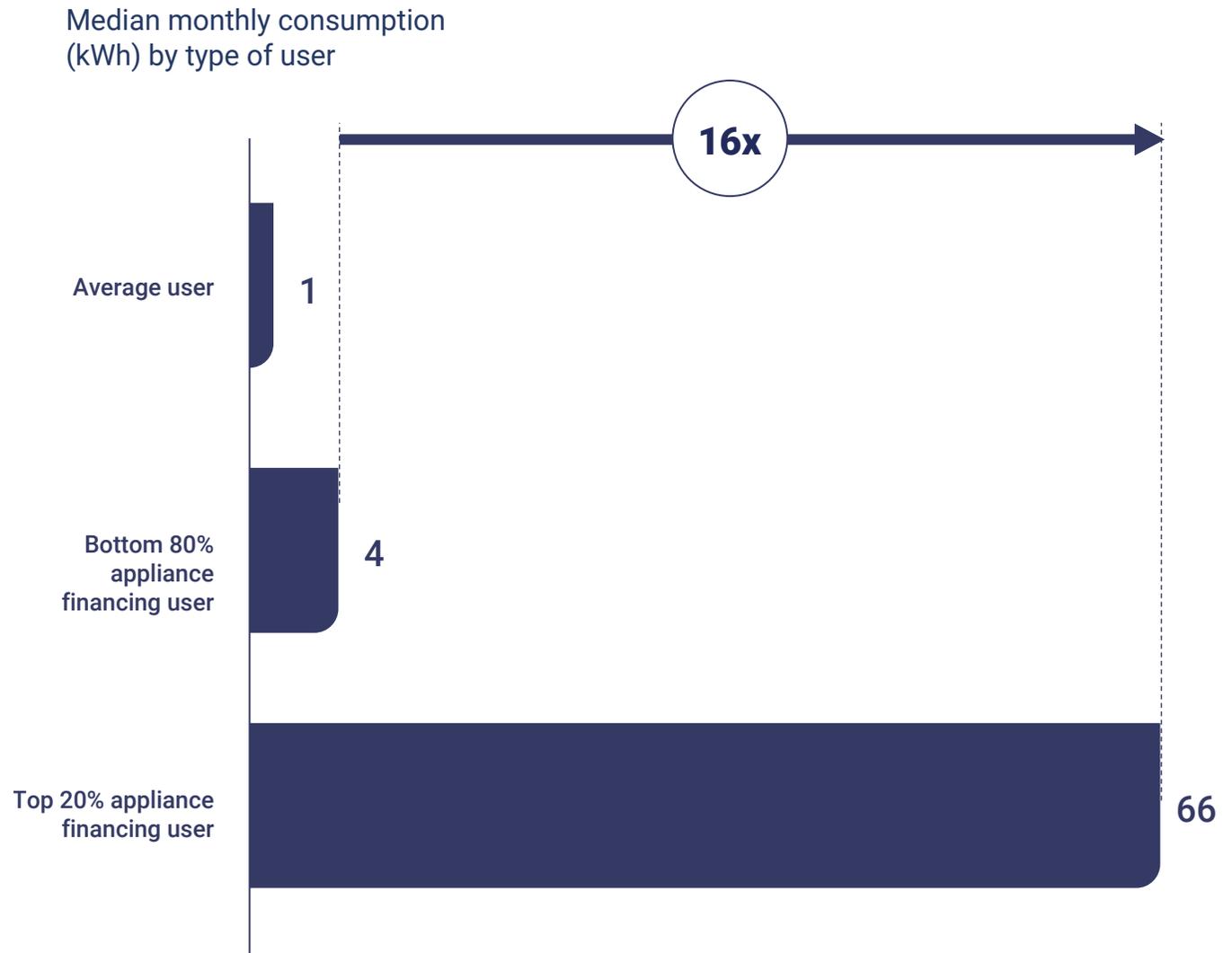
Consumption decreased across both treatment sites and control sites in the months following the onset of the covid period. However, control sites did not recover to pre-covid levels in contrast to appliance financing sites

The results suggest that appliance financing allows customers to increase their consumption sustainably over a prolonged period of time, despite economic shocks

Note: (1) Compares ACPU 3 months before launching Appliance Financing to the same period one year after. Showing data for 2 control sites, 5 treatment sites, and 36 AF users. Control sites are other sites nominated by developers with similar characteristics but with no appliance financing programs in place

**02** The top 20% of appliance financing customers consume at least 16x more than their peers

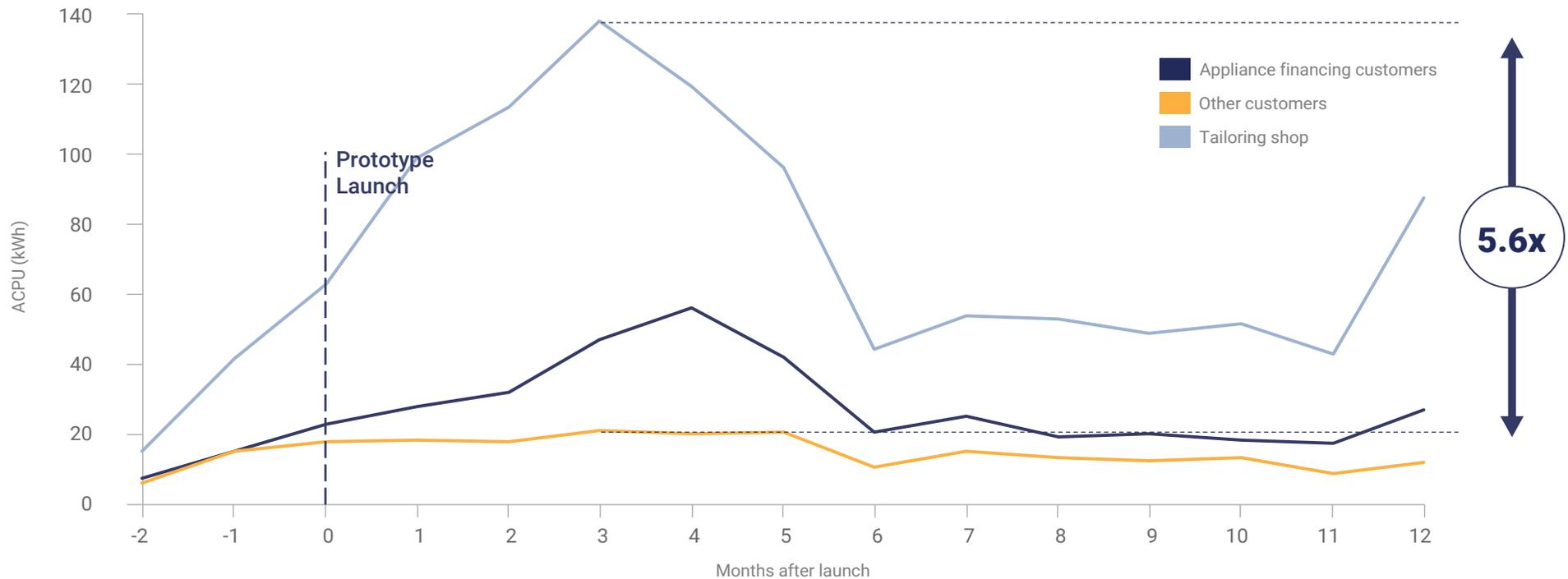
The pareto principle generally states a minority of inputs results in the majority of outputs - this applies within the appliance financing user group



Note: The top 20% of appliance financing users had appliances including Freezers/Fridges, Ice Machines, Sewing Machines, Welding Machines, Woodworking drills

# This top 20% of appliance financing customers utilize equipment or machinery that meets specific community needs e.g. tailoring

ACPU (kWh) comparison across customers in tailoring shop site



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Ubiquitous appliances like freezers and TVs typically have a higher uptake rate and increase consumption

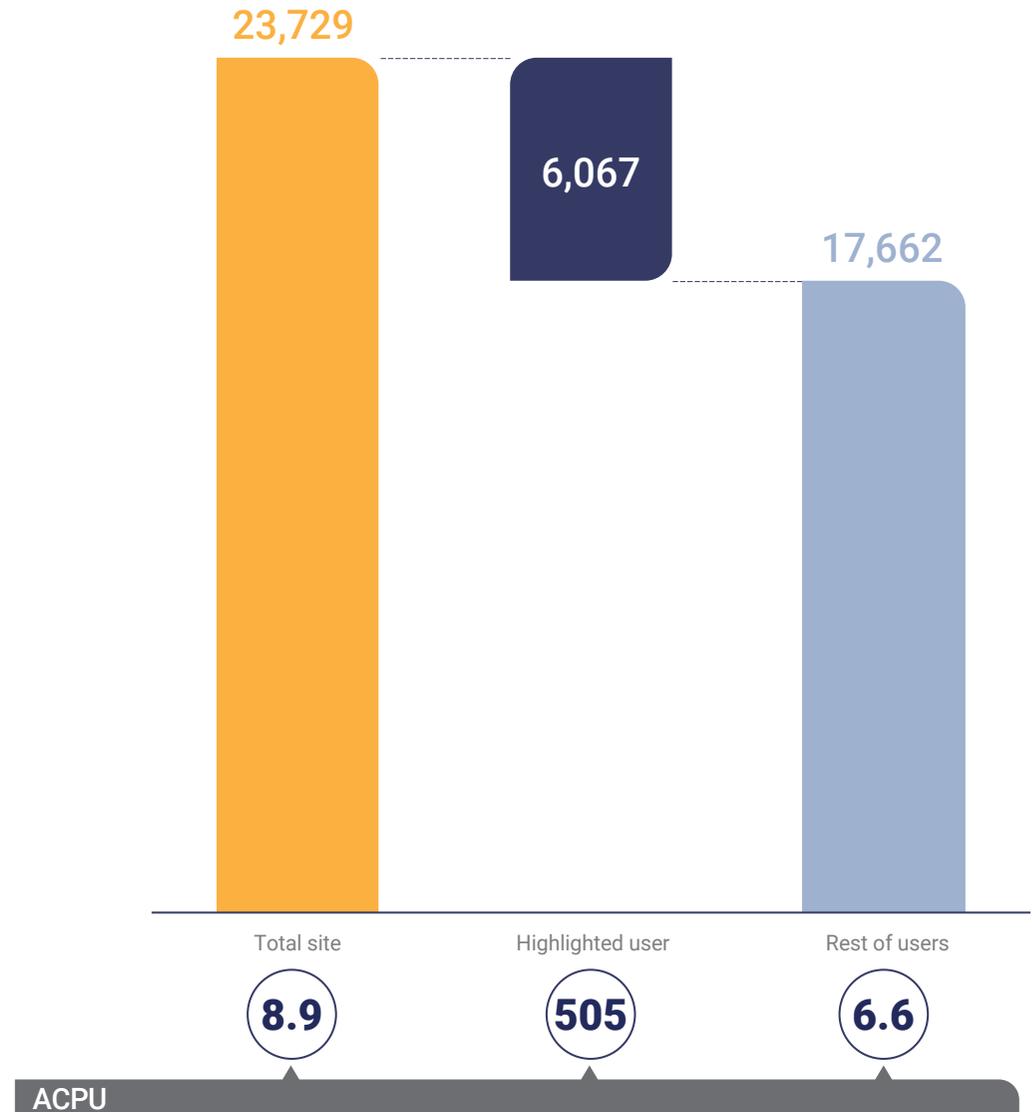
However, customers covering a **specific need in a community** tend to generate a disproportionate demand for electricity resulting in this significantly higher consumption

For example, one customer who has the only tailoring shop in the community, that has one sewing machine and one weaving machine, **consumes up to 5x more** than other appliance financing customers

## Spotlight: A desalination and ice-making machine generated 25% of an entire site's demand for one year

Country:	Kenya
Location:	Longech, Lake Turkana
Connections:	227
Accessibility:	Limited accessibility by boat (fastest and most convenient) and road
Business:	Fish value addition

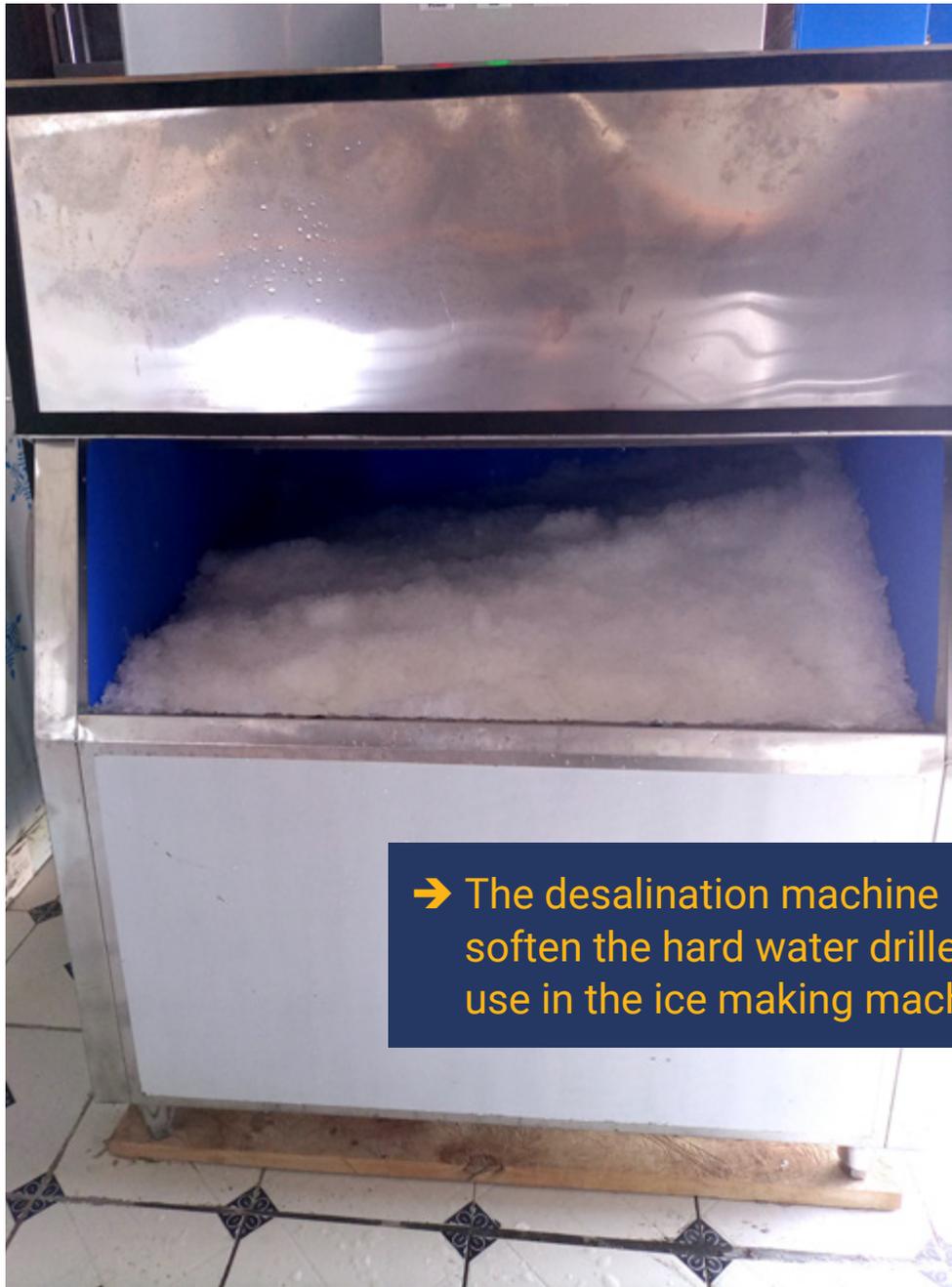
Annual demand generated by user with desalination and ice-making machine vs rest of users in selected site





**Business case**

→ The user purchases fresh fish from fishermen on Lake Turkana, and produces ice for preservation during storage and transportation to market

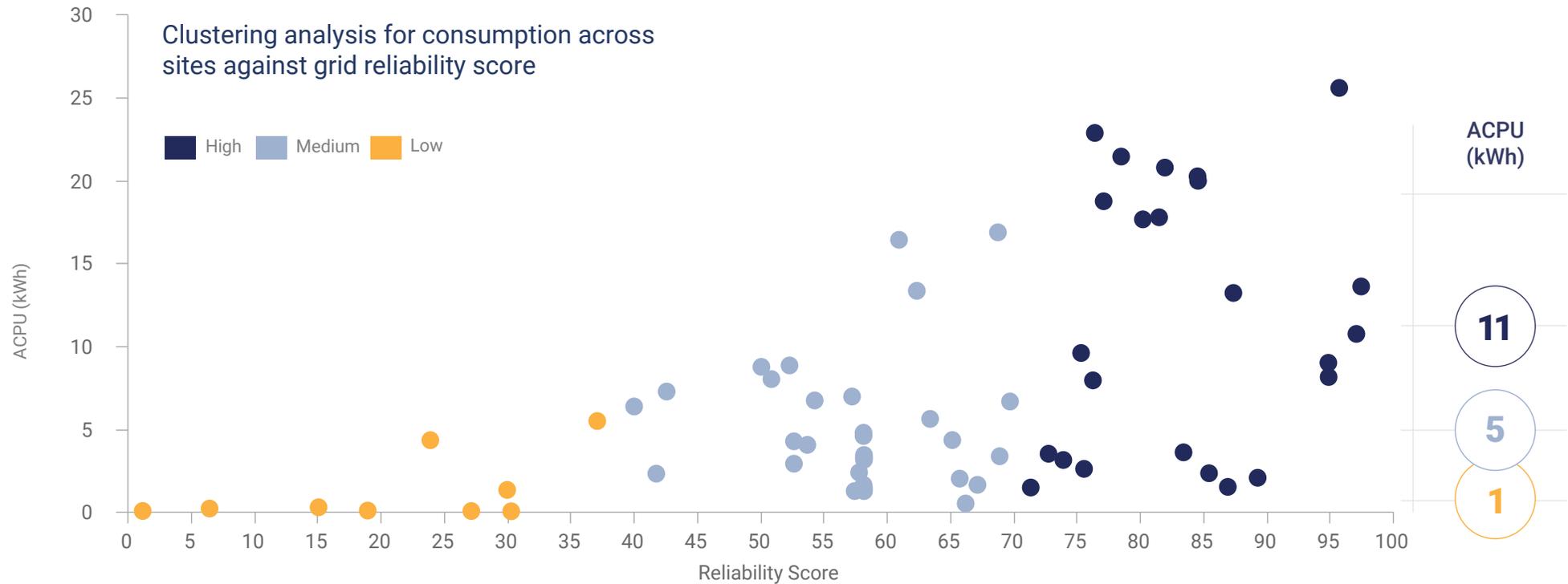


→ The desalination machine is used to soften the hard water drilled on site for use in the ice making machine



**03** Customers in high reliability sites consume >10x more than low reliability sites

# Reliable connections are critical to enabling higher consumption among customers – sites with higher reliability consume more than 10x of low reliability sites



Appliance financing customers are mostly entrepreneurs who need **stable, reliable** power to run their businesses

Where they cannot rely on this, they quickly seek alternatives such as diesel generators

However, when power is reliable, entrepreneurs reward mini-grid developers with increased consumption – consuming 10x more than when power is unreliable

Mini-grid developers are acutely aware of this and have renewed focus on reliability above all else

**Note:** Reliability score is calculated as the percentage of total operating hours that the site supplied electricity to its users. It does not take into account supply quality - e.g., voltage

**“ Before we even think about doing appliance financing again, we must focus on providing reliable connections across our sites”** – East African Mini Grid Developer

# 04 At low tariffs, reliable power boosts consumption even further

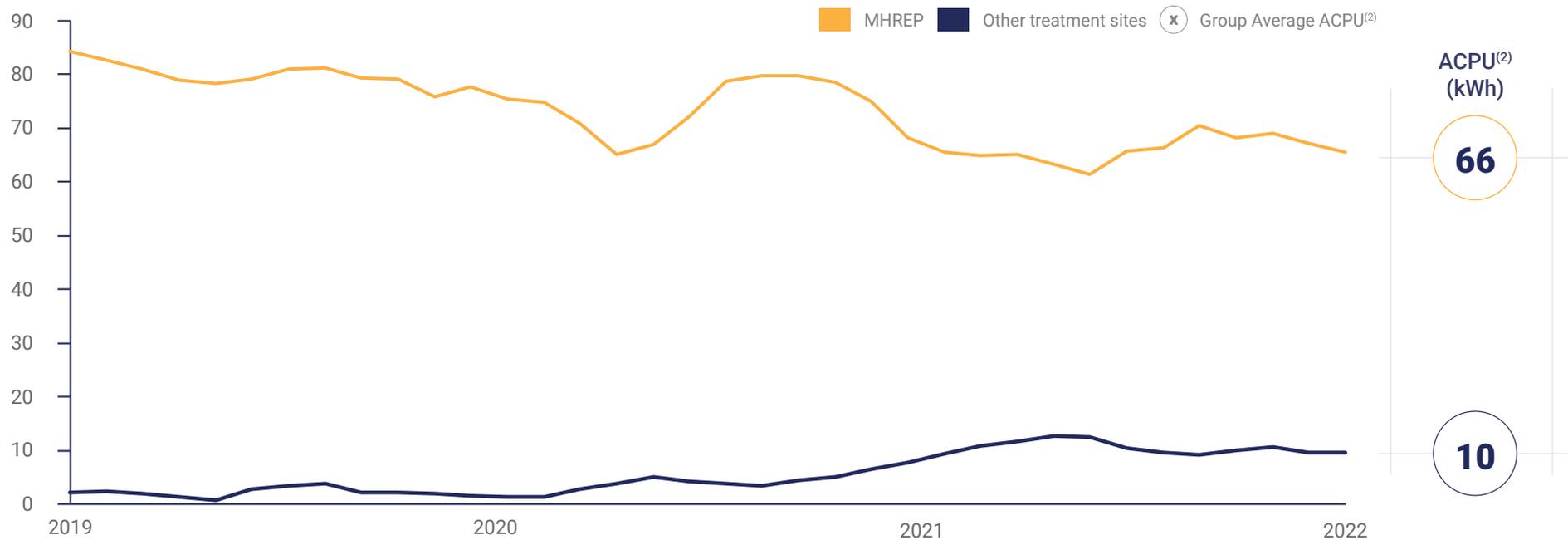
# Spotlight: Mwenga Hydro & Rural Electrification Project (MHREP) in Tanzania

Site Overview	
Country:	Tanzania
Location:	Muthindi District
Description:	<ul style="list-style-type: none"><li>- Highland area with tea growing and forestry</li><li>- High level of agro-processing associated with forestry such as carpentry shops and pellet production from saw dust</li></ul>
Mini-grid details	
Generation type:	Hydropower and wind power
Generation capacity:	6.4 MW Hydropower (4 MW) and Wind power (2.4 MW)
Households connected:	5,500 over 32 villages
Lifeline tariffs:	~4c/kWh up to 50kWh/month
Residential and commercial tariff:	13c/kWh
Reliability score:	97% uptime



# The MHREP mini-grid in Tanzania is an exemplar of the two basic characteristics that drive consumption – reliable power and low tariffs

ACPU<sup>(1)</sup> (kWh) across MHREP site compared to other Appliance Financing sites and control sites



MHREP is not a typical African mini-grid site – it is **hydro and wind powered and large**, serving over 5,500 households and feeding into the grid. Typical mini-grids across the continent are solar hybrids serving 200-250 households

Regardless of these atypical characteristics, the Muthindi mini-grid provides **the key ingredients that drive consumption – cheap, reliable power**

This, coupled with the agri-processing potential in the area result in very high average consumption - **over 6x higher than other appliance financing sites**

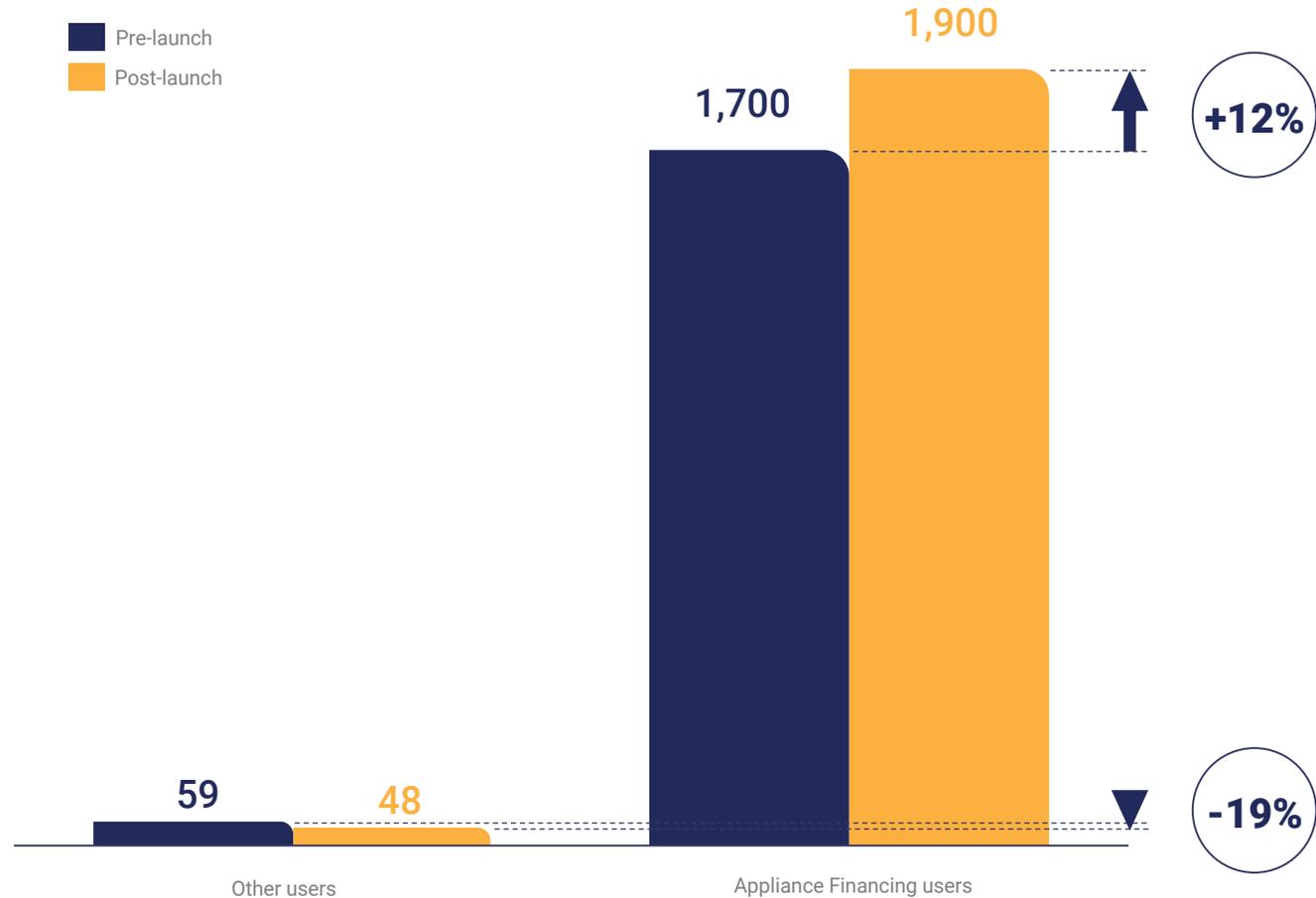
Note: (1) Moving average consumption per user over a three-month period (2) ACPU over a six-month period two years after launching appliance financing on Muthindi site

ACPU at this site was **already relatively high** across all customers prior to availability of appliance financing

Following the introduction of appliance financing, **ACPU further increased 12%** for customers who had bought appliances and equipment

On the other hand, ACPU for the other users decreased 19% over the same period

ACPU pre vs post launch<sup>(1)</sup>,  
Appliance financing users vs Other users<sup>(2)</sup>



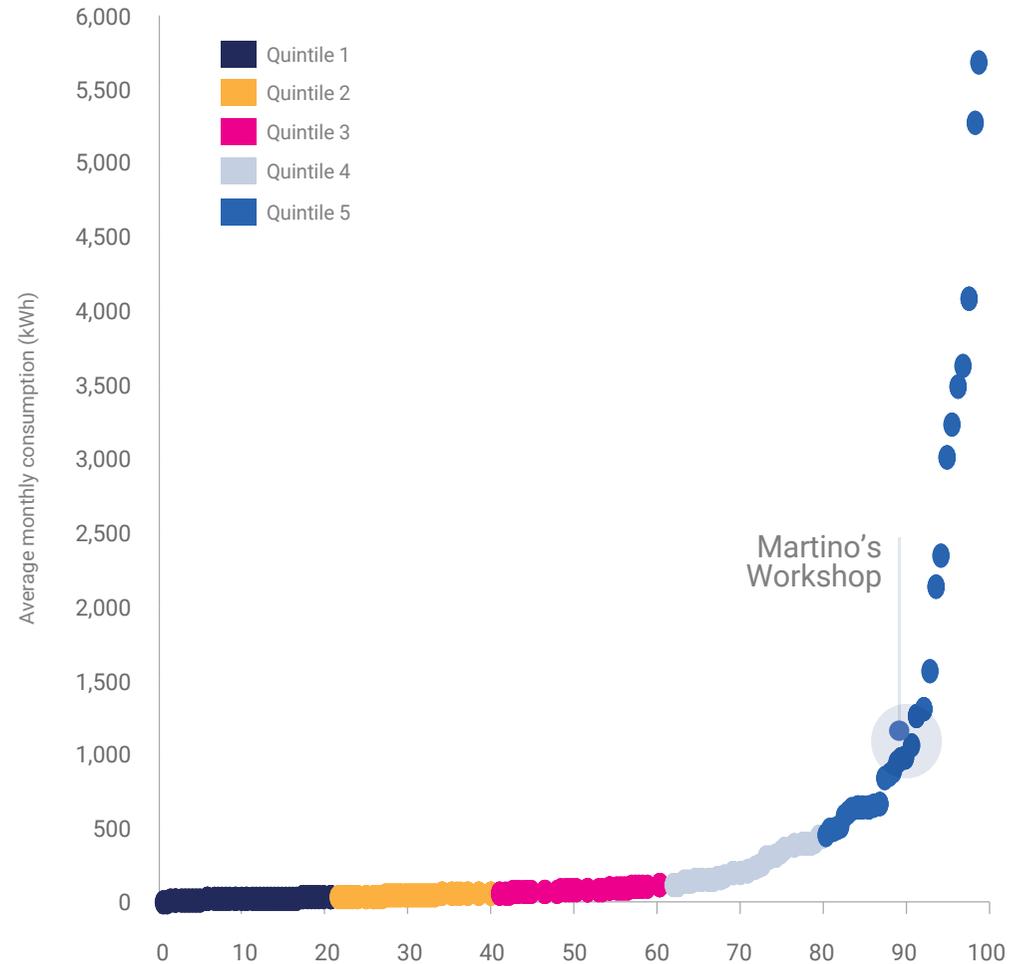
Note: (1) Comparing 6 months before launching Appliance Financing to same period two years after. (2) Other users includes all other users in the same site that are not part of the Appliance Financing program.

## Spotlight: Martino runs a successful carpentry business in Muthindi making him one of the top 20% consumers amongst appliance financing users

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User Profile	
Name:	Martino Kitosi
Sex and Age:	Male, 41
Equipment specifications	
Type:	Bench saw milling machine
Power Rating:	2.2 kW

Average monthly consumption at the site across quintiles, kWh





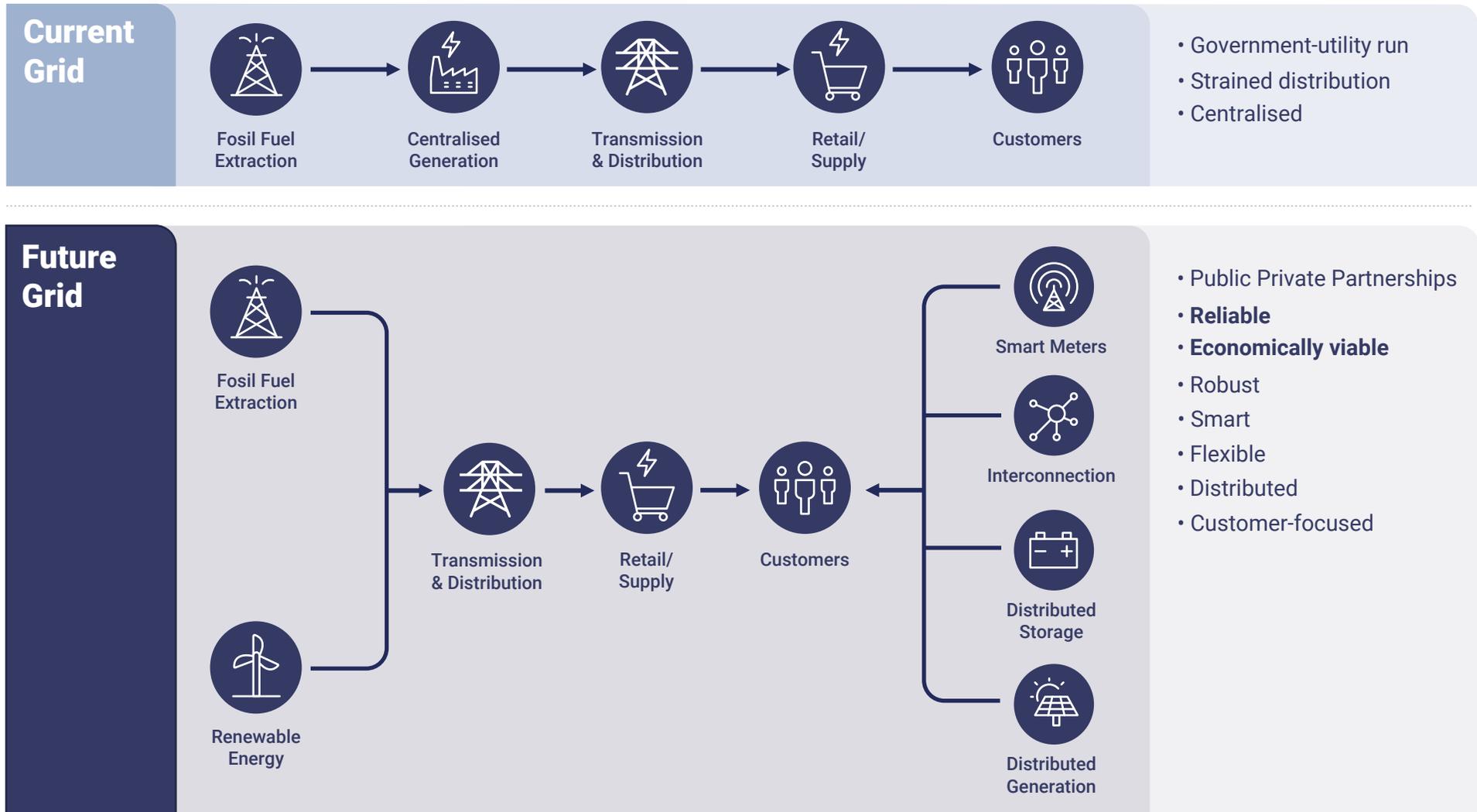
**Business case**

→ Martino participates in value addition for the forestry sector by providing carpentry services for the community

→ His workshop makes doors, windows and desks for customers in his village and nearby areas

# 05 Cheap, reliable power is the bedrock of the future grid

# The future power grid is an interwoven mesh of distributed storage, generation, and consumption – reliable and cheap power is fundamental for making it economically viable



## The Innovation Lab is advocating for the role of distributed renewable power in providing cheap, reliable power as part of the future grid

The Innovation Lab is supporting Governments and International Donors to reframe incentives and regulatory frameworks to reward reliable power, not just connections.

Reliable power, underpinned by cheap tariffs, provides a strong foundation for consumption enabled by appliance financing.

To promote cheaper tariffs, the Lab together with GEAPP and the Government of Sierra Leone have launched a tariff reduction pilot. Tariffs will be lowered across eight sites, with subsidies given to mini-grid developers to maintain their commercial viability.

Consumption increase data at these lower tariffs will inform estimation of the subsidy requirement and disbursement duration for a potential national scale-up across Sierra Leone's 101 mini-grid sites.

As part of efforts to scale appliance financing, the Lab has designed an appliance financing roadshow program in partnership with ESMAP.

The roadshow program aims to offer appliances and income generating machinery, together with affordable financing to existing Ethiopian Electric Utility mini-grid customers

and newly connected mini-grid customers in line with the roll-out of the mini-grid component of the World Bank's ADELE program.

The Lab is convening a task force made up of developers, technical partners, manufacturers, suppliers, financiers, and government agencies and host roadshows at these mini-grids as they were rolled out.

Please contact [mglabsops@crossboundary.com](mailto:mglabsops@crossboundary.com) for more information and for collaboration opportunities.

### Program partners



# Disclaimer and acknowledgements

The Lab is supported by the University of Massachusetts Amherst, Rochester Institute of Technology, and Duke University, who support experiment design and analysis of results. The Lab's work and the results presented here are strongly endorsed by the Africa Minigrid Developers Association (AMDA).

The Lab's Innovation Insight series provides ongoing, early insights on the prototypes so mini-grid developers, governments, and funders can act on the results as they emerge. All results and analysis in these series is therefore shared as actionable business intelligence rather than scientific evidence.

While these series are not intended to meet the standards of an academic paper, the Lab will publish more complete reports at the end of each prototype, and has partnered with University of Massachusetts Amherst, Rochester Institute of Technology, and Duke University to publish academic papers on certain prototypes.

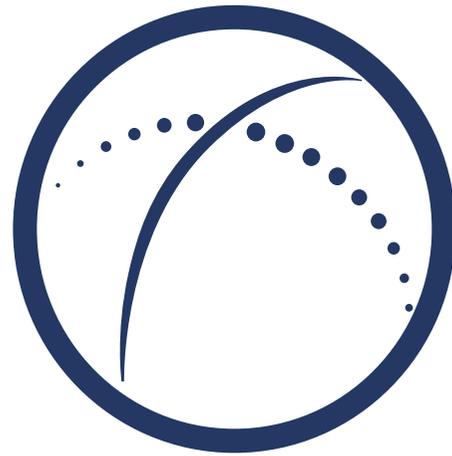


CrossBoundary's Mini-Grid Innovation Lab's work is made possible by the following funders:



And by the following developers:





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