International Labour Organization

STRENGTHEN2

Co-funded by the European Union

Employment impact assessment of the productive use of energy (PUE) of the Green Mini-Grid (GMG) Facility, Kenya

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ISBN: 9789220410295 (web PDF)

Front page photo credits: Own source

This publication was co-funded by the European Union. Its contents are the sole responsibility of the authors and do not necessarily reflect the views of the European Union.

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Acronyms and Abbreviations

AFD	Agence Française de Développement
AMDA	Africa Mini-Grid Developers Association
DFID	Department for International Development (United Kingdom)
DRE	Decentralized Renewable Energy
EmplA	employment impact assessment
EU	European Union
FCDO	Foreign, Commonwealth and Development Office (United Kingdom)
FGD	focus group discussion
FTE	full-time equivalent
GDP	gross domestic product
GMG	Green Mini-Grid
ILO	International Labour Office/Organization
IRENA	International Renewable Energy Agency
KES	Kenyan shilling
KII	key informant interview
KPEA	KUDURA Power East Africa
KPI	key performance indicator
kW	kilowatt
kWh	kilowatt hour
M-PESA	mobile money
MTP	Medium-Term Plan
OHS	occupational health and safety
PUE	productive use of energy
PV	photovoltaic
RVE.SOL	Rural Village Energy Solutions
SACCO	savings and credit cooperative
SDG	Sustainable Development Goal
SMEs	small and medium-sized enterprises
SSA	sub-Saharan Africa

Acknowledgements

The authors would like to thank the developers Renewvia, Kudura and Powerhive for their continued support and coordination regarding the survey and data collection. They would also like to thank the project implementers, AFD for their support. This report was produced under the overall guidance of Mito Tsukamoto, Chief Employment in Investments branch of the ILO and Ralf Krueger, Chief Technical Adviser of the STRENGTHEN2 project (ILO). Pamphile Sossa, Technical Specialist (ILO), Maikel-Lieuw Kie Song, Senior Technical Specialist (ILO) and Gerard Hendriksen (IED) provided further much appreciated comments. The authors would like to extend their gratitude to all reviewers. Many thanks to Rohin Otieno for providing the country situation analysis section and May Hofman for editing the report.

Executive summary

The ILO STRENGTHEN2 project is conducting employment impact assessments of investments in sub-Saharan Africa to promote the creation of more and better jobs. This report presents an employment impact assessment (EmpIA) of the second phase of the Green Mini-Grid Facility Programme in Kenya. It follows on from a previous EmpIA on the short-term direct, indirect and induced employment outcomes conducted by the STRENGTHEN2 project (Oyuma, Game and Lieuw-Kie-Song 2023). To complement, this report focuses on the long-term employment and livelihood impacts from the productive use of energy (PUE) by businesses created as a result of access to the mini-grids' electricity. It aims to uncover how mini-grids contribute to job creation in the long-term, including the types of jobs that are created and who benefitted from these the most. In addition, insights on contributing factors to employment outcomes, such as access to financial services, costing and satisfaction of services were collected to understand components that impact job outcomes and form the basis of recommendations for employment promotion.

Quantitative and qualitative data were collected from a survey of 94 small and medium-sized enterprises (SMEs) and from focus group discussions (FGDs) across twelve sites. The majority of SMEs fell within the agriculture sector and services sector, with business types varying between the different mini-grid site locations that spanned three counties in rural areas of Western Kenya. The gender balance of the sample[1] was 60 per cent male and 40 per cent female, with 44 per cent classified as youth (18–35 years).

The total headcount of workers in the overall sample was 195; 120 of these being paid workers. The estimated total full-time equivalent (FTE) of the paid workers sample was 118, which comes to an average of 9.8 FTE jobs created per site.[2] The distribution of workers in paid employment was 52 per cent male and 48 per cent female, indicating an almost equal distribution of men and women participating in paid employment. The majority of these jobs (52 per cent) were permanent jobs, with seasonal and casual workers making up the remaining 48 per cent.

The majority of contracts were informal, with 82 per cent of contracts among permanent workers being informal. However, 66 per cent of all enlisted workers in the overall sample were reported to be family members. About two thirds of the total workforce in the overall sample were also reported to be skilled labourers. Of these, females represented 41.8 per cent.

The results show a bias towards men in wages/compensation, which were better for men across all paid job categories. The average daily wage in the overall sample was about 350 Kenyan shillings (KES) for men and about KES 260 for women. Seasonal workers, both men and women, appear to earn relatively higher average daily wages than casual and permanent workers.

In the long-term, job creation increased, SME owners were asked how their situation had changed as a result of access to energy and starting their PUE business. 69 per cent stated that they were unemployed before but would now consider themselves employed. 84 per cent of SMEs reported that the revenue from their PUE business had increased in the two years. 40 per cent reported that their workers' wages had increased compared to the period before they joined the PUE business; 80 per cent of the SMEs in the FGDs perceived that either their overall household incomes or income from their PUE business had increased compared to the previous two years.

Based on comparisons between different developers, it appears that the main driver of job creation is appropriate access to finance, which allows the setting up and expansion of PUE businesses. Token rates, connection fees and other costs also play a part, alongside reliability of the energy and service. Wages and employment appeared to be lower across developers' sites that were engaged in more agricultural activities. Based on these findings, it is recommended that developers should offer tiers of PUE appliance financing or provide more appliances on credit. Connecting the developers with partners who can provide PUE appliances, such impact investors, could be a viable option. Furthermore, reducing mini-grid token rates through subsidies will increase energy consumption and enable further expansion. For developers' however, there are barriers to implement these changes due to high operational costs. Donors would need to provide further incentives to increase sustainability of the business. This de-risking could attract more private investment within the sector which would lower costs for customers to further enable them to expand SMEs and spur job creation.

[1] In this study, the sample included only the owner, partner or top manager of the SME business.
[2] This assumes that the number of SMEs and jobs created are similar across sites, but as observed, this is not always the case so should be interpreted with caution.

Résumé Exécutif

Le projet STRENGTHEN2 de l'OIT réalise des évaluations de l'impact sur l'emploi de projets d'investissement en Afrique subsaharienne afin de promouvoir la création d'emplois plus nombreux et de meilleure qualité. Ce rapport présente une évaluation de l'impact sur l'emploi de la deuxième phase du programme Green Mini-Grid Facility au Kenya. Il fait suite à une précédente étude d'impact sur l'emploi direct, indirect et induit à court terme menée par le projet STRENGTHEN2 (Oyuma, Game et Lieuw-Kie-Song 2023). Ce rapport complémentaire se concentre sur les impacts sur l'emploi à long terme et les moyens de subsistance de l'utilisation productive de l'énergie (UPE) par les entreprises créées grâce à l'accès à l'électricité des mini-réseaux. Il vise à explorer comment les mini-réseaux contribuent à la création d'emploi à long terme, ainsi que les types d'emplois créés et les bénéficiaires principaux. En outre, des informations concernant l'accès aux services financiers, ainsi que le coût et la satisfaction des services ont été analysées afin de mieux comprendre les éléments ayant un impact sur la création d'emploi et de pouvoir établir des recommandations pour la promotion de l'emploi.

Des données quantitatives et qualitatives ont été recueillies à partir d'une enquête menée auprès de 94 petites et moyennes entreprises (PME) et de discussions avec des groupes cibles sur 12 sites. La majorité des PME appartiennent aux secteurs de l'agriculture et des services, les types d'entreprises variant entre les différents sites de mini-réseaux qui couvrent trois comtés dans les zones rurales de l'ouest du Kenya. L'échantillon[3] est composé de 60 pourcent d'hommes et de 40 pourcent de femmes, dont 44 pourcent sont des jeunes (18-35 ans).

Le nombre total de travailleurs dans l'échantillon global était de 195, dont 120 étaient des travailleurs rémunérés. Le nombre total d'équivalents temps plein (ETP) de l'échantillon de travailleurs rémunérés est estimé à 118, ce qui correspond à une moyenne de 9,8 emplois ETP créés par site[4]. La répartition des travailleurs rémunérés était de 52 pourcent d'hommes et de 48 pourcent de femmes, ce qui indique une répartition presque égale entre les hommes et les femmes occupant un emploi rémunéré. La majorité de ces emplois (52 pourcent) étaient des emplois permanents, les 48 pourcent restants étant occupés par des travailleurs saisonniers et occasionnels.

La majorité des contrats étaient informels, avec 82 pourcent des contrats permanents informels. Cependant, 66 pourcent de tous les travailleurs engagés dans l'échantillon global étaient des membres de la famille. Environ deux tiers de la main-d'œuvre totale de l'échantillon global sont également des travailleurs qualifiés. Parmi eux, les femmes représentaient 41,8 pourcent.

Les résultats montrent que les salaires/rémunérations sont meilleurs pour les hommes que pour les femmes dans toutes les catégories d'emplois rémunérés. Le salaire journalier moyen dans l'ensemble de l'échantillon était d'environ 350 shillings kenyans (KES) pour les hommes et d'environ 260 KES pour les femmes. Les travailleurs saisonniers, hommes et femmes, semblent gagner des salaires journaliers moyens relativement plus élevés que les travailleurs occasionnels et permanents.

Les propriétaires de PME ont été interrogés sur l'évolution de leur situation suite à l'accès à l'énergie et à la création de leur entreprise de UPE. 69 pourcent d'entre eux ont déclaré qu'ils étaient auparavant au chômage et qu'ils se considéraient désormais comme employés. 84 pourcent des PME ont déclaré que les revenus de leur entreprise de UPE avaient augmenté au cours des deux années écoulées. 40 pourcent ont indiqué que les salaires de leurs employés avaient augmenté par rapport à la période précédant leur entrée dans l'entreprise de UPE; 80 pourcent des PME interrogées lors des discussions de groupe ont estimé que les revenus globaux de leur ménage ou les revenus de leur entreprise de UPE avaient augmenté par rapport aux deux années précédentes.

Sur la base de comparaisons entre différents promoteurs, il semble que le principal moteur de la création d'emplois soit un accès approprié au financement, qui permet la mise en place et l'expansion des entreprises de UPE. Les tarifs des jetons, les frais de connexion et autres coûts jouent également un rôle, tout comme la fiabilité de l'énergie et du service. Les salaires et l'emploi semblent être plus faibles sur les sites des promoteurs qui sont engagés dans des activités plus agricoles. Sur la base de ces résultats, il est recommandé aux promoteurs de proposer des niveaux de financement des appareils UPE ou de fournir davantage d'appareils à crédit. La mise en relation des promoteurs avec des partenaires capables de fournir des appareils UPE, tels que des investisseurs à impact, pourrait être une option viable. En outre, la réduction des taux symboliques des mini-réseaux par le biais de subventions augmentera la consommation d'énergie et permettra de poursuivre l'expansion. Pour les promoteurs, cependant, il existe des obstacles à la mise en œuvre de ces changements en raison des coûts opérationnels élevés. Les bailleurs de fonds doivent fournir des incitations supplémentaires pour accroître la viabilité de l'entreprise. Cette réduction des risques pourrait attirer davantage d'investissements privés dans le secteur, ce qui réduirait les coûts pour les clients et leur permettrait de développer les PME et de stimuler la création d'emplois.

[3] Dans cette étude, l'échantillon ne comprenait que le propriétaire, le partenaire ou le cadre supérieur de la PME.

[4] Cela suppose que le nombre de PME et d'emplois créés est similaire d'un site à l'autre, mais ce n'est pas toujours le cas et il convient donc de l'interpréter avec prudence.

1. Introduction

The STRENGTHEN2 project aims to leverage employment impact assessment (EmpIA) in sub-Saharan Africa for the creation of more and better jobs. STRENGTHEN2 is working to assess the employment impact of (mostly) infrastructure investments funded by the European Union (EU). In Kenya, the Green Mini-Grid Facility (GMG) Programme enhances access to energy in Kenya by encouraging private investment in renewable energy-based mini-grids. It aims to support economic development in rural communities through productive usage of electricity and job creation, improving the lives of 100,000 Kenyans whilst respecting the environment. The project is funded by the United Kingdom's Department for International Development (DFID) (now the Foreign Commonwealth and Development Office (FCDO)) and the European Union (EU). The first phase, GMG1, was funded by DFID and was completed in October 2020, four years after it began in 2016. The second phase, GMG2, is funded by the European Union under the EU-Africa Infrastructure Trust Fund and is currently under implementation by the Agence Française de Développement (AFD). In total, the project has 80 mini-grid sites from four developers, split across GMG1 with 47 sites and GMG2 with 33 sites and an additional 20 sites currently under construction in Turkana county.

This employment impact assessment focuses on the long-term employment and livelihood effects created by the mini-grids and productive use of energy (PUE). This EmpIA follows on from a previous assessment of GMG2 conducted by STRENGTHEN2 focusing on the direct, indirect and induced employment impacts of the programme. The study recorded a total of 4,407 jobs created, expressed as the headcount. There was a clear bias towards male and unskilled jobs from employment in the construction and operations phase of the mini-grids and recommendations were made to reduce these biases for future programs on mini-grid construction in Kenya.

Productive use of energy can be broadly defined as an extension of households' capacity to generate income from non-farm activities, providing a way to increase socioeconomic development after households gain access to electricity from mini-grids. PUE contributes to higher incomes, welfare benefits and leads to increased demand for electricity (World Bank 2023). Many developers provide interventions for promoting productive uses to SMEs and measuring the impact of such interventions can highlight recommendations for stakeholders to further accelerate the impact of rural energy access. This study aimed to cover the following objectives:

1. Report on the existing sociodemographic profile and labour market situation among SMEs in communities that have received access to solar mini-grid energy under the GMG programme
2. Assess how livelihood and employment impacts have changed as a result of access to energy and subsequent PUE within SMEs, and how these differ between developers'
3. Provide recommendations for developers', implementing partners and other relevant stakeholders for boosting economic and employment outcomes within mini-grid programmes

To meet these objectives, this report presents the impacts on SMEs relying on electricity generated by the GMG facility, with a sub-focus on long-term socio-economic effects as a result of access to the mini-grid electricity and PUE. It targets three developers, two as part of GMG2 and one under GMG1. The report focuses on the results from a survey of SMEs and FGDs undertaken to collect data on employment and livelihoods in September/October 2023. Data was collected on how participants viewed their employment situation as changing since the introduction of the mini-grid electricity and the PUE.

This document starts by providing a background on previous research on employment within the renewable mini-grid sector. It then outlines the methodology and survey design used in the questionnaire and FGDs. The results section covers an analysis of the data collected, split into the areas of demographics, capital expenditure, labour demand, access to financial services, livelihoods and long-term employment related outcomes. The report ends with a conclusion and recommendations for promoting decent work further within the sector.

2. Background

2.1 Country overview

Kenya is a country in sub-Saharan Africa (SSA) within East Africa, with a population estimated to be about 54 million (World Bank 2020a) and average annual population growth of 2.2 per cent. The country is divided into 47 semi-autonomous counties and has a population density of 74 per square kilometre (East African Community 2019). The average household size is 3.9 people (KNBS 2020). The rural population represents 72 per cent of the total population, with 28 per cent of the population living in urban areas (World Bank 2020b).

Kenya is a lower middle-income economy, registering an average annual gross domestic product (GDP) growth of 5.6 per cent from 2015 to 2019. The Kenyan economy grew by 6.8 per cent in 2021 and decreased by 0.3 per cent in 2020, due to COVID-19. This is expected to improve in 2022, where GDP is forecast to grow by 5.9 per cent. Similarly, GDP per capita, which stood at about US$1,970 in 2019, declined to approximately US$1,940 in 2020, and is expected to bounce back and increase gradually in subsequent years (AfDB 2021). As of 2020, Kenya was the third largest economy in sub-Saharan Africa, after Nigeria and South Africa.

Kenya's total employment (outside small-scale agriculture and pastoralist activities) stood at 18.3 million persons in 2021 (KNBS 2022). The informal sector accounted for 81.4 per cent of jobs outside small-scale agriculture and pastoralist activities. The urban employment-to-population ratio is 58 per cent, and the rural ratio is 59 per cent (Timmis 2018). Male employment accounted for 60.7 per cent of the total wage employment in 2021 (KNBS 2022). Kenya's youth unemployment rate for 2021 was 13.84 per cent, a 0.26 per cent increase from 2020 (World Bank 2022). The major economic sectors in Kenya with high value-added and that contribute the most to the national GDP are the services sector at about 56 per cent, followed by agriculture at 23.5 per cent and industry at 21 per cent (AfDB 2022). The agriculture sector's contribution to employment is significant, employing between 56 per cent to 54 per cent between 2017 and 2019, the services and industry sectors employed approximately 39 per cent and 6 per cent between 2017 and 2019 respectively (World Bank 2022).

Unemployment in Kenya increased from 7 per cent in 2015 to 10.4 per cent in 2020, largely due to the economic slowdown caused by COVID-19. The majority of the unemployed (about 85 per cent) are under the age of 35 (AfDB 2021), with about 30 per cent having attained primary-level education, 35 per cent secondary, 11 per cent mid-level and 9 per cent university education.

Kenya seeks to become a highly industrialized but environmentally clean middle-income nation by 2030. The main national development blueprint is Vision 2030, which is broken down into five-year medium-term plans. The current medium-term plan (MTP III) covers 2017–22, and is focused on achieving four strategic objectives, known as "The Big Four": (i) expand manufacturing from 9.2 per cent of GDP to 15 per cent; (ii) attain 100 per cent food and nutrition security; (iii) achieve universal health coverage; and (iv) build 500,000 affordable houses.

Among others, MTP III also addresses entrenched challenges of poverty, unemployment and socio-economic inequalities as well as mitigation of the effects of climate change in the context of the Paris Agreement, guided by the Climate Change Act, National Climate Change Framework Policy, National Climate Change Action Plan, and National Climate Change Response Strategy. Hence, "The Big Four" concerns supporting sectors with proven potential for high value addition and job creation to assist industrialization and achieve the needed structural transformation and improved welfare. Furthermore, the National Treasury has launched the Kenya Vision 2030 Fourth Medium Term Plan (MTP) 2023–2027 preparatory process that will guide the development agenda for the country in promoting social and economic growth. This is in line with Sustainable Development Goal (SDG) 8, to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

2.2 Mini-grids and job creation

Employment is the cornerstone of productive economic development, contributing to higher per capita income, inclusive jobs and reduction in poverty, as well as increasing gender equality and independence (UN DESA 2022). Moreover, women's participation in labour markets is crucial to

advancing gender equity and overall better economic opportunities, especially in developing countries (Pimkina and de La Flor 2022).

Mini-grids are emerging as a viable technology to accelerate access to electricity in sub-Saharan Africa. In addition to offering a sustainable, cost-effective option for the accelerated electrification of rural households, the deployment of mini-grids brings about other benefits such as job creation, local industry development, education and health improvements. Notably, the mini-grids sector, together with off-grid solar systems, is expected to be the least-cost solution for approximately 450 million people by 2030 (IEA 2022).

The Decentralized Renewable Energy (DRE) sector – including mini-grids – is essential to achieving universal energy access (SDG 7) and contributing to achieving SDG 8 – job creation. A recent annual jobs review from the International Renewable Energy Agency (IRENA) shows that within renewable energy, the solar photovoltaic (PV) industry has been the largest employer since 2016, with close to four million people employed worldwide in 2020 (IRENA and ILO 2022; IRENA 2022). The Africa MiniGrid Developers Association (AMDA) suggests that mini-grid companies not only create economic opportunities in communities but also provide direct employment across the whole value chain (AMDA and Economic Consulting Associates 2020). AMDA further shows that mini-grid developers created 621 local village jobs and 402 central staff jobs between 2010 and 2019 in 288 sites across western, central, eastern, and southern Africa, and that on average, a mini-grid site creates 0.15 full-time positions for every kilowatt (kW) of installed generation capacity. Thus, a standard mini-grid of 20 kW creates around three full-time jobs, corresponding to the most recent ILO direct employment impact study on the GMG Facility in Kenya, suggesting that 2.8 FTE were jobs created per mini-grid site during operations and maintenance (Oyuma, Game, and Lieuw-Kie-Song 2023).

In addition to direct employment, mini-grids create long-term employment and play a crucial role in advancing equitable distribution of jobs. A Precise Consulting study suggests that productive use of energy (PUE) technologies (defined as solar-powered systems that enable agricultural, commercial, or industrial activities) can create around 190,000 jobs across three high-potential value chains in Ethiopia (Precise Consulting 2021). Moreover, a recent report by the Rockefeller Foundation states that given the potential to rapidly deploy DRE technologies close to the end-user, around 491 million additional new jobs can be created in downstream applications across agriculture, enterprises, health and education, among others (Rockefeller Foundation 2022).

While the potential for job creation in renewable energy has been assessed at the global level, there is an increasing demand for renewable energy employment studies at the national level. To date, there is very little information available worldwide or from specific countries regarding the quantified employment impact and potential benefits of mini-grids compared to other electricity supply options (Day and Kurdziel 2019; Power for All 2022). There is also a dearth of information regarding long-term employment effects and job creation in the mini-grid sector. While there has been increased attention given to jobs in recent publications within the renewable energy community, the existing data is still insufficient – and virtually non-existent in the countries' statistical offices – to make informed policy decisions. The censuses conducted by Power for All represent the most comprehensive employment surveys to date in the DRE sector. Again, while direct employment effects are calculated relatively easily, the measurement of indirect, induced and long-term employment effects is more difficult, as the isolation and causality between a project and the resulting job impacts is not explicit. Long-term impacts take time before they are fully established and observed, unlike the more immediately visible direct impacts from the construction and monitoring phases of the projects.

Productive use appliances contribute significantly to the profitability of a mini-grid, as well as to increases in household incomes, job creation in the rural community and general well-being of their users, thus supporting local economic development. Over time, this supports the mini-grid business model further by supporting customers to spend more on electricity, as they can afford more. Productive use appliances such as grain mills typically have power ratings of 1,000-10,000 watts (1-10kW), 10 times more than commercial appliances such as shop fridges (50-100 watts), and 100 times more than household appliances such as TVs (30-50 watts) (Crossboundary 2020). Moreover, productive use appliances are typically/ideally operated during the day when electricity from solar mini-grids is cheapest.

3. Methodology, developers and sites

3.1 Methodologies employed

Following the first EmpIA of the Green Mini-Grid (GMG) Facility, Kenya, in 2022, which focused on direct employment effects and estimates of indirect and induced employment effects, a methodology was designed to assess the long-term employment effects of investments in mini-grids. The GMG developers Rural Village Energy Solutions (RVE.SOL)/ KUDURA Power East Africa (KPEA), Renewvia and Powerhive had been included in the first study – measuring the direct employment effects. RVE.SOL/KPEA and Renewvia were visited due to the focus of the assessment on GMG2, while Powerhive from GMG1 was visited to provide some context of mini-grid sites that had been operational for a longer period. The same three developers were included in this study – assessing long-term employment effects of mini-grids and the impacts of PUE in the GMG Facility, Kenya.

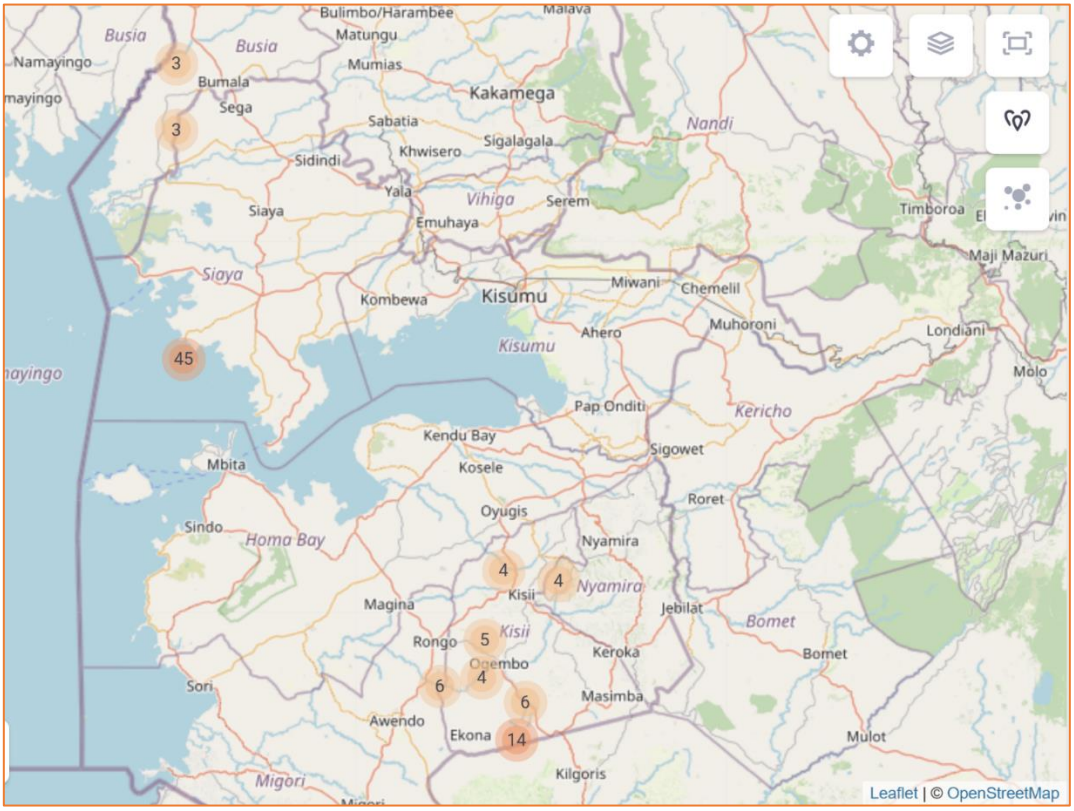
The study design was a descriptive and exploratory study employing a mixed methods approach, utilizing both qualitative and quantitative data collection methods. The study objective was to assess the employment impacts generated by SMEs relying on electricity generated by the GMG facility, with a sub-focus on long-term socio-economic effects as a result of access to the mini-grid electricity. The study will help in gaining a better understanding of the effects of PUE and related activities in creating jobs, and in particular, mechanisms through which access to mini-grid electricity impact on employment, and what types of long-term quantitative and qualitative socio-economic impacts can be expected. The design aimed at collecting and analyzing a selected and limited set of comparable data from the three developers and comprised the following five key components:

+ *Literature review/desktop analysis:* Global, regional and national documentation on the renewable energy sector, mini-grids and associated long-term employment effects and productive use of energy, as well as literature from the GMG Facility, Kenya and the selected developers.
+ *Developer surveys:* Consultations and key informant interviews (KII) with the three selected developers, as well as data abstraction from company records and internal key performance indicator (KPI) monitoring systems.
+ *Customer surveys:* Quantitative surveys of 94 SMEs across the three developers.
+ *Focus group discussions:* Qualitative surveys (3) comprising one FGD with some 10 selected SMEs/individuals per developer. The selection criteria ensured, as much as possible, gender balance, age and varied mini-grid sites as well as a mix of SME types.
+ *Site visits and observation* of all the selected SMEs' operational premises.

Primary data (questionnaire) were collected from a total of 94 SMEs – the mini-grid customers utilizing the mini-grid electricity for commercial/business purposes and focused on (i) demographic profiles; (ii) capital expenditures, revenues and operation costs for PUE businesses; (iii) labour demand among SMEs; (iv) wages/levels of compensation and skills levels of SME labourers; (v) access to financial services; and (vi) livelihood enhancement, satisfaction and well-being in the household as well as regarding PUE appliance and the mini-grid service. Additional data were also collected from the developers targeting the management and operational areas of the mini-grids, focusing on (i) remote monitoring and customer data; (ii) customer productive appliance-specific data; (iii) site operational data; and (iv) user (customer) experience data.

Data collection happened in September/October 2023, the enumerators first reported to the respective developer's offices, and with their support managed to sample (based on the lists provided), transverse and collect data from SMEs spread across several villages and mini-grid sites within Kisii, Siaya and Busia counties (figure 1). Four sites were visited in Busia, six in Kisii and two in Siaya, 12 sites in total. Data were collected in the respondents' language of choice using tablets and supported by the RSS-RAMP platform. Data quality assurance and control was achieved and monitored in four ways: staff training, internal auditing, measures to ensure data quality, and quality control reporting. Quantitative data were then combined and exported to IBM SPSS 25.0 for analysis, while transcribed qualitative data were analysed using framework analysis and thematic approaches.

▶ **Figure 1. Map of Kenya showing the study areas within Busia, Siaya and Kisii counties**



Source: Authors' mapping from data collection points.

3.2 Description of the selected developers and sites

The results described below highlight differences across developers, which raises questions on the different approaches, financing, and socio-economic context of sites locations and how these influence the outcomes. The three developers differ in approach, commitment and ambition towards rural development. Site-specific conditions such as cultural orientation and rural accessibility may also render the projects more of a success in some areas than others. It is important to note that in the following descriptions the developers have been anonymized for confidentiality purposes. Hence, the sampled developers have been presented as Developer 1, Developer 2 and Developer 3.

Developer 1 (GMG1 and GMG2) aims to power rural villages, rural schools, and rural clinics and hospitals as well as small-scale farms, businesses and private residences. The developer has so far established 33 mini-grids across Kenya, with 11 sites in Busia County (GMG1), and 22 sites in Turkana County (GMG2). The developer has been in operation for about 12 years, of which eight years were in the pilot phase in the Sidonge site in Busia. Notably, Developer 1 planned to expand and build an additional 22 mini-grids in Kenya's Busia County (under GMG2). This did not go ahead and instead; it focused on building 22 new sites in Turkana County with financing to develop additional sites in the county. Busia – the focus of this study for Developer 1 – is in western Kenya, bordering Uganda to the west. It is known for its diverse culture, agriculture and trade activities. Busia is inhabited by the Luhya tribe and the Teso of Kenya, and small groups of the Luo. Agriculture is the backbone of the economy in Busia, with a majority of the population engaged in farming. During Q4 2021, Developer 1 had connected 50 SMEs and 54 public institutions in Busia, an increase from Q1 2020 when it had connected 32 SMEs and 40 public institutions (see Annex 2). However, at the time of the study, there were only six active SMEs connected in Busia (with only two females) and 6 public institutions. This decrease was due to a reduction in the chicken brooding programme within some of the sites, which closed due to cost implications.

Developer 2 (GMG1) became the first private utility in Kenya's history to be licensed to develop mini-grids and to sell electricity to the public. The success of the venture increased government attention to the sector and arguably made it easier for other private developers to operate in Kenya. Developer

2 operates in Kisii and Nyamira counties and has been in operation for about 11 years, with most recent sites being developed in 2020. Currently, Developer 2 runs 21 mini-grids in the country (18 in Kisii County and three in Nyamira County). It has also introduced a micro-financed poultry programme for customers, as well as financing for electric pressure cookers to encourage less carbon-intensive cooking. The developer has also facilitated the roll-out of electric mills, motorbikes and tuk-tuks, and hatcheries across its sites. More recently the developer started the production of black soldier flies as feed stock for chicken production. Kisii County – the focus of this study for Developer 2 – is in the southwestern part of Kenya and is known for its lush green landscapes, vibrant culture and bustling trading sector and markets. The county is predominantly inhabited by the Gusii community. Kisii County is also known for its agriculture, with tea, coffee, bananas and maize being some of the main crops grown. The county is also home to several industries, including soapstone carving. The economy of Kisii is derived from commerce and agriculture. Historical data on the evolution of SMEs and public institutions was not available at the time of the study. However, at that time there were 65 active SMEs connected.

Developer 3 (GMG2) entered the African market in 2015, where it now has mini-grid sites in Kenya and Nigeria. In Kenya, Developer 3 runs 11 mini-grid sites funded under GMG 2: two are located in Siaya, one in Kajiado, seven in Turkana and one in Homabay. The two site locations in Siaya are situated in the islands of Ndeda and Oyamo, in Lake Victoria. Until 2018, the Ndeda mini-grid site had no source of power besides kerosene, petrol and disposable batteries. Access to affordable and reliable electricity for the Ndeda population has increased opportunities for SMEs and improved cold storage for its vibrant fishing industry. Developer 3 has also introduced a water treatment facility enabling access to clean water for the population living in Ndeda. Ndeda and Oyamo Islands in Siaya – the focus of this study for Developer 3 – are known for fishing and tourism. Fishing is the major economic activity on Ndeda Island – the community relies on it for livelihood. Oyamo Island, on the other hand, has residents practising subsistence farming besides fishing. Prior to the addition Developer 3's mini-grid, many institutions on the islands, including government and public offices, primary and secondary schools, and health centres, needed electricity. The electrification has not only improved the quality of life for residents but also opened opportunities for economic growth and development.

Data provided by Developer 3 suggest that during Q3 2023, a total of 378 SMEs and 37 public institutions had been connected (all sites). Between Q4 2021 and Q3 2023, the total number of connected SMEs within the period appears to lie between 370 and 390, with a constant number of 37 public institutions connected in the same period, suggesting no significant increase in the number of SMEs over time (see Annex 2). In the Siaya County sites (Ndeda and Oyamo), at the time of the study there were 54 active SMEs connected (50 in Ndeda and four in Oyamo) and 11 public institutions (six in Ndeda and five in Oyamo). Notably, a majority of SMEs in Ndeda appeared to be shops.

4. Results

The findings are presented in the form of proportions that show the percentage distribution of various indicators and characteristics among the SME respondents. Measures of central tendency have also been used to describe and present numerical data. Furthermore, findings detail synthesized qualitative information as well as triangulation of key results from various data sources, including information from literature review, FGDs, developers and stakeholder consultations to validate the main results and provide additional qualitative context.

The findings are organized in six sub-sections:

1. Demographic and socio-economic profile
2. Capital expenditure, operational costs and revenues
3. Labour demand, wages and skill levels
4. Access to financial services
5. Livelihood enhancement, satisfaction and overall well-being
6. Long-term impacts from access to mini-grid electricity

Analysis has further delved into key challenges, opportunities and lessons learned regarding mini-grid service, along with how developers support SMEs. Aspects of attitude to risk, social and gender issues specifically related to mini-grids, the developers and the study areas, and possible impacts on people – both positive and negative – have also been assessed. It is also important to note that in the discussions in this section, the developers have been anonymized as previously, for confidentiality purposes. Hence, the sampled developers are presented as Developer 1, Developer 2 and Developer 3.

4.1 Demographic and socio-economic profile

The gender distribution of the SME respondents[5] in the overall sample was unequal, with the majority (62 per cent) being male (see table 1). This is because priority in the study design was given to the owners/heads of the SMEs. A large proportion of the respondents (90.4 per cent) were also in the productive age group (18–49 years), while about 44.7 per cent could be classified as youth as they were below 35 years. This could point to a fair engagement of youth in embracing the use of mini-grid energy for productive uses in rural areas. The mean age was 37.1 (SE 1.18), while the median age was 35 years. The youngest respondents in the overall sample were 20 years old.

▶ Table 1. Distribution of SME owners/managers, by gender

	Developer 1		Developer 2		Developer 3		Total (All)	
Gender	No.	%	No.	%	No.	%	No.	%
Female	2	**33.3**	18	41.9	16	**35.6**	36	**38.3**
Male	4	**66.7**	25	58.1	29	**64.4**	58	**61.7**
Total	**6**	**100**	**43**	**100**	**45**	**100**	**94**	**100**

Source: Authors' research.

The majority of the sampled respondents were household heads (58.5 per cent) followed by partners or spouses (28.7 per cent). Developer 2, being in operation for a longer period, appeared to have relatively more respondents as partners or spouses (44.2 per cent), a good pointer of accelerated female participation in the productive use of mini-grid energy over time. Again, a majority of the household heads in the overall sample were male (90.4 per cent), although Developer 3 seemed to have a substantial proportion of female household heads (20 per cent). About eight in ten of the SME respondents in the overall sample (84 per cent) were married, while 11.1 per cent of respondents for Developer 3 were either single or widowed. Moreover, about two thirds (66 per cent) of SME households in the overall sample were male-headed monogamous households, followed by male-headed polygamous households (16 per cent). Developer 2 had the lowest proportion of male-headed polygamous households (7 per cent).

The average household size in the overall sample was 5.5 (SE 0.27, n=521), with Developer 1 having the highest average household size of 8.5 (SE 1.48). A majority of all the SME households

[5] In this study, an SME respondent refers to the owner, partner or top manager of the SME.

(57.4 per cent) had 4 to 6 members. The average household size appeared slightly higher than the national average of 3.9 persons (KNBS 2020).

There appeared to be a relatively equal proportion of female (48.2 per cent, n=251) and male (51.8 per cent, n=270) household members in the overall sample. Again, eight in ten SME households in the overall sample (81.9 per cent) had at least a child of school age (6–18 years), with Developer 3 having slightly lower proportions. Of the households with these children (6–18 years), a majority had one or two children (53.2 per cent), while 39 per cent had three or four. The estimated median annual amount spent per SME household on school fees appeared to be KES 40,000 (Developer 1: KES 12,000, Developer 2: KES 50,000, and Developer 3: KES 20,000). According to the overall sample, the highest level of education that most members of the SME households had reached was A-level secondary education (27.7 per cent), followed by O-level secondary education (23.4 per cent); while 18.1 per cent had attained either college/mid-level or university level. The results also suggest that more female household heads/spouses had reached primary school level (34 per cent) than O-level secondary (21.3 per cent) and A-level secondary (28.7 per cent). Finally, most respondents (owners/heads of the sampled SMEs) had only reached primary school level (28.7 per cent), O-level secondary (18.1 per cent) and A-level secondary (27.7 per cent). Nevertheless, these findings suggest that the SME respondents were generally literate.

The majority of SME households in the overall sample were also found to use other non-mini-grid energy sources, mainly charcoal/firewood (77.7 per cent) and gas (66 per cent), but exclusively for cooking. The estimated median expenditure per month on these energy sources were KES 1,200 for charcoal/firewood and KES 1,500 for gas. Very few SME households (4.3 per cent) were using petrol, mainly for business transportation purposes, and kerosene for cooking (1.1 per cent). This could be an indicator that the use of kerosene for lighting and cooking purposes has generally been eliminated among the mini-grid and SME customers.

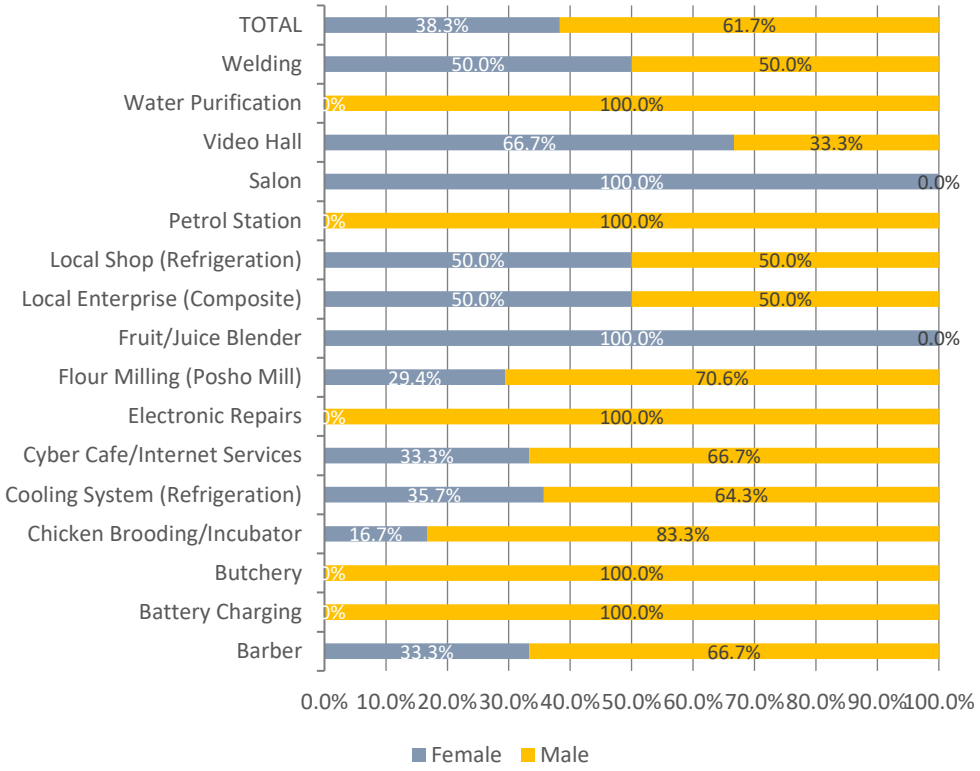
The most common PUE businesses appeared to be barber shops and flour milling, observed in each of the developers, but more so at Developer 2 (Table 2). Cooling systems (refrigeration) were observed more at Developer 3, with the selected sites being fishing and fish trading zones in need of cold storage facilities. Chicken brooding/incubation was observed at Developer 1. Other SMEs observed at each of the developers were salons and video halls.

▶ Table 2. Distribution of the sampled PUE SMEs, by developer

	Developer 1 No.=6	Developer 2 No.=43	Developer 3 No.=45	Total (All) No.=94	
Type of PUE business	%	%	%	No.	%
Barber	**16.7**	**30.2**	8.9	**18**	**19.1**
Battery charging	0.0	4.7	6.7	**5**	5.3
Butchery	0.0	0.0	2.2	**1**	1.1
Chicken brooding / Incubation	**33.3**	9.3	0.0	**6**	6.4
Cooling system (refrigeration)	0.0	0.0	**31.1**	**14**	**14.9**
Cyber café / Internet services	0.0	0.0	6.7	**3**	3.2
Electronic repairs	0.0	0.0	2.2	**1**	1.1
Flour milling (posho mill)	**16.7**	**34.9**	2.2	**17**	**18.1**
Fruit blender (juicer)	0.0	0.0	2.2	**1**	1.1
Local enterprise (composite)	0.0	0.0	**13.3**	**6**	6.4
Local shop (refrigeration)	0.0	0.0	**17.8**	**8**	8.5
Petrol station	0.0	2.3	0.0	**1**	1.1
Salon	**16.7**	**11.6**	2.2	**7**	7.4
Video hall	**16.7**	2.3	2.2	**3**	3.2
Water purification	0.0	0.0	2.2	**1**	1.1
Welding	0.0	4.7	0.0	**2**	2.1
TOTAL	**100**	**100**	**100**	**94**	**100**

Source: Authors' research.

▶ Figure 2. Types of PUE SMEs, by gender

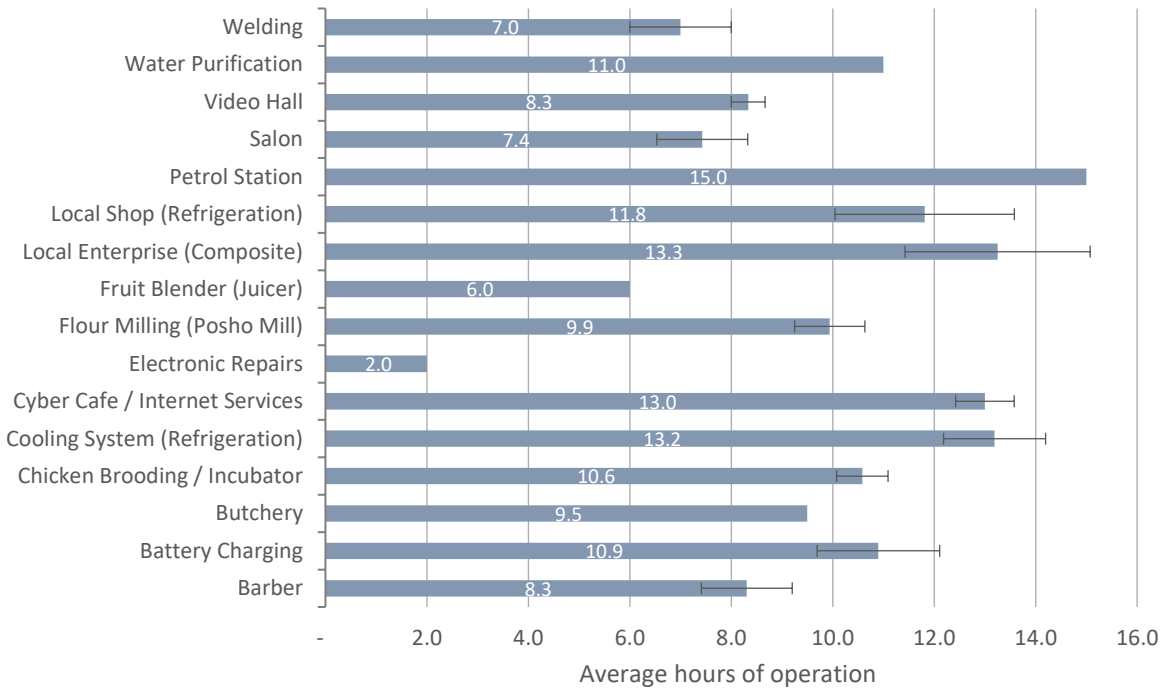


Source: Authors' research.

Figure 2 illustrates the gender distribution among the SME businesses, where overall, men appear more likely than women to own or run these PUE businesses. It also appears that women have a preference for certain types of PUE business such as a salon or fruit/juice blending, compared to men, albeit being equally engaged in other types (local shops and composite enterprises). Women also appear to be more engaged than men in running video halls.

It also appears that a majority of the SMEs operate longer than eight hours in a day (see figure 3). In the overall sample, the average duration of operation of the SMEs appeared to be about ten hours per day. However, Developer 3 SMEs seemed to operate for longer hours (averaging about 12 hours). The median duration of operation for the sampled SMEs was 3.0 years.

▶ **Figure 3. Average typical hours of operation per day for SME businesses, by PUE appliance**



Source: Authors' research.

4.2 Capital expenditure, operational costs and revenues

Having identified PUE appliance costs as a key barrier to customers in rural areas establishing value-added businesses along with provision of electricity, developers are keen to offer tiers of PUE appliance financing. Finance has generally been available to mini-grid customers for kitchen appliances, barbershop equipment, phones, televisions and refrigerators, provided to enhance energy usage. SMEs and farmers also access financing for computer, carpentry and welding equipment, incubators, drip irrigation systems and flour milling, among others. A majority of SMEs from Developer 1 (66.7 per cent) and Developer 2 (51.2 per cent) reported receiving their PUE appliances on credit from their respective developers. However, just about a quarter (26.7 per cent) of SMEs from Developer 3 received such appliances on credit.

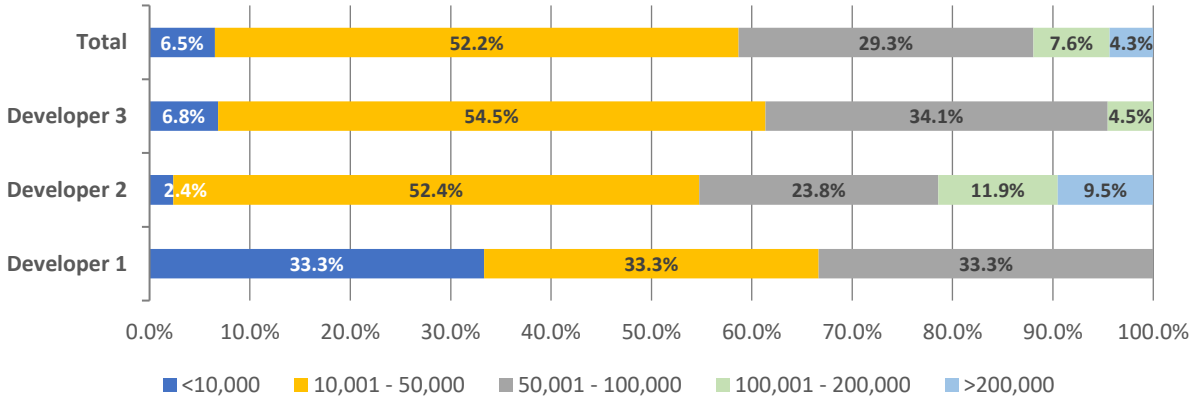
The study delved into assessing the capital expenditures of the sampled SMEs, Table 3 presents the average start-up costs of typical PUE businesses in rural areas, disaggregated by developer. The estimated median capital expenditure for the start-ups of the various PUE SME businesses in the overall sample appeared to be KES 50,000. Developer 1 SMEs had the lowest median capital expenditure at KES 18,500, while Developer 3 SMEs had the highest, at KES 50,000.

▶ **Table 3. Average capital expenditures (start-up costs) of sampled SMEs, by developer**

Developer	Mean	Std. error of mean	Median	No.
Developer 1 (KES)	33 167	14 443	18 500	6
Developer 2 (KES)	85 840	17 923	47 500	42
Developer 3 (KES)	52 950	4 633	50 000	44
All (KES)	**66 675**	**8 678**	**50 000**	**92**

Note: Accurate data on capital expenditure was not available for two SMEs (water purification and a local petrol station).
Source: Authors' research.

▶ Figure 4. Sampled SME capital expenditure classes, by developer



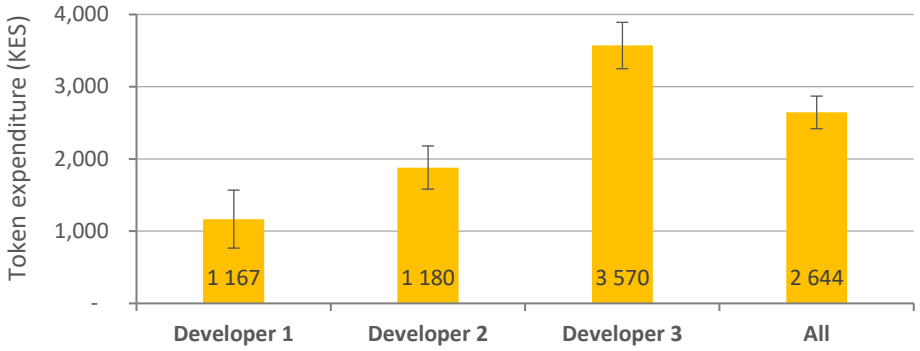
Source: Authors' research.

The findings further suggest that a majority (52.2 per cent) of the SMEs across all the developers appear to have capital expenditures ranging between KES 10,000 and 50,000 (figure 4). The highest median capital expenditure appeared to be for chicken brooding/incubation (KES 250,000), followed by cyber café/Internet services (KES 100,000), welding (KES 92,500) and flour milling (KES 80,000). The lowest median expenditures were for barber shops (KES 18,400), salons (KES 15,000) and fruit/juice blending (KES 4,500).

A key item of operational expenditure among SMEs was the purchase of mini-grid electricity tokens for use with the PUE appliances. It is however important to note that the three developers have different pricing policies (and rates approved by the regulator EPRA) depending on their sites and locations: the customer base, connection fees, tariffs and tier systems tend to differ across the developers. In particular, for commercial customers, Developer 1 charges KES 9,280 as a connection fee and a rate of about KES 69 per kWh usage. Developer 2 charges KES 9,980 as a connection fee and a rate of about KES 43 per kWh usage, and Developer 3 charges KES 500 as a connection fee for each domicile commercial connection and a rate of about KES 80 per kWh usage.

Figure 5 illustrates the mean monthly mini-grid electricity token expenditure among the sampled SMEs. The estimated *mean* expenditure in the overall sample appeared to be KES 2,644 (Developer 3: KES 3,570, Developer 2: KES 1,880, Developer 1: KES 1,167). On the other hand, the estimated *median* monthly mini-grid electricity token expenditure in the overall sample appeared to be KES 2,000 (Developer 3: KES 3,000, Developer 2: KES 1,200, Developer 1: KES 750). It thus appears that Developer 3 SMEs could be spending higher amounts on mini-grid electricity tokens since the rates are higher than at the other developers. On the other hand, the findings suggest a relatively higher SME consumption per connection among Developer 3 SMEs (see Annex 2) compared to Developer 1 SMEs, a possible explanation to their higher expenditure on tokens. As earlier noted, a majority of Developer 3 SMEs reside within island zones where agricultural activities are rare and most income-generating activities revolve around fishing and fish trading as well as the supporting business enterprises. These activities may result in higher consumption for the powering of fridges for ice and storing fish. It may also be worth noting that the lower connection tariff offered by Developer 3 could be a driving factor for an increased uptake of SME businesses consuming the mini-grid power.

▶ **Figure 5. Estimated mean monthly mini-grid electricity token expenditure**



Source: Authors' research.

In estimating the average annual net incomes received per SME, the study computed the reported revenues received directly using the PUE appliances, and both the reported operational expenditures (excluding wages) and maintenance costs for the respective PUE appliances. However, it is important to note that some of the PUE businesses do not exclusively run the PUE appliances and may have other supporting goods and services that may or may not be supported. For example, a flour mill (posho mill) might be trading in maize (grains) in addition to milling. A customer would then purchase the maize and mill it at the same premise, with the accounting for both activities mixed up. A local shop can have a refrigerator used to store multiple perishable goods which are also sold together with non-perishable goods. It is thus difficult to directly isolate costs as the causality is not explicit. To mitigate this, data collection specifically focused on those businesses that primarily gain their revenues from the PUE appliances, and those where without the PUE appliance the business would not be viable, or those with very minimal mix-up of other goods and services. The reported operational and maintenance costs were deducted from the reported revenues to obtain rough estimates of net incomes. The results are shown in table 4.

▶ **Table 4. Estimated PUE revenues, operational and maintenance costs and net incomes**

Annual revenues & expenditures	Developer 1		Developer 2		Developer 3		Total (All)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Est. revenue (KES)	**132 720**	57 384	**195 195**	36 091	**378 636**	44 095	**280 598**	28 855
Est. operational costs* (KES)	**21 600**	10 414	**37 886**	12 614	**105 687**	20 338	**70 164**	12 010
Est. maintenance costs (KES)	**12 300**	4 657	**33 263**	7 474	**37 333**	5 891	**33 625**	4 813
Estimated net income (KES)	**98 820**		**124 046**		**235 616**		**176 809**	

Note: *Computation for operational costs excludes wages paid, as about half of the SMEs do not use paid labour. The costs captured under operational costs thus include rent, water, electricity and so on.
Source: Authors' research.

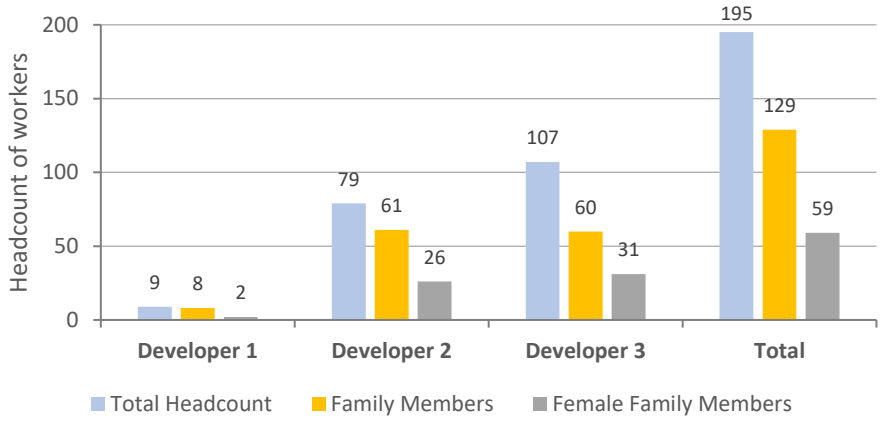
The findings suggest that the overall average annual revenue per SME was about KES 280,000. The average annual operational costs per SME were about KES 70,000, while average annual maintenance costs per SME were KES 33,000. Ultimately, the average annual net income per SME seemed to be KES 176,000. Developer 3 SMEs appeared to have higher average annual net incomes (about KES 235,000) compared to Developer 2 (about KES 124,000) and Developer 1 (about KES 98,000). The lowest estimated average monthly net income (estimated from Developer 1 – about KES 8,235), is lower than the national minimum wage in Kenya of KES 15,120 per month in 2023 (KNBS 2022).

Overall, the results suggest that Developer 3 appears to have higher capital expenditures, higher operational and maintenance costs, higher revenues and ultimately higher estimated net incomes compared to Developer 1 and Developer 2. High capital expenditure can indeed have an impact on employment, but the relationship is multifaceted. It is essential to consider various factors, including the type of investment, industry, and economic context. For instance, SMEs with higher capital expenditures may have higher annual maintenance and possibly higher operational costs due to their investments.

4.3. Labour demand, wages and skill levels

It should be noted, that at the time of the study Developer 1 had only six active SMEs, Developer 2 had 65 active SMEs, while Developer 3 had 54 active SMEs connected. Of these, all Developer 1 SMEs (100 per cent), 43 Developer 2 SMEs (66 per cent) and 45 Developer 3 SMEs (83 per cent) were sampled for the study. The total headcount of all workers in the overall sample was 195, of whom 129 were family members, out of which 59 were female family members (see figure 6). Developer 3 appeared to have more workers in total compared to Developer 1 and Developer 2. About two thirds (68.7 per cent, n= 134) of the total workforce in the overall sample were also reported to be skilled labourers. Of these skilled labourers, females (n=56) represented 41.8 per cent.

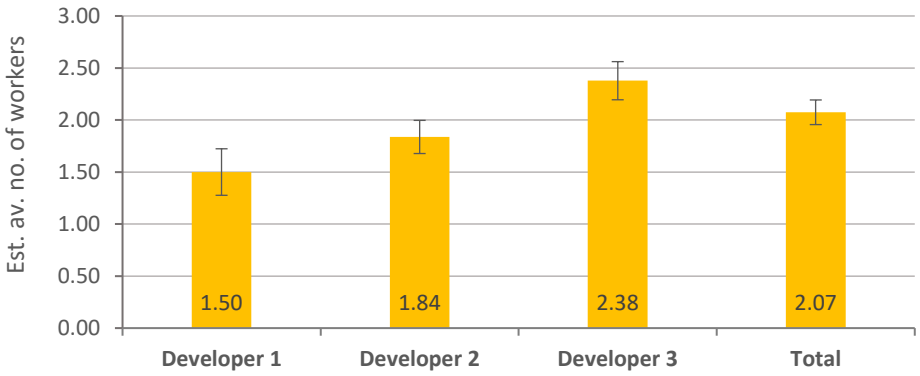
▶ Figure 6. Total number of workers (headcount) across the developers



Source: Authors' research.

Given the total headcount, the study further delved into assessing the typical number of workers a single SME would employ. The majority of the sampled SMEs overall (77.7 per cent) appeared to have one or two workers (suggesting either the owner alone or with a support staff/assistant). Close to a quarter (22.4 per cent) of SMEs overall appeared to have more than two workers. On further computing the average number of workers per SME across the developers, the results suggest an estimate of two workers per SME in the overall sample and across the developers (see figure 7).

▶ Figure 7. Estimated average number of workers per SME across the developers

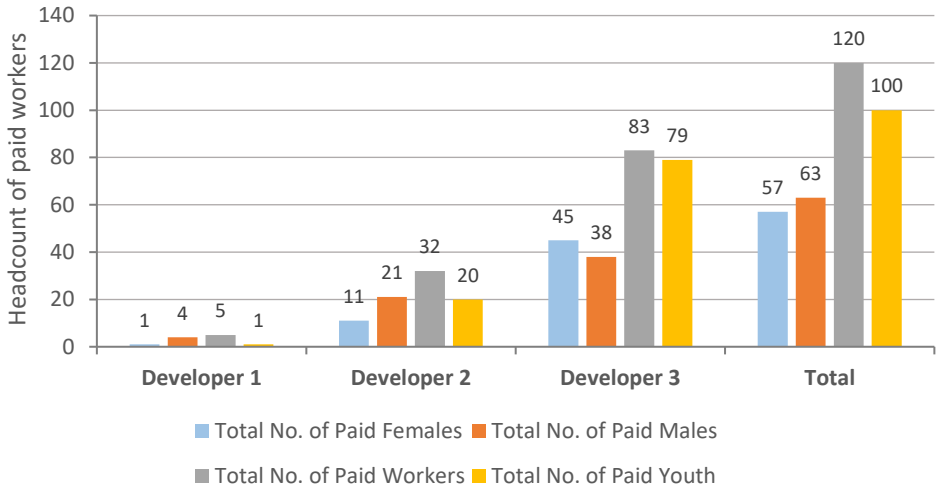


Source: Authors' research.

Half of the SMEs (50 per cent) in the overall sample reported using paid labour in their PUE enterprises. Of those who used paid labour in the overall sample, the types of employment offered include permanent workers (30.8 per cent), casual workers (40.8 per cent) and seasonal workers (28.3 per cent). Developer 2 SMEs appeared to employ more casual workers than Developer 1 and Developer 3 SMEs. On the other hand, Developer 1 had the highest proportion of SMEs employing permanent workers (66.7 per cent). The majority of contracts offered to all categories of paid workers in the overall sample were also informal at 67.9 per cent (permanent 81.8. casual 63.2, and seasonal 53.3 per cent).

The headcount of paid workers in the overall sample was 120 (including the owner if directly involved), with females representing 47.5 per cent (figure 8). The distribution of females in the paid employee categories were 48.6 per cent permanent, 49.0 per cent casual and 44.1 per cent seasonal (see Annex 3). This shows that men and women participate equally in the paid job opportunities created among the sampled SMEs, the consumers of mini-grid electricity in rural areas. Of the total paid workforce in the overall sample, youth (18–35 years) represented 83.3 per cent. Moreover, permanent workers in the paid youth category in the overall sample were 86.5 per cent, casuals were 77.6 per cent, while seasonal were 88.2 per cent, illustrating the fact that more job opportunities among the SMEs go to youth (Annex 3).

▶ Figure 8. Total number of paid workers (headcount) across the developers



Source: Authors' research.

The overall annualized full-time equivalent (FTE) job was calculated per developer, as well as the average annualized FTE per typical SME. An FTE was defined as one person working for eight hours a day for 260 days in a year (equivalent to a total of 2,080 hours). It is important to note that data was computed only for SMEs that reported using paid labour. Again, some SMEs (n=9) were found to employ two categories of workers. The estimated total FTE per developer based on the paid workers sample is presented in table 5.

▶ Table 5. Estimated paid labour input (FTE) per developer and per SME, by gender

	FTE females				FTE males				FTE total			
Developer	Sum	Mean	SE	N	Sum	Mean	SE	N	Sum	Mean	SE	N
Developer 1	0.4	0.4		1	5.4	1.8	0.9	3	5.7	1.9	0.8	3
Developer 2	7.1	0.7	0.3	10	16.7	1.4	0.6	12	23.8	1.6	0.7	15
Developer 3	48.7	1.9	0.3	26	39.7	1.6	0.2	25	88.4	2.3	0.2	38
Total	**56.2**	**1.5**	0.3	37	**61.8**	**1.5**	0.2	40	**118**	**2.1**	0.2	56

Note: Sum = Total FTE for all SMEs, while Mean = Average FTE per SME.
Source: Authors' research.

The estimated total FTE in the overall paid workers sample was 118, being slightly higher among males (61.8) compared to females (56.2), the results suggest a fairly equal participation of men and women in paid labour intensity. Again, Developer 3 also appeared to generate more FTE jobs compared to other developers. When looking at the average number of FTE jobs per SME, the results suggest that Developer 1 SMEs would likely generate an FTE of 1.9 per SME, Developer 2 would generate an FTE of 1.6 per SME, while Developer 3 would generate an FTE of 2.3 per SME. This finding corroborates the fact that Developer 3 has more workers on average per SME as well as a higher labour intensity compared to the other two developers. These figures could be used as indicative values for employment potential that could be generated per SME within a particular developer's site (see Annex 5).

Further computation of FTE paid labour input by gender and category of worker was conducted; the results are shown in table 6 and further displayed in Annex 4. The estimated total FTE in the overall paid workers sample was 61.5 for permanent workers, 38.6 for casuals, and 17.9 for seasonal workers. The estimated total FTE in the overall paid workers sample for female paid labour input was 25.9 for permanent workers, 21.2 for casuals and 9.0 for seasonal workers, whereas the estimated total FTE in the overall paid workers sample for male paid labour input was 35.6 for permanent workers, 17.4 for casuals and 8.8 for seasonal workers.

▶ Table 6. Estimated paid labour input (FTE), by gender and worker category

Developer		FTE females			FTE males			FTE total		
		C	P	S	C	P	S	C	P	S
Developer 1	Total FTE (All SMEs)	**0.4**	-	-	**0.4**	**5.0**	-	**0.7**	**5.0**	-
	Av. FTE per SME	0.4	-	-	0.4	2.5	-	0.7	2.5	-
Developer 2	Total FTE (All SMEs)	**4.7**	**2.1**	**0.3**	**12.2**	**0.9**	**3.6**	**16.9**	**3.0**	**3.9**
	Av. FTE per SME	0.8	1.1	0.2	1.7	0.9	0.9	1.9	1.5	1.0
Developer 3	Total FTE (All SMEs)	**16.2**	**23.8**	**8.7**	**4.8**	**29.7**	**5.3**	**21.0**	**53.5**	**14.0**
	Av. FTE per SME	1.6	2.4	1.5	0.7	2.5	0.9	1.7	2.8	2.0
Total	Total FTE (All SMEs)	**21.2**	**25.9**	**9.0**	**17.4**	**35.6**	**8.8**	**38.6**	**61.5**	**17.9**
	Av. FTE per SME	1.2	2.2	1.1	1.2	2.4	0.9	1.8	2.7	1.6

Note: C=Casual; P=Permanent; S=Seasonal.
Source: Authors' research.

The results suggest that average wages paid/compensation for men are better than for women in all the paid job categories. The average daily wage in the overall sample was about KES 350 for men and about KES 260 for women (table 7). Again, seasonal workers appeared to earn relatively higher average daily wages than casuals and permanent workers, for both men and women. Developer 3 also appeared to pay higher daily wages across the type of workers, compared to Developer 1 and Developer 2.

▶ Table 7. Average daily wages/compensation paid per category of worker, by sex

	Casual		Permanent		Seasonal		Total	
Developer	Av. daily wage (KES) (females)	Av. daily wage (KES) (males)	Av. daily wage (KES) (females)	Av. daily wage (KES) (males)	Av. daily wage (KES) (females)	Av. daily wage (KES) (males)	Av. daily wage (KES) (females)	Av. daily wage (KES) (males)
Developer 1	120	167		275			120	239
Developer 2	192	250	350	200	250	475	235	321
Developer 3	240	293	265	431	325	383	269	381
Total	**216**	**264**	**279**	**395**	**306**	**420**	**256**	**352**

Source: Authors' research.

The main benefit paid workers were offered by the SMEs in the overall sample appeared to be meals (offered by 67.9 per cent of SMEs), followed by housing (offered by 35.7 per cent of SMEs). The ease of obtaining appropriate paid labour appeared less difficult among Developer 1 and Developer 2 SMEs, but more difficult for Developer 3 SMEs. On a rating scale of 1 (very difficult) to 10 (very easy), the median score among SMEs was 10 for either Developer 1 or Developer 2, and 1 for Developer 3. Almost none of the SMEs (3.2 per cent) in the overall sample reported paying workers under the age of 18. From the FGDs it was reported that children under 18 were rarely involved in

the SME businesses and engaged only in light activities on weekends and in the evening after school.

The main occupational health and safety (OHS) measure put in place by a majority of SMEs in the overall sample (66 per cent) appeared to be cleanliness and sanitary conveniences, followed by protective clothing. Only 12.3 per cent of workers (n=24) experienced an illness or injury at the workplace as a result of work-related activities in the 12 months preceding the survey.

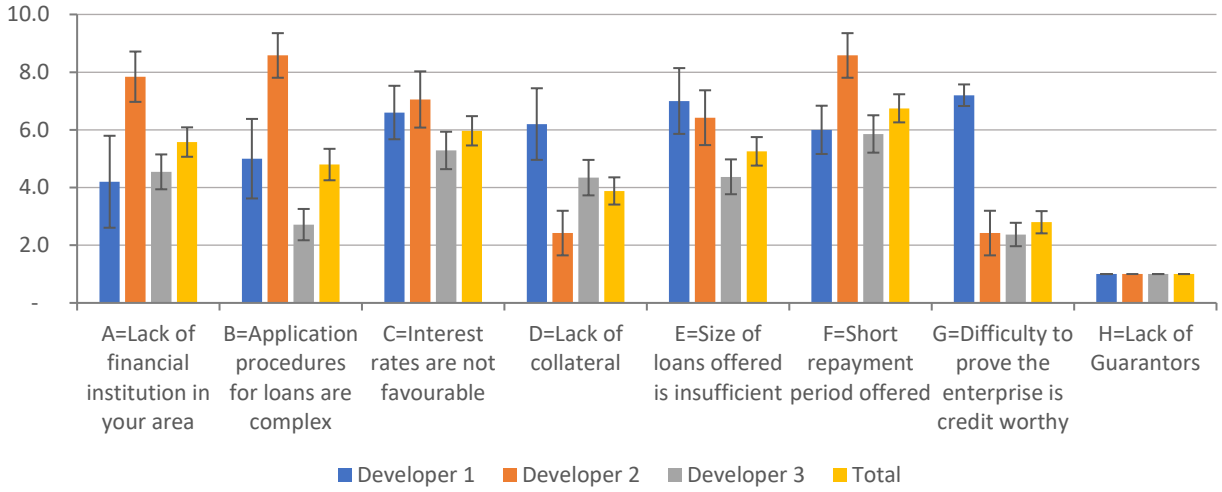
4.4 Access to credit and financial services

One of the key factors in accessing credit with formal and informal financial institutions in Kenya is the ability to pay, which is informed by the characteristics of an individual's savings and financial transactions, which in turn provide information on creditworthiness. This study briefly assessed the understanding, knowledge and practises of SMEs/owners regarding financial institutions, as well as their borrowing and saving culture. Three quarters (75.5 per cent) of SMEs in the overall sample reported that they had some savings at the time of the survey. Of those, 46.5 per cent in the overall sample report had savings of between KES 10,000 and 50,000. The majority of Developer 1 SMEs (60 per cent) and Developer 3 SMEs (50 per cent) reported having savings of between KES 10,000 and 50,000, while only 37.5 per cent of Developer 2 SMEs had a similar magnitude of savings. In fact, another 37.5 per cent of Developer 2 SMEs appeared to have savings of below KES 10,000. In general, a majority of SMEs in the overall sample (69 per cent) had savings below KES 50,000.

The main reported means of saving appeared to be banks (56.3 per cent) followed by mobile banking (22.5 per cent). Notably, some SMEs appeared to have more than one means of saving: about 37.5 per cent of Developer 2 SMEs reported self-help groups (informal) as their means of saving, while 31 per cent of Developer 3 SMEs reported table banking (informal) as their means. Generally, all Developer 1 SMEs and about half of Developer 3 SMEs and Developer 2 SMEs reported saving with a bank (a formal institution). Eight in ten SMEs in the overall sample (81.9 per cent) were aware of where they could borrow money or ask for credit, again with Developer 2 depicting the lowest proportion (65.1 per cent). Banks and self-help groups appeared to be the most popular places cited in the overall sample. However, more Developer 2 SMEs (71.4 per cent) cited self-help groups while more than half of Developer 3 SMEs cited table banking (53.5 per cent). Very few SMEs in the overall sample (9.1 per cent) appeared to be aware of mobile loans (such as M-PESA) or they simply ignored this source. Of those who mentioned knowing a source, the majority (66.2 per cent) had borrowed from such sources in the two years preceding the survey.

A majority of SMEs overall (62.8 per cent) cited lack of finance as a critical constraint to their PUE businesses, with Developer 1 having the largest proportion of such SMEs (83.3 per cent) compared to Developer 3 SMEs (77.8 per cent) and Developer 2 SMEs (44.2 per cent). On a rating scale of 1 (not severe at all) to 10 (very severe), SMEs provided a score on some predefined obstacles in accessing finance. Based on the average scores among SMEs that cited constraints, Developer 2 SMEs appeared to have several obstacles with average scores above 6, followed by Developer 1 SMEs (see figure 9). The most severe obstacles faced by Developer 2 SMEs were the short repayment periods offered and complex loan application procedures. For Developer 1 SMEs, the most severe obstacles were difficulty in proving their enterprises creditworthy, insufficient size of the loan offered and unfavourable interest rates. The most severe obstacles cited in the overall sample appeared to be short repayment periods and unfavourable interest rates.

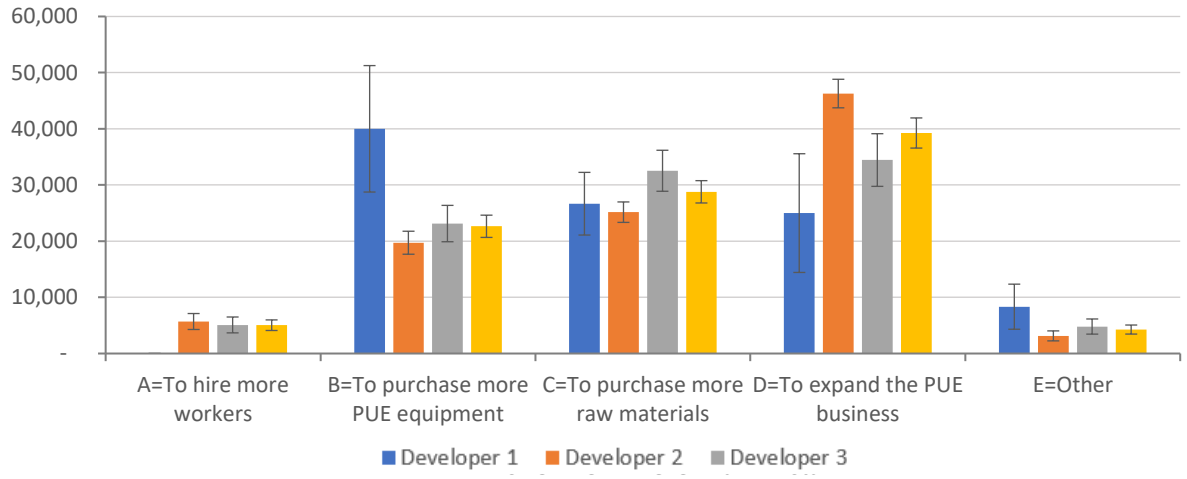
▶ **Figure 9. Severity of obstacles in accessing finance for PUE businesses**



Source: Authors' research.

SMEs were also asked, supposing their PUE business received financing of up to KES 100,000, how they would allocate the funds on some predetermined activities. The average spending per SME in the overall sample indicated that there would be very low spending on hiring more workers. Developer 1 SMEs would not spend on hiring more workers but would allocate more funds on purchasing more PUE equipment. The highest average spending appeared to be on expanding the PUE business (see figure 10).

▶ **Figure 10. How SMEs would allocate funding on business activities**



Source: Authors' research.

4.5 Livelihood enhancement, satisfaction and overall well-being

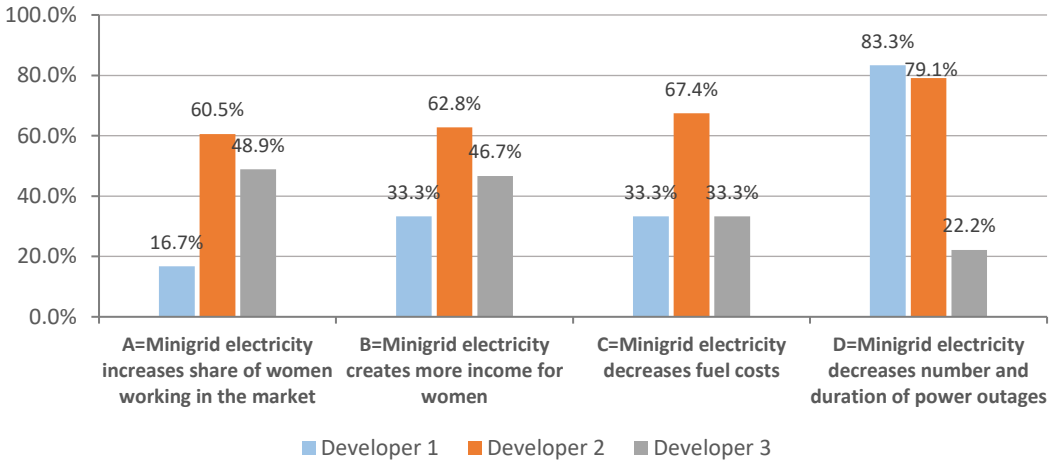
Besides the PUE businesses, SME households were found to engage in other income-generating activities. Overall household revenues were estimated from all household income streams in the 12 months preceding the survey. Respondents were asked about their main agricultural and non-agricultural income sources and their corresponding revenues (self-reported). A majority of SMEs in the overall sample (63.8 per cent) reported having at least an agricultural source of income, particularly Developer 1 SMEs (83.3 per cent). Developer 2 SMEs had a relatively lower proportion of SMEs (55.6 per cent) reporting an agricultural income source.

The main sources of agricultural income among all SMEs appeared to be farming and selling of crops (63.3 per cent) followed by poultry keeping and sales (25 per cent). Farming and selling of crops remained the primary agricultural income source overall, and particularly among Developer 1 and Developer 2 SMEs (80 per cent each). On the other hand, at Developer 3 a majority of SMEs engaged in fishing/trading of fish (32 per cent) and poultry keeping and sales (32 per cent). In addition, about eight in ten SMEs in the overall sample (80.9 per cent) reported having non-agricultural income sources; these appeared to be income from non-agricultural PUE business (75 per cent) followed by business-trade/self-employment (39.5 per cent). These were also cited as the primary non-agricultural income sources. All the cited agricultural income sources appeared to be informal, while only 14.4 per cent were formal.

The estimated mean annual agricultural revenue overall was about KES 176,000 (Developer 2: KES 217,000, Developer 1: KES 191,000, Developer 3: KES 121,000), while the estimated mean annual non-agricultural revenue was KES 179,000 (Developer 1: KES 300,000, Developer 3: KES 252,000, Developer 2: KES 80,000). It is important to note that these estimates were aggregates of self-reported revenues received in the previous 12 months and did not specify whether they were gross or net. The results suggest that agricultural revenues contributed to 73.1, 38.8 and 32.4 per cent of Developer 2, Developer 1 and Developer 3 SMEs' overall household revenues respectively. In the overall sample, agricultural revenues contributed to 49.5 per cent of overall household revenues. The proportion of revenues from SME PUE business against overall household revenues in the overall sample was estimated at 79 per cent (100 per cent for Developer 3, 65.6 per cent for Developer 2 and 27 per cent for Developer 1). The results indicate that Developer 3 SMEs exclusively relied on the mini-grid energy for their household incomes. The findings also show that more than half of SME households in the overall sample had women participating in decision-making, both on the use of household income from the primary (largest) source (58.5 per cent) and from the PUE business (51.1 per cent). Developer 1 SMEs had the highest likelihood of women participating in these decisions.

SMEs were also asked about the perceived level of impact on their business of having electricity. On a rating scale of 1 (least impactful) to 10 (very impactful), the median score among SMEs was 10 for both Developer 2 and Developer 3 SMEs and 8 for Developer 1, suggesting more impact perceived among Developer 2 and Developer 3 SMEs. On the other hand, the study assessed the attitudes of SME respondents on a 5-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree) towards specific predetermined impacts of mini-grid electricity. The subsequent analysis focused only on those who disagreed (disagree + strongly disagree) with some of the predetermined impacts (see figure 11).

▶ Figure 11. Distribution of SMEs who disagreed with predetermined impacts of mini-grid electricity



Source: Authors' research.

It appeared that a majority of Developer 2 SMEs did not believe that mini-grid electricity increases the share of women working in the market or creates more income for women or decreases fuel costs or decreases the number and duration of power outages. A majority of Developer 1 respondents also refuted the proposition that mini-grid electricity decreases the number and duration of power outages. Finally, SMEs were asked about their perceived level of satisfaction with the mini-grid service provided. On a rating scale of 1 (least satisfied) to 10 (very satisfied), the

median score among SMEs was 10 for Developer 2, 8 for Developer 3 and 4 for Developer 1, suggesting that Developer 1 SMEs were least satisfied with the mini-grid service.

4.6 Long-term employment impacts from access to mini-grid electricity

A majority of SMEs in the overall sample (66 per cent), reported that they had expanded their PUE businesses since they had access to the mini-grid energy, and within the two years preceding the survey, an indicator of positive economic growth among the SME mini-grid customers. Again, a majority of SMEs in the overall sample (84 per cent) reported that the revenue from their PUE businesses had increased compared to when they started their PUE businesses, a reason attributable to access to the mini-grid electricity. However, all Developer 1 sampled SMEs and 93.3 per cent (almost all) of Developer 3 sampled SMEs reported facing challenges with their PUE businesses in the 12 months preceding the survey. The key challenges mentioned included electricity outages/fluctuations, the high cost of electricity, poor business management and competition. In contrast, a much lower proportion (58.1 per cent) – though still a majority – of Developer 2 SMEs reported facing these challenges in the same period.

It is also notable that half of the SMEs (50 per cent) in the overall sample reported using paid labour in their PUE enterprises. In fact, this paid labour was a result of accessing/using the mini-grid electricity for the particular PUE businesses. Furthermore, results on the total FTE aggregates suggested an equal participation of men and women in the intensity of paid labour among SMEs in the overall sample, with youth (18–35 years) representing 83.3 per cent of the total paid workforce. This illustrates the fact that more job opportunities created among the SMEs go to the youth, corroborating earlier findings of a fair engagement of the youth in embracing the use of mini-grid energy for productive uses in rural areas.

The findings from FGDs across the developers also point to the fact that the mini-grid electricity has created more permanent self-employed job opportunities and sources of income. Some of these opportunities have emanated from PUE SME businesses, including barber shops, mini-shops, salons, video halls, posho mills, chicken rearing, welding, M-PESA shops, bars, hotels and so on. The main PUE SMEs fall within the agriculture sector; the service industry is secondary. In addition, access to the mini-grid electricity has spurred other indirect and induced job opportunities within the rural communities. The main source of labour is family labour, supported by other external temporary jobs. However, there is a concern among some SMEs that high token and operational costs threaten to diminish the already created job opportunities and to reduce incomes and wages, particularly among the youth, as it may no longer be profitable to run the SME businesses at such high cost. In addition, management challenges on the developer side threaten to diminish opportunities that could create more jobs.

A majority of SMEs in the overall sample (56.4 per cent) reported that there were no workers who transitioned to permanent employees or upgraded to higher-ranking positions within their PUE business. Developer 2 had the highest proportion/majority of SMEs (67.4 per cent) reporting they had indeed workers who transitioned to permanent employees or upgraded to higher-ranking positions within their PUE business due to access to electricity from the mini-grid, compared to Developer 1 (16.7 per cent) and Developer 3 (24.4 per cent), which could be attributed to its longer duration of operation among sites. On the other hand, a majority of SMEs in the overall sample (69.1 per cent) reported that there were no workers who left their PUE business since having access to the mini-grid electricity, a pointer to a good retention rate of labour supplied. However, a majority of Developer 3 SMEs (55.6 per cent) reported that indeed there were workers who left their PUE business compared to Developer 1 (16.7 per cent) and Developer 2 (7.0 per cent), which could be attributed to the migrant nature of its residents.

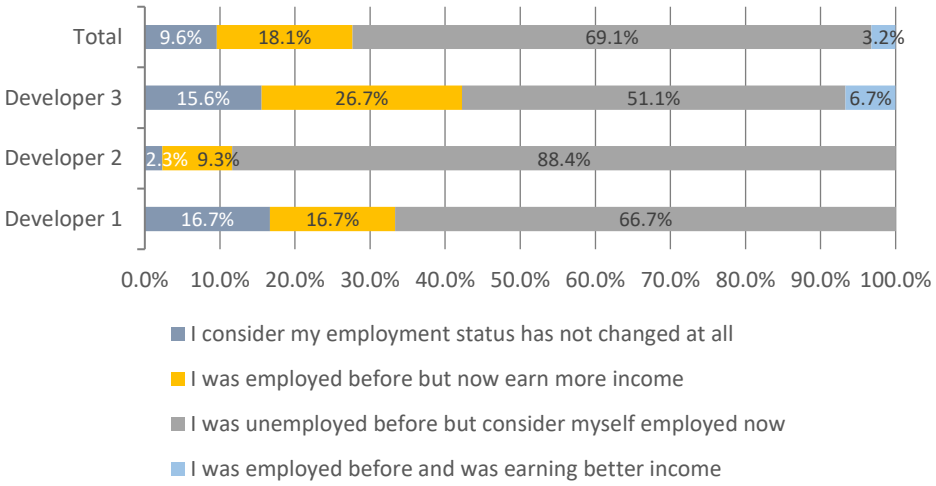
A difference was observed in the change in employee wages across the developers. Overall, four in ten SMEs (40.4 per cent) reported that their workers' wages had increased compared to the period before they joined the PUE, particularly among Developer 2 SMEs (51.2 per cent). In contrast, a majority of Developer 1 SMEs (66.7 per cent) and Developer 3 SMEs (64.4 per cent) reported that their workers' wages had stayed the same compared to the period before they joined the PUE (since access to the mini-grid electricity). Both findings suggest income security /stabilization of income among the SME workers.

A small majority of SMEs in the overall sample (53.2 per cent) reported that they had participated in training offered by their respective developer, particularly among Developer 1 SMEs (83.3 per cent) and Developer 2 SMEs (74.4 per cent). Only about 28.9 per cent of Developer 3 SMEs had ever participated in such training. As a result of the training and engaging with the developer, a majority of SMEs in the overall sample (54.3 per cent) now employed good practices that they had never

used before, while another 27.7 per cent had improved the practices they used before. Some of the main good practices pointed out included the proper use and maintenance of PUE appliances, business management, and rational use of the mini-grid electricity.

On how the sampled SME owners compared their employment status at the time of the survey with their status before starting their PUE businesses (as a result of mini-grid electricity), a majority in the overall sample (69.1 per cent) stated that they were unemployed before but considered themselves employed at the time of the survey, with more Developer 2 SMEs depicting this (88.4 per cent). On the other hand, about a quarter of Developer 3 SMEs (26.7 per cent) perceived that they were employed before but now earned more income. Only a few of Developer 3 SMEs (6.7 per cent) across the overall sample stated that they were self-employed before and had been earning better incomes then than at the time of the survey. The results are illustrated in figure 12.

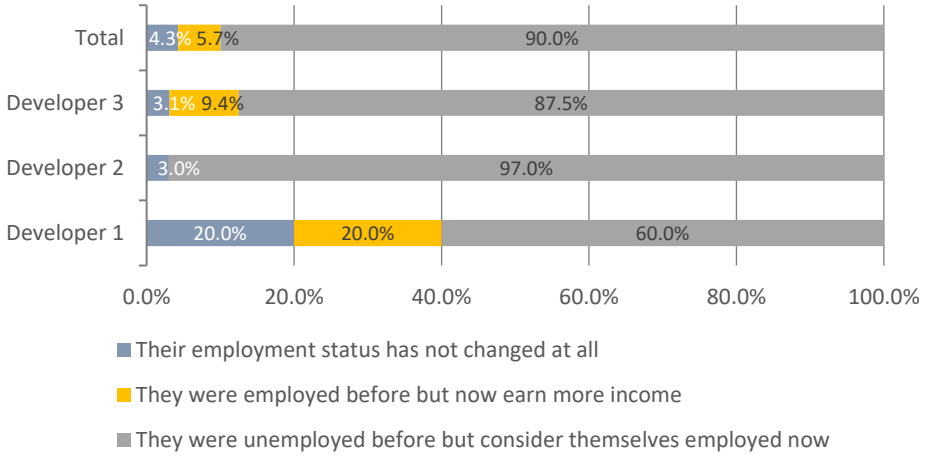
▶ Figure 12. Perceptions of SME owners on changes in their employment status



Source: Authors' research.

On how the sampled SME owners compared their workers' employment status at the time of the survey with their status before joining the PUE businesses, a majority in the overall sample (90 per cent) stated that their workers were unemployed before but considered them employed at the time of the survey, again with more Developer 2 SMEs depicting this (97 per cent). The results are illustrated in figure 13.

▶ Figure 13. Perceptions of SME owners on changes in their workers' employment status



Source: Authors' research.

About eight in ten SME households perceived that either their overall household incomes or income from their PUE business had increased compared to two years previously. Developer 2 had the highest proportion of SMEs reporting increases in both incomes compared to the other developers. However, half of Developer 1 SMEs reported that income from their PUE businesses had decreased in the same reference period.

5. Conclusions and recommendations

The GMG programme has the aim of providing access to electricity to support livelihoods and enhance economic development for communities in rural Kenya. This assessment has focused on mini-grid sites from three developers, part of both phases of the GMG programme, and has sought to measure the long-term employment and livelihood impacts. It follows on from an EmpIA of the direct, indirect and induced employment, where it was estimated that the total number of short-term direct, indirect and induced jobs created during GMG2 was 4,407, expressed as the headcount. This equated to a total of 134 jobs (headcount) per mini-grid site, or 300 connections.

This section outlines the conclusions and recommendations from a survey of 94 SMEs across the three developers and FGDs of 30 SMEs (ten for each developer). It aims to summarize the long-term impacts and provide recommendations for promoting employment further that is related to the renewable energy sector.

5.1 Summary of impacts

The survey showed that the majority of SMEs fell within the agriculture sector and services sector. Of the sample, 60 per cent were male and 44 per cent youth. The total headcount of all workers in the sample was 195 and almost a quarter of the SMEs had more than two employees. The distribution of male and female in paid employment was 52 and 48 per cent respectively, indicating that men and women participate equally in the paid job opportunities created among the sampled SMEs, the consumers of mini-grid electricity in rural areas.

The estimated total FTE in the overall paid workers sample was 118, which comes to an average of 9.8 FTE jobs created per site, from the sites surveyed. The estimated total FTE in the overall paid workers sample was 61.5 for permanent workers, 38.6 for casual workers, and 17.9 for seasonal workers. These results suggest that paid labour intensity in the overall sample is still highest among the permanent categories. Of the total paid workforce, youth represented 83 per cent, suggesting that most job opportunities go to the youth and illustrating a decent engagement of the youth in embracing the use of mini-grid energy for productive uses in rural areas.

The results also suggest a bias towards men for wages paid/compensation, where average wages are better for men than for women in all the paid job categories: the average daily wage in the overall sample was about KES 350 for men and about KES 260 for women. Again, seasonal workers appeared to earn relatively higher average daily wages than casuals and permanent workers, for both men and women.

Since having access to the mini-grid electricity and PUE appliances, 66 per cent of the SMEs (62) said they had expanded their business within the two years prior to the survey. When comparing their employment status at the time of the survey with their status before starting their PUE businesses (as a result of mini-grid electricity), a majority in the overall sample (69.1 per cent) said that they were unemployed before but considered themselves employed at the time of the survey. A majority (84 per cent) of SMEs reported that the revenue from their PUE business increased in the two years, which they attributed to access to energy. From the FGDs, 40 per cent of SMEs reported that their workers' wages had increased compared to the period before they joined the PUE business, while 80 per cent of the SMEs in the FGDs perceived that either their overall household income or income from their PUE business had increased compared to the two years before the survey.

Informal contracts were widespread across all categories; the majority of contracts were informal in all of them (permanent 81.8 per cent, casual 63.2 per cent, seasonal 53.3 per cent). Moreover, 66 per cent of all enlisted workers (headcount) in the overall sample (n=195) were reported to be family members. About two thirds (68.7 per cent) of the total workforce in the overall sample were also reported to be skilled labourers. Of these, females represented 41.8 per cent. Some developers provided training on the use of PUE appliances and electricity, and because of these, most SMEs in the sample (54.3 per cent) stated that they now employed good practices that they had never used before. Some of the main good practices pointed out included proper use and maintenance of PUE appliances, business management, and rational use of the mini-grid electricity.

5.2 Contributing factors to employment creation

The impacts summarised above highlight the positive effect the mini-grids and PUE have had on jobs within SMEs. From the survey, discussions and drawing on comparisons across the developers, a few observations can be made on drivers of employment creation across the sample.

It was found that token rates, credit schemes and connection costs differed among each developer. Developer 3 had the consumers with the highest token expenditure and consumption, alongside the lowest connection fee but highest token rates. Developer 3 had the highest number of FTE jobs and highest wages recorded among the SMEs. They also had the lowest percentage of appliances offered on credit, which indicates that there may be other reasons for the high number of jobs created. This could be due to context, where Developer 3 sites have the lowest number of agricultural activities compared to other sites, which may be less income generating. The sites are more engaged in fishing activities. Developer 2 had the lowest token rates, SMEs among the sites perceived that their employment status had changed the most, from unemployed to now employed.

When looking at satisfaction and attitude towards the service, Developer 2 and 3 had perceived higher impact among customers, which aligns with them having a higher number of jobs created. They also scored the highest on satisfaction, with issues such as electricity outages being flagged among Developer 1 participants. This could indicate that reliability of the energy may play a part in employment outcomes. Access to finance was highlighted as the main constraint to PUE business expansion, with Developer 1 SMEs flagging this the most alongside creditworthiness, interest rates and size of loans offered. Developer 3 SMEs seemed to have less obstacles to accessing finance, which also aligns with the observed higher job creation.

5.3 Comparison with other energy sources

As one of the first comprehensive studies on the long-term impacts of PUE from mini-grids, there is a lack of research to compare results to in other countries. However, for an alternative comparison – connection to the main grid – opinions on this were asked among the sampled SMEs and developers. As the sampled sites did not have access to the national grid (Kenya Power) before the mini-grid electricity, it was not possible to directly compare job creation from one to the other.

Looking at other aspects, Kenya Power appears to have better token rates compared to all the developers, particularly Developer 1 and Developer 3. Developer 2 does have better token rates compared to others, attributable to subsidized rates. It should be noted that some developers have increased capacity to subsidize rates due to better profitability among sites that have higher economic activity – such as the island sites included under Developer 3. The developers also appear to restrict power output, unlike Kenya Power, thus limiting the power usage and operation time, which in turn prohibits flexibility of SME business operations (as businesses may not be able to operate on a 24-hour schedule). On the other hand, in case of power outages, Developer 1 management appears to respond faster than Kenya Power. At Developer 2, mini-grid power installation costs appeared cheaper than Kenya Power installation costs. The mini-grid power is also easily available and accessible for installation in select rural areas where Kenya Power has no reach. It should be noted that although access to the national grid may provide better token rates, the areas benefiting from the mini-grids fall outside areas of planned grid expansion or the regulations of mini-grids being 15km of the national grid. The mini-grids provide access to energy for areas that would otherwise not be covered by the national grid. The national grid often also has issues with quality and outages, which can be a barrier for SME development.

5.4 Recommendations for mini-grid electricity in rural areas

From the survey findings and SME FGDs, it is clear that there exist key opportunities for mini-grids to create and promote more employment opportunities among customers of the mini-grid electricity. Having identified PUE appliance costs as a key barrier to customers in rural areas, in establishing value-added businesses along with provision of electricity, developers should be keen to offer tiers of PUE appliance financing. Connecting the developers with partners who can provide PUE appliances, such as NGOs or impact investors, could be a viable option to ease the burden of managing appliance financing.

Based on the findings from the study and discussions with developers, donors and implementing partners, the following recommendations could be considered to promote job creation within the sector:

- Reducing mini-grid token rates will create more jobs and improve incomes and wages, as more men, women and youth will be attracted into PUE SME businesses and purchase more PUE appliances. Token rates are however high due to high operational costs which affect tariffs.
- In order to reduce token rates and tariffs, more needs to be done by donors for developers to increase sustainability and profitability of the business. There needs to be more of a focus on operational costs rather than just capital expenditure.
- Providing more PUE appliances on credit will spur more SME businesses, create more employment, and boost local incomes among rural communities. The PUE appliances should be provided on attractive and affordable credit terms based on rural customers' ability to pay. Partnering and working with impact investors is encouraged.
- More needs to be done to de-risk the business, which would attract more private investment in the sector. This would enable power to be provided at a more cost-competitive level.
- Providing more PUE appliances for irrigation purposes has the potential to improve food security.
- Employing more standby technicians can create more jobs, but also reduce mini-grid power issues and outages thereby reducing business losses.
- The water bottling business being initiated by Developer 1 will have the potential to employ more youth.
- Reintroducing electric vehicles/motorcycles by Developer 2 will employ more youth. Reintroducing brooders will also create more employment opportunities across all the developers.
- Conducting training on PUE and the application of PUE appliances/electricity to generate income will improve performance of the SMEs.

Although there are challenges associated with the mini-grids, it is clear that there has been a positive impact on employment outcomes and livelihoods for the communities that benefit from them. This is reflected through the survey and the FGDs, where respondents agreed that the mini-grids had a positive impact on their lives and were satisfied with the service. As challenges differ between developers, it is recommended that a set of best practices be developed and promoted across developers, project implementers and donors to address some of the issues and improve the service.

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Annexes

Annex 1. Photographs of installations and PUE appliances from selected sites


DEBE KINYOZI
PHONE CHARGING


UFO-STAR
550A


BUTCHERY


Grino
Water Solutions GmbH

Annex 2. Mini-grid power production and consumption among SMEs

 # = count

▶ Table A2.1 Operational KPI (customers, production and consumption) for Developer 3, 2021-23

Operational KPI	Unit	Q4'21	Q1'22	Q2'22	Q3'22	Q4'22	Q1'23	Q2'23	Q3'23
Customers									
Number of active sites	*# 11*	11	11	11	11	11	11	11	11
Installed connections	***# 11***	**1 905**	**1 921**	**1 990**	**1 996**	**1 996**	**1 996**	**1 996**	**1 996**
Connected households	*# 11*	1 081	1 535	1 550	1 601	1 606	1 603	1 603	1 543
Connected SMEs	***#***	**370**	**371**	**389**	**388**	**389**	**389**	**387**	**378**
Connected public institutions	*#*	37	37	37	37	37	37	37	37
Connected public lighting poles	*#*	44	44	44	44	44	44	44	44
Production									
Installed PV kWp	*KWp*	286	286	286	286	286	286	286	286
Operational PV kWp	*KWp*	286	286	286	286	286	286	286	286
Installed storage capacity	*kWh*	576	576	576	576	576	576	576	576
PV generation efficacy	*%*	80	80	79	80	78	80	80	80
Plant utilization	*%*	48	70	59	67	68	70	75	77
Consumption									
Average household cons./connection	*kWh/con.*	7.5	7.2	6.5	7.2	7.0	5.8	6.5	1.4
Average SME cons./connection	***kWh/con.***	**42.8**	**33.7**	**53.4**	**46.3**	**56.5**	**46.3**	**48.7**	**10.6**

Source: Authors' research.

▶ Table A2.2. Operational KPI (customers, production and consumption) for Developer 1, 2021-23

Operational KPI	Unit	Q1'20	Q2'20	Q3'20	Q4'20	Q1'21	Q2'21	Q3'21	Q4'21
Customers									
Number of active sites	*#*	11	11	11	18	18	14	14	14
Installed connections	***#***	**1 917**	**1 953**	**1 948**	**2 642**	**3 251**	**3 802**	**3 804**	**3 807**
Connected households	*#*	1 865	1 878	1 873	2 557	3 704	3 704	3 704	3 704
Connected SMEs	***#***	**32**	**36**	**36**	**50**	**41**	**45**	**47**	**50**
Connected public institutions	*#*	40	41	41	51	52	54	54	54
Connected public lighting poles	*#*	362	362	362	362	362	362	362	362
Production									
Installed PV kWp	*KWp*	283	283	283	283	283	283	283	283
Operational PV kWp	*KWp*	283	196	188	188	188	188	188	188
Installed storage capacity	*kWh*	1 048	1 048	1 048	1 048	1 048	1 048	1 048	1 048
Operational storage capacity	*kWh*	726	726	726	726	726	726	726	726
PV generation efficacy	*%*	100	68	67	67	67	67	67	67
Plant utilization	*%*	14	22	27	30	28	42	54	59
Consumption									
Average household cons./ **connection**	*kWh/con.*	1.5	1.7	2.6	2.1	2.3	2.0	2.3	2.1
Average SME cons./ connection	***kWh/con.***	**1.9**	**1.7**	**5.5**	**1.7**	**1.9**	**2.0**	**3.1**	**1.7**

Source: Authors' research.

Annex 3. Paid workers by contract type

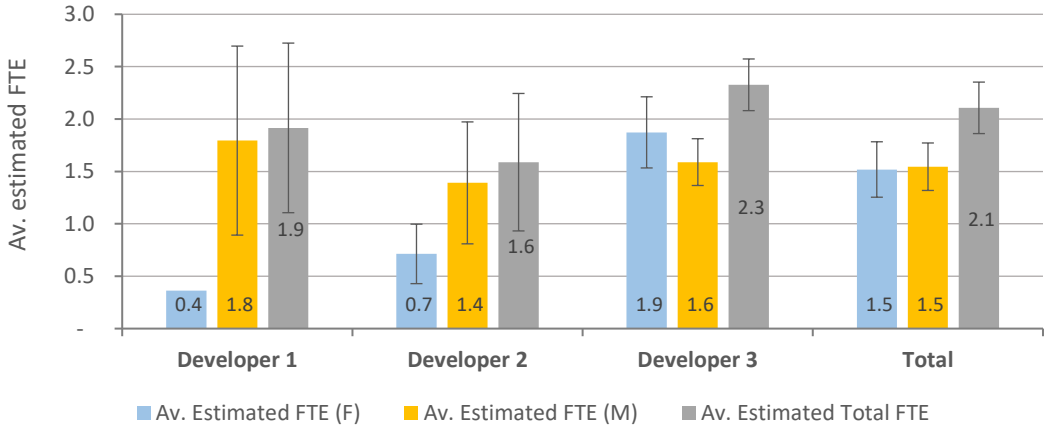
▶ Table A3.1 Total number of paid workers (headcount), by contract type

Developer	Type of contract	Total no. of females	Total no. of males	Total no. of workers	No. of persons ages 18–35
Developer 1	Casual	1	1	2	0
	Permanent		3	3	1
	Total	**1**	**4**	**5**	**1**
Developer 2	Casual	7	14	21	14
	Permanent	2	1	3	1
	Seasonal	2	6	8	5
	Total	**11**	**21**	**32**	**20**
Developer 3	Casual	16	10	26	24
	Permanent	16	15	31	30
	Seasonal	13	13	26	25
	Total	**45**	**38**	**83**	**79**
Total	Casual	24	25	49	38
	Permanent	18	19	37	32
	Seasonal	15	19	34	30
	Total	**57**	**63**	**120**	**100**

Source: Authors' research.

Annex 4. Comparison between male and female average paid labour

▶ Figure A4.1 Comparison between male and female average paid labour FTEs per SME



Source: Authors' research.

Annex 5. Estimated potential employment by developers

Using the average FTE jobs per SME at each developer, the below table illustrates the computed potential total FTE that could be generated by the developers in the respective counties of Busia, Kisii and Siaya, based on the number of sites they have.

▶ Table A5.1 Estimated potential employment (FTE) that could be generated by developers

Developer	No. of sites visited	No. of SMEs visited	Estimated average no. of SMEs per site	No. of sites per developer	Estimated FTE generated per SME	Potential total FTE that could be generated per county
Developer 1 (Busia)	4	6	2	11	1.9	41.8
Developer 2 (Kisii)	6	43	7	18	1.6	201.6
Developer 3 (Siaya)	2	45	23	2	2.3	105.8

Source: Authors' research.

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