



**SUPPLEMENTARY MATERIAL: SAMPLING METHODS AND SAMPLE DESCRIPTION**

**Barriers and Policy Solutions for Off-Grid Energy Development: Evidence from a Comparative Survey of Private Sector Developers in Eastern Africa**

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# Detailed description of sampling and sample composition

This additional material provides more detail regard the methodology for the policy brief of the same name which can be found on the Climate Compatible Growth website [\[1\]](#).

## SAMPLE SELECTION AND COMPOSITION

The objective of the study was to collect information on the barriers and opportunities facing private sector companies involved in the provision of off-grid energy technologies. As such, a listing of private sector enterprises involved in delivering energy generation or other energy sector technologies was undertaken. This covered each of the four national capital cities of the researched countries: Addis Ababa (Ethiopia), Kampala (Uganda), Nairobi (Kenya), and Dar es Salaam (Tanzania). From this list, in order to have sufficiently large samples in each country to analyse country-specific patterns, a sample size of fifty firms with off-grid energy activities or interests was targeted for participation.

The numbers of relevant off-grid firms were not so large, so interviews generally proceeded with the exhaustive set of all such companies that gave their consent to participate. Additional firms with energy sector activities, even if not

off-grid, were included to complete the sample in Ethiopia in particular; these were sampled randomly from the list of firms, once the off-grid enterprises were exhausted. In Ethiopia, where the sector is nascent, the final number of participating firms was 41, in Kenya, Tanzania, and Uganda, final sample sizes were 50, 50, and 49, respectively. The data collection was conducted in September and October of 2021.

## DETAILED DESCRIPTION OF THE SAMPLE

Data collected via the surveys offer a rich perspective on the diverse experiences of these companies. Respondent and firm characteristics for the sample are presented in **Table 1**. Respondents across countries were in their mid-30s on average (slightly older in Ethiopia and slightly younger in Uganda and Kenya). In Ethiopia, Kenya, and Uganda, the respondents are also highly educated with the vast majority having completed university degrees; the Tanzanian sample stands out as having a significantly lower education level (more than 50% with secondary or less). On average, respondents had 6.3 years of experience working with the organization enrolled in the survey and 5.6 years working on off-grid energy activities in particular. While respondents in Ethiopia had

spent the longest time with their organizations, they had the least off-grid experience (3.5 years on average), perhaps reflecting the nascent nature of interest and labour opportunities in this sector in their country.

The energy firms included in the survey were about 10 years old, on average, with those in Kenya and Ethiopia somewhat older (13 years); these two countries' organizations also had more average time working in the off-grid energy sector – with older firms in Ethiopia appearing especially active in marketing of diesel technologies – specifically (about 11 years vs. 3 and 7 years in Tanzania and Uganda). Only the sample from Uganda contained non-profits (n=2) or hybrid organizations (n=2). Most rented their offices, and rental costs were by far the highest in Nairobi (at US Dollars (USD) 1,680/mo on average), and lowest in Dar es Salaam (USD 300/mo), which largely reflects the larger size of the firms (in terms of employees) in the Nairobi sample. There was considerable variation in rental costs across firms, however, reflecting variation in their relative size (e.g., 98 employees per firm in Kenya on average vs. only 4 in Tanzania). The organizations were mostly sole proprietorships or limited liability companies, though multi-ownerships were somewhat common in Uganda. Male workers comprised about 72% of the labour force of these organizations, slightly lower in Kenya and Uganda (68 and 70%, respectively) and higher in Tanzania (77%) and Ethiopia (73%).

As noted in the main brief, about 55% of the organizations identified off-grid energy as one

of their main sectors of activity; this share was lowest in Uganda (16%) and highest in Kenya (98%). Large proportions also identified their main activities as work in energy efficiency (54%), energy for public services (23%), other specific energy uses, e.g., water pumping (29%), and non-energy activities were mentioned by 37% of firms. Thirty-five percent were part of an off-grid energy association. We asked firms to identify the energy products or technologies that provided their organizations the most revenues: nearly half identified stand-alone solar home systems as this product. This technology was the highest selling for firms across the four countries, though in Ethiopia, there is also an equal share (32%) of firms receiving their greatest revenue from generators. Between 6–9% of all sample firms identified each of the following other products as their primary revenue source: mini-grid connections, non-solar generators, pico-solar devices, batteries, appliances, and solar pumps.

Finally, in terms of business prospects and status, very few appeared to access debt finance, either in the form of simple loans (only 26%) or identifying debt financing as a share of their overall portfolio of resources (15%). Equity financing makes up the majority of resources (83%), followed by debt and then grants. The latter provided a very small share of organizations' funds (3%). About 18% of these organizations also reported using other parts of their business to subsidize their off-grid activities, though the subsidies usually amount to less than 10% for the majority (about 70%) of these firms. The modal cost and revenues brackets identified demonstrate the competitive and breakeven nature of the sector, in that revenues do not clearly outweigh costs overall or in any country.

<sup>1</sup> This reflects the somewhat different sampling strategy employed in Ethiopia. Relatively few Ethiopian firms participated in the off grid market; hence, we included firms working in related activities, e.g., sellers of generators.

*“The survey findings reveal that a set of common challenges confront off-grid firms in these countries [1]”*

VARIABLE	OVERALL	ETHIOPIA	KENYA	TANZANIA	UGANDA
<b>Respondent characteristics</b>					
Age (yrs)	35.7 (9.14)	40.5 (11.7)	33.4 (7.65)	35.9 (10.1)	33.6 (4.68)
Respondent is male	73%	80%	66%	80%	65%
Highest level of education					
Secondary or less	17%	7%	0%	58%	2%
Some higher education	12%	7%	2%	26%	12%
Completed university	55%	85%	98%	16%	86%
Masters or PhD	15%	32%	6%	2%	24%
Experience w/organization (yrs)	6.3 (5.4)	9.6 (8.3)	5.3 (4.8)	5.2 (3.5)	5.7 (3.4)
Experience in off-grid sector (yrs)	5.6 (5.0)	3.5 (5.6)	6.4 (5.7)	5.5 (4.1)	6.5 (4.0)
<b>Organization characteristics</b>					
Year of start-up	2010 (11.1)	2007 (13.6)	2007 (13.6)	2014 (8.3)	2013 (4.8)
Fully private <sup>1</sup>	98%	100%	100%	100%	92%
Office in the capital city					
Own office space	12%	7%	15%	4%	20%
If own, value ('000 USD)	390 (506)	1014 (609)	No data	No data	155 (175)
If rent, monthly cost (USD)	878 (1,367)	717 (676)	1,679 (2,505)	299 (155)	838 (549)
Type of company <sup>2</sup>					
Sole proprietorship	33%	44%	2%	60%	29%
Limited liability company	55%	56%	92%	30%	45%
Other	12%	0%	8%	10%	26%
Time in off-grid sector (yrs)	7.8 (8.4)	11.0 (10.7)	10.9 (9.7)	3.1 (4.5)	6.8 (5.1)
<b>Number of employees in country</b>					
Overall	47.7 (175.0)	20.5 (21.8)	97.8 (296.9)	4.2 (6.1)	65.4 (162.9)
Off-grid only	36.7 (160)	14.4 (18.5)	80.6 (304.1)	2.9 (2.8)	49.1 (91.8)
% male	71.8 (19.6)	73.3 (20.5)	67.8 (18.5)	76.7 (25.5)	69.6 (11.1)
Entry wage for locals (USD/mo)	231 (183)	100 (39.2)	323 (129)	91 (83)	340 (211)
Member of off-grid association	35%	44%	38%	14%	49%
<b>Access to credit</b>					
Applied for loan in past year	26%	39%	27%	26%	14%
Could obtain loan if needed	85%	85%	69%	98%	88%
Likely to add workers next year	43%	63%	73%	17%	21%
<b>Highest selling energy technology</b>					
Mini-grid connections	6%	2%	14%	0%	6%
Solar home systems	49%	32%	54%	62%	47%
Non-solar generator	9%	32%	0%	3%	0%
Pico-solar device	7%	17%	6%	3%	3%
Batteries	7%	2%	8%	3%	15%
Appliances	7%	0%	0%	21%	9%
Solar pumps	7%	2%	10%	5%	12%
Other	8%	12%	8%	5%	9%
<b>Financing</b>					
% Debt	14.8 (21.9)	21.2 (31.9)	22.2 (23.0)	4.4 (9.5)	13.8 (14.4)
% Equity	82.9 (24.2)	77.2 (32.6)	76.7 (26.4)	95.6 (9.5)	80.8 (19.1)
% Grants	3.3 (11.1)	1.6 (6.0)	6.9 (16.8)	0.0 (0.0)	5.7 (13.6)
Profitability					
Modal revenue bracket (USD/yr)	10–100k	100–500k	10–100k	10–100k	100–500k
Modal cost bracket (USD/yr)	10–100k	100–500k	10–100k	10–100k	100–500k
Firm loses money on off-grid	18%	7%	37%	0%	26%
N	190	41	50	50	49

Table 1. Description of sample enterprises and respondents

Notes: Standard deviations reported in parentheses, for non-binary variables.

<sup>1</sup> Omitted categories are NGO or non-profit, and hybrid.

<sup>2</sup> Other includes multi-owner proprietorship, general partnership company, limited partnership, and cooperative.

## REFERENCES

[1] Jeuland, M., Beyene, A., Babyenda, P., Hinju, G., Mulwa, R., Phillips, J., Zwedie, S. (2022). Barriers and Policy Solutions for Off-Grid Energy Development: Evidence from a Comparative Survey of Private Sector Developers in Eastern Africa: Supplementary Material. Climate Compatible Growth Programme COP27 Policy Brief Series (Version 1). Available at: <https://www.doi.org/10.5281/zenodo.7107879>

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