

Unlocking the Benefits of Productive Uses of Energy for Women in Ghana, Tanzania and Myanmar

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Cover photo:Car mechanic, welder and corn miller in the Brong Ahafo region of Ghana

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ABBREVIATIONS

ANOVA	Analysis of variance
CSO	Civil society organisation
ESRF	Economic and Social Research Foundation (Tanzania)
FGD	Focus group discussion
GHC	Ghanaian cedi
GII	Gender Inequality Index
GNI	Gross national income
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)
HDI	Human Development Index
IDS	Institute of Development Studies
ISSER	Institute of Statistical, Social and Economic Research (Ghana)
KII	Key informant interview
Ks	Myanmar kyat
LMI	Lower middle-income
LPG	Liquefied petroleum gas
NEP	National Electrification Programme (Myanmar)
NGSEN	National Gender and Sustainable Energy Network (Tanzania)
OLS	Ordinary least square
PUE	Productive uses of electricity
SHS	Solar home system
SME	Small and medium-sized enterprise
SSI	Semi-structured interview
STEM	Science, technology, engineering and mathematics

GLOSSARY

Gender concepts and approaches

Access to resources[1]:	Access refers to the ability to use and benefit from specific resources (material, financial, human, social, political, etc.) although this can be curtailed if there is no control over resources (see below: Control over resources).
Agency:	Agency is the human capability to exert influence over one's functioning and the course of events by one's actions. It is the ability for a person, or agent, to act for herself or himself.
Control over resources[2]:	Entails being able to make decisions over the use of resources including whether others have the right to use or enjoy the benefits of a resource.
Empowerment:	Expansion in an individual's ability to make strategic life choices in a context where this ability was previously denied to them.
Gender and sex:	Sex refers to the biological differences between male and female bodies. Gender refers to the socially-constructed attitudes, values, roles and responsibilities of women and men, in a given culture and location which are learnt and change over time.
Gender Analysis:	The critical examination of a problem or situation in order to identify the differences in the gender roles, activities, needs, rights/entitlements and available opportunities of women, men, girls and boys.
Gender approach:	The design and implementation of policies and projects in such a way that they are more gender aware in their objectives, implementation and outcomes.
Gender awareness:	The understanding that there are socially determined differences between women and men based on learned behaviour that affects one's ability to take decisions and action, and to access and control resources.
Gender-aware policy:	A policy that takes into account the social relationships of women and men as well as the differences in their needs, as opposed to a policy that is gender-neutral and implicitly assumes that women and men have the same needs.
Gender-balanced participation:	Equal numbers of women and men (or parity) in participation in a specific activity.

[1] Resources are means and goods, including economic (household income) or productive means (land, equipment, tools, work, credit); political means (capability for leadership, information and organization); and time.

[2] See footnote 2 for definition of resources.

Gender blindness:	The failure to recognise the different roles, responsibilities, capabilities, needs and priorities of women and men.
Gender discrimination:	Giving differential treatment to individuals on the grounds of their gender in the distribution of income, access to resources and participation in decision-making.
Gender division of labour:	Is an overall societal pattern where women are allotted one set of gender roles and men another.
Gender equality:	Gender equality is the condition in society when both men and women are attributed equal social value, equal rights and equal responsibilities, and have equal access to the means (resources, opportunities) to exercise them.
Gender equality competence:	The skills, attributes and behaviours of individuals and organisations needed in order to mainstream gender.
Gender equity:	Means fairness and justice for women and men in the distribution of benefits and responsibilities.
Gender equitable access (to energy services/technologies):	Access to energy services or technologies that are enabled in ways that ensure women and girls' needs and aspirations are met to live the life of their choosing and which contributes to achieving gender equality.
Gender equitable energy outcomes:	Women and girls lives improve relative to men's as a consequence of energy investments. Women have equal opportunity to men to participate as managers, employees or entrepreneurs in the processes of implementing these investments.
Gender gap:	An observable and sometimes measurable gap between men and women in terms of a specific societal outcome.
Gender goal:	Expresses the desired state for women and men to be achieved by a policy or project.
Gender ideology:	Attitudes regarding the appropriate roles, rights and responsibilities of men and women in society which generally support gender inequality.
Gender inequality:	Inequality, on the basis of a person's gender, in access to and control over the various material and non-material resources and assets of a society and the benefits which accrue from these.
Gender issues:	Identification and framing of an incidence of gender inequality.
Gender mainstreaming:	A strategy for ensuring that the concerns and experiences of women and men are an integral part of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres.

Gender neutral:	The assumption, enshrined in gender neutral language[3] and concepts, that women and men benefit equally from policies, programmes and projects with equal capacity and opportunity to respond to and to influence and control the processes and outcomes. to.
Gender norms:	Gender norms refer to a wide range of social-cultural accepted notions of what is perceived as "normal" in a community, linked to behaviour, beliefs, attitudes and practices, which determine how individuals perceive their potential and worth.
Gender parity:	Is the situation when women and men are able to access opportunities and resources equally.
Gender policy:	Overarching vision or policy on gender adopted by a government, a sector or an organisation, which as a statement of commitment to gender mainstreaming in all their project activities.
Gender Responsive:	Actions that reflect an understanding of the realities of women's and men's lives and addresses the issues taking into consideration the implicit and explicit social norms.
Gender roles:	Sets of behaviour, activities, tasks and responsibilities assigned to men and women, differentiated according to the cultural norms and traditions of the society where they live which define perception of what it is to be male and female and hence shape identity.
Gender sensitive policies and programmes:	Policies and projects should use a gender sensitive approach that takes into account the differences in women and men's lives, while aiming at eliminating inequalities and promoting an equal distribution of resources.
Gender stereotypes:	Preconceived ideas whereby males and females are arbitrarily assigned characteristics and roles linked to their sex which can limit the development of natural talents and abilities restricting life opportunities.
Patriarchy:	Patriarchy is an ideology which promotes the male domination of ownership and control, at all levels in society, which maintains and operates the prevailing system of property rights and the gender division of labour.
Practical needs:	Requirements that women and men perceive as immediate necessities, such as water, shelter and food, for their survival.
Productive needs:	The inputs required for the work done by both women and men for pay in cash or kind including both market production with an exchange value, and subsistence/home

[3] Examples of gender neutral language include: people, households and communities.

	production with actual use value and also potential exchange value.
Quota system:	A specified number of participation spaces so that various groups can share and participate in social, political and economic activities.
Self –Awareness:	An individual's decision to alter their attitudes, and those held by others, towards themselves or existing societal norms, such as gender norms.
Sex-disaggregated data:	Separation of data by sex as the basis of gender analysis.

Energy concepts

Access to energy services:	The ability of an end user to utilise energy services (such as lighting, cooking, motive power etc.) that require an energy appliance and suitable energy supply. Access to energy services does not necessarily imply control or decision making.
Access to energy supply:	The ability of an end user to utilize an energy supply that can be used for desired energy services. Energy access is taken to refer to both physical availability of supply and ability to use the supply. Access to energy supply and access to appliances are necessary for access to energy services.
Attributes/characteristics of energy supply:	Characteristics of energy supply that influence its usability for various energy services. Attributes according to the ESMAP (2015) prioritisation for defining Tiers of energy access are used: capacity, affordability, availability, reliability, quality, health and safety, legality and convenience.
Availability of energy supply:	The time and duration of supply at the location of demand for energy services.
Connection:	A connection entails registration as a consumer to use an energy supply infrastructure, this can be electricity or piped gas, as well as bottled gas that needs to be collected at a delivery point.
Decentralised energy supply:	Energy supply generated at a point near point of use. Decentral supply can be grid connected or off-grid (individual or small distributed system), and can be in the form of electricity, heat etc.
End user:	The consumer who requires energy services. End users may be WITHIN a household, users for productive uses in enterprises or community institutions etc.

Energy:	Energy comes in different forms including fossil fuels, biomass fuel, power (electricity), and animate forms of energy, particularly human metabolic energy. Food energy is not included.
Energy access:	See 'access to energy' above.
Energy carrier:	The form in which energy is delivered to the end user, for example, fuels (biomass and fossil fuels), batteries and electricity. The end-user has to make an additional transformation of the energy into a useful form, for example, switching the radio on which converts electricity into sound.
Energy efficiency:	The ratio of output energy to input energy gives a measure of the conversion efficiency of a particular piece of equipment. The ratio varies and can never be 100%. Engineering design aims to maximise the conversion efficiency which in turn influences the economics of use.
Energy poverty:	It can be seen as an absence of sufficient choice in accessing adequate, affordable, reliable, clean, high-quality, safe and benign energy services to support economic and human development.
Energy services:	The desired and useful services that result from the use of energy; for example, illumination, comfortable indoor climate, refrigerated storage, transportation, appropriate heat for cooking. End users usually express a need or desire for an energy service rather than a particular form of energy.
Energy supply:	Physical availability of energy carriers at a location of demand. Energy supply is an insufficient indicator of access as it does not assume the ability to use the supply (for example the supply may not be affordable or appropriate for use to take place).
Energy technologies:	The hardware, or end-use device, that converts an energy carrier into a form of energy useful for the end-user to provide the desired energy service.
Fuels:	Fuels are a store of energy including solid and non-solid fuels, from both fossil and renewable sources.
Grid:	A system of synchronized power providers and consumers connected by transmission and distribution lines and operated by one or more control centres.
Grid connected:	A physical connection to the electric power grid is in place (as opposed to off-grid). Grid connection may or may not include illegal physical connections- depending on data source.

Household connection:	The connection (grid or non-grid) to an energy supply at household level (does not provide an indication of use, or possible differentiated use by members of the household. A household connection may include productive uses).
Metabolic energy:	Human energy, derived from the food we eat: an important energy source for completing many tasks but one that is usually ignored in energy planning.
Modern energy:	There is no universally agreed definition of 'modern energy'. A definition is chosen for modern energy to include electricity, gas (eg natural gas, LPG, biogas, producer gas) and liquid fuels for transport (e.g. petrol, diesel and biofuels). This definition thereby separates the issue of modernity from a number of issues of sustainability such as related to including fossil fuels (which not everyone would agree should be included) and to including biofuels if they compete with food crops.
Off-grid:	Electricity supply that is not connected to a central grid system.
Productive uses of energy:	Use of energy for income generation (in formal and informal enterprise, which can be homebased or in an enterprise location), including farm and non-farm income generation.
Reliability of energy supply:	Predictability of energy supply, entails absence of unexpected outages.
Stacking:	The use of multiple energy carriers to meet an energy demand.
Useful energy:	The energy that goes into an energy service, rather than being lost in conversion or transport.

CONTRIBUTING ORGANISATIONS AND AUTHORS

Institute of Development Studies (IDS), Brighton, UK. Ana Pueyo, Mar Maestre and Marco Carreras

IDS is a global research and learning organisation for equitable and sustainable change. It publishes a wide range of high-quality and high-impact outputs, including our flagship publication, the *IDS Bulletin*, an open access, peer-reviewed journal exploring emerging international development challenges. IDS has been working with partners to tackle complex development challenges in this way since 1966, producing cutting-edge research, knowledge and evidence to shape the changes needed to support people, societies and institutions to navigate the challenges ahead.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Accra, Dar es Salaam, and Yangon. Samuel Adoboe (Ghana), Sven Ernedal (Tanzania) and Htate Htar Aung (Myanmar)

GIZ is the German Development Agency dedicated to shaping a future worth living around the world. It has more than 50 years' experience in a wide variety of areas, including economic development and employment promotion, energy and the environment, and peace and security. GIZ works with business, civil society actors and research institutions, fostering successful interactions between development policy and other policy fields and areas of activities.

Institute of Statistical, Social and Economic Research (ISSER), Legon, Ghana. Simon Bawakyillenuo and Innocent Agbelie

ISSER was established in 1962 as the Institute of Statistics to provide a programme of teaching and research in statistics. In 1969, it was reorganised and renamed the Institute of Statistical, Social and Economic research, with an expanded mandate to conduct research in the social sciences in order to generate solutions for national development. ISSER currently serves as the research wing under the College of Humanities, University of Ghana, and engages in policy-relevant research, the findings of which are intended to help policymakers take the best decisions for national development.

National Gender and Sustainable Energy Network (NGSEN), Dar es Salaam. Gisela Ngoo and Everline Kihula

NGSEN is an organisation that links energy partners with gender and energy in Tanzania. The network emerged to fill the gaps and challenges entrenched in the gender and energy relationships for joint action. This relationship and its consequences for development are inadequately understood by many, including policymakers and decision makers. Through networking and collaboration with other institutions with similar vision on energy and gender at national and international levels, NGSEN promotes energy and gender issues to instil

appropriate action to guarantee sustainable energy that benefits men and women.

Economic and Social Research Foundation (ESRF), Dar es Salaam. John Kagiba and Patrick Tuni Kihenzile

ESRF was established in 1994 as an independent, not-for-profit institution for research and policy analysis. Its formation was based on the assumption that there was need and demand for an improved understanding of policy options and development management issues, and that the capacity for this was lacking in the Tanzania civil service. ESRF addressed this gap by putting into place qualified professional staff, modest resources and a favourable research environment for the analysis and discussion of economic and social policy. Its primary objectives are to strengthen capabilities in policy analysis and development management and to enhance the understanding of policy options within government, the public sector, civil society and the donor community, and the growing private sector.

Independent research consultants, Yangon, Myanmar. Khon Ja, Esther Jeyang, and Shadan Mung Dan Zau

EXECUTIVE SUMMARY

Access to electricity is increasingly recognised as a key enabler for economic growth and social development, as it can increase productivity, enable new types of job-creating enterprises, reduce the drudgery of unpaid care work, and increase access to labour markets. To unleash the income-generation and poverty-reduction potential of energy access interventions, productive uses of electricity (PUE) are critical. They are important both for electricity consumers (to generate income) and suppliers (for the financial viability of their electricity systems, whether on or off-grid).

Research shows that access to electricity alone is insufficient to trigger productive uses. Enablers like skills, access to markets, and finance to purchase equipment are required. However, because men and women use energy differently at work, the promotion of productive uses is likely to deliver different benefits for women and men. Women face different challenges when it comes to accessing paid work: they are limited in their choice of markets and jobs and access to capital, and are twice as likely as men to work in the informal sector. They also face constraints to grow their business to a sufficient scale.

Harnessing the income-generation potential of electricity is not straightforward, though. So far, the literature has not provided conclusive evidence of its impact either on the creation of new enterprises or improved performance of existing ones. Most authors agree that electricity is a necessary but not sufficient condition for income generation and poverty reduction. The most commonly cited enablers are: (1) access to finance for electrical appliances; (2) access to markets for the additional production; (3) skills for entrepreneurs to identify the new opportunities created by electricity and to prepare sound investment plans; (4) access to other infrastructure or services; and (5) a high quality of the electricity supplied.

Gender considerations

The debate on how electricity impacts enterprises has largely ignored gender considerations. The energy and gender literature has instead focused on the household realm, where women suffer heavy burdens of energy poverty. The household-centred literature has provided strong evidence on the links between energy poverty in the household and women's health burdens, use of time, education, access to information, and other factors. However, productive uses are also gendered: a significant body of gender and entrepreneurship literature shows that women and men have differential access to these key enablers. Women entrepreneurs and employees face different challenges than men when it comes to using and deriving benefits from electricity. This is mainly because women and men operate in different types of productive activities, at different locations, and have different access to enablers such as assets, finance, markets, infrastructure and skills. By following a gender-blind approach to PUE, policymakers could be depriving half of the potential workforce of its benefits, and electricity suppliers could be missing half of their productive consumers.

The conceptual framework developed for this research (see Section 2) combines the literature on gender, entrepreneurship and labour markets with literature, which helps disentangle many of the relationships unexplained in the latter. The gendered study of enterprises absorbing labour and the gender constraints preventing women benefiting

equally with men from interventions to promote PUE remain as important gaps in the literature. For example, women have limited agency to decide time allocation, wage inequalities reduce women's incentives to switch from household work to paid work, and there remain inequalities in access to the skills, capital and markets that can realise the income-generation potential of electricity.

Research questions

This research report provides empirical evidence from three case studies in Tanzania, Ghana and Myanmar to address the existing literature gap on gender and PUE. The focus is on electricity, because our target regions benefited from interventions to provide access to electricity, and in some cases to promote productive uses and gender mainstreaming. However, our fieldwork covered all the different types of energy that women and men use productively, including cooking fuels, diesel or even metabolic energy.

We address three research questions. What are the differential benefits of PUE for men and women? What explains these differences? And which interventions can successfully address the constraints faced by men and women to benefit from PUE?

Research locations

In Ghana, we analysed urban areas that had been provided with improved electricity supply in light industrial zones. In Tanzania, we looked at fishing villages on three islands. One of the islands had access to electricity from mini-grids and had benefited from a programme to promote PUE among women; the other two had not been exposed to gender mainstreaming programmes for energy (one of them had electricity from the main grid, the other only from individual solar home systems). In Myanmar, we looked at rural areas, some of which had only recently received electricity from mini-grids, while others remained without access.

The case studies combine rural (Tanzania and Myanmar) and urban (Ghana) contexts, in two countries with relatively low rates of access to electricity (Tanzania and Myanmar) and another with relatively high rates (Ghana). In Tanzania and Myanmar, more than 90 per cent of the population depends on traditional cooking fuels such as charcoal and firewood, whereas Ghana has made further progress with introducing modern cooking fuels.

In terms of economic development, Ghana has the highest per capita income, while Tanzania has the lowest. Comparing three countries with such different circumstances enables us to both highlight persisting inequalities in PUE and to identify areas that can be transformed with economic development and urbanisation. Both Ghana and Myanmar hold lower middle-income (LMI) status, whereas Tanzania is still a lower income country, aiming to attain LMI status by 2025. Tanzania has one of the lowest electricity access rates in the world, with just 35 per cent of the population having a connection. On the other hand, Myanmar has the lowest level of access in Southeast Asia and would hold the same ranking for the Asia region too, if it were not for North Korea. Tanzania, however, has been making rapid progress in increasing electrification rates and adopting off-grid solutions, being one of the rising stars in the SE4ALL Global Tracking Framework report (World Bank 2017). On the other hand, Myanmar launched the National Electrification Programme (NEP) (2016–2030), which expects to achieve universal electrification by 2030, mainly through grid extension.

Reliability of electricity supply is poor in all three countries. All experience frequent blackouts, which, in the case of the two African countries, can last for many hours. As a result, a large share of enterprises in Ghana and Tanzania use private generators as a back-up for the main grid, which can considerably raise the cost of electricity. Poor electricity supply is pinpointed as the biggest obstacle to growth by 25 per cent of enterprises in Tanzania and 19 per cent in Ghana. In Myanmar, the share is lower, at 13 per cent.

In terms of gender equality, all three countries are ranked in the bottom half of the Gender Inequality Index (GII), with Myanmar closest to the middle. Each of the countries has enacted policies to promote women's social and economic empowerment, but women are still disadvantaged in labour markets.

Research methods

The research used a mixed-method approach, combining quantitative, qualitative, participatory and/or action research and learning. Qualitative and participatory approaches allow for a more nuanced and richer understanding of the interrelations between PUE, access to electricity and gender. They can also give voice to outliers, which are typically neglected in quantitative approaches dominated by averages. For example, they can consider the perspectives of women working in male-dominated sectors, and vice versa, to reveal the social norms behind gender segregation at work. At the project design stage, participatory and action research approaches are fundamental to design workable solutions, as they enable people to identify problems and solutions by themselves.

The specific regional focus in each country was decided jointly with GIZ, through a partnership with local researchers. Thus, in each country, we targeted communities where GIZ was implementing PUE interventions or had done so in the past. This facilitated fieldwork logistics and the identification of key stakeholders.

The analytical strategy for the research in each country was as follows.

- **Tanzania:** We compared outcomes of male- and female-owned enterprises in three regions – one with access to electricity from mini-grids and with a project with a gender focus (or specific intervention to ensure that women benefit) (Bwisya), another only with access to grid electricity (Murutunguru), and another without access to grid or mini-grid electricity, and with no gender interventions (Irugwa).

- **Ghana**: We compared outcomes of male- and female-owned enterprises located inside and outside light industrial zones in three towns with grid electricity: Techiman, Tuobodom and Berekum. Light industrial zones, implemented with GIZ support, cluster similar economic activities – in this case related to the car repair industry – to benefit from economies of agglomeration and joint provision of infrastructure and business services.

- **Myanmar**: We compared uses of energy in villages that currently have access to energy for productive uses with those that are still not connected to any stable source of electricity. The five surveyed villages were clustered in two groups according to their electricity supply system: (1) Myaing, Oak Pho and Kenti village, which have access to stable sources of energy, being used for productive

uses; and (2) Hti Ne and Kan Gyi Taw, with no stable access to electricity and no productive uses.

We used the same research tools across the three countries to facilitate comparison of results. Research tools included an enterprise census, an enterprise questionnaire, guidelines for key informant interviews (KIIs) and semi-structured interviews (SSIs), and participatory focus group discussions (FGDs). FGD tools consisted of: community and energy mapping, activity and energy use mapping, access to and control over resources, and gendered value chains. Table 1 shows the sample size for each research tool, disaggregated by gender.

Table 1: Sample size by research tool and country

	Tanzania	Ghana	Myanmar
Enterprise questionnaire	**316** F: 118 M: 198	**400** F: 147 M: 253	-*
Key informant interviews	**10** F: 2 M: 8	**10** F: 3 M: 7	**17** F: 3 M: 14
Semi-structured interviews	**26** F: 13 M: 13	**40** F: 20 M: 20	**33** F: 17 M: 16
Focus group discussions	**74** F:36 M: 38	**80** F:35 M: 45	**87** F: 46 M: 41

* In Myanmar, only qualitative methods were used due to the difficulty in finding research partners able to provide sufficiently robust quantitative data

Findings

Evidence from our three case studies validates our conceptual framework, indicating that, in the absence of gender interventions, male entrepreneurs benefit more from the promotion of PUE when it focuses on electricity as the energy carrier. Furthermore, the case studies suggest reasons for these differential impacts, providing evidence on the gendered constraints that women face when trying to unlock the benefits of PUE.

Results show that men and women use energy differently at work. Men are more heavily involved in rural enterprises, and own a larger percentage of them. They also dominate the most profitable sectors of agriculture, such as cash crops, and fishing. In rural and urban areas alike, men operate in sectors that typically consume more electricity or diesel. Women are, instead, mainly in charge of food preparation and more heavy consumers of cooking fuels such as charcoal, firewood and gas. Women's productive use of energy is also widespread, but in smaller quantities. The data show no significant differences between women and men for energy consumption as a whole, and energy intensity (measured as the share of energy expenditure in total expenditures and total profits).

As well as differences in how men and women use energy at work, there are also similarities. For example, electricity is the most frequently used type of energy for both male- and female-owned enterprises, even if a significantly higher share of male-owned enterprises use it. On the other hand, women dominate the use of cooking fuels, whether

gas, charcoal or firewood (of which charcoal is the most common). Gas was unavailable on the Tanzanian islands visited but was used by almost a quarter of female entrepreneurs in Ghana. Diesel is also more frequently used by men than women in their enterprises. When total energy expenditure is taken into account, however, we find no significant differences between men and women in Ghana or Tanzania, as lower expenditure on electricity is offset by higher expenditure on cooking fuels. Finally, poor electricity reliability is a drag on both male- and female-owned businesses. However, women in Ghana were more affected by unreliable supply, as the distribution network is weaker outside industrial zones. Results from the regression model show that electricity use is consistently associated with better outcomes for businesses in all countries, while being female is associated with lower profits and lower electricity consumption.

The light industrial zones in Ghana improved electricity supply mainly for male-owned enterprises in the auto mechanics sector. Only 13 per cent of enterprises in these zones are owned by women, and women employees are a minority. In Tanzania, most enterprises in our sample are owned by men and employ other men. Moreover, men´s enterprises are usually more profitable than women´s and more frequently use electricity. Given the lower electricity consumption levels of women´s enterprises, even those connected to the grid would obtain fewer benefits. Women's role as less-intensive consumers of electricity could make them less interesting for private sector suppliers. For example, one of the directors of the mini-grid supplier in Bwisya indicated that their two priority sectors, which act as anchor loads in the island, are fishing and milling – both male-dominated.

Evidence from Myanmar, while anecdotal, showed that men benefit more, and more rapidly, from PUE. In all five villages in our sample, men had access to and control over the diesel generators, while women used firewood and charcoal. When electricity arrived in the communities, a key informant in Oak Pho explained, 'for income work, women [still] use firewood more and men use mini-grid more. Firewood is used for cooking food for pigs and animals. It is also used for making charcoal. Solar mini-grid is used for building houses and rice pounding machine.'

The Ghanaian case study showed that improving electricity supply for men's enterprises does not necessarily mean that women are disadvantaged. For example, Ghana's progressive tariff scheme – by which higher-consuming commercial clients pay more per kWh than those consuming less – creates a cross-subsidy from more electricity-intensive, male-owned enterprises to lower-consuming, female-owned enterprises. Furthermore, there was no evidence that male-dominated enterprises in the light industrial zone were performing better than female-owned enterprises outside the zone. On the contrary, increased competition in industrial clusters and distance from the town centre appeared to have had a detrimental effect on all businesses in the light industrial zones. In fact, the predominantly male-owned enterprises in the zone displayed lower profits than their counterparts outside the zones. This highlights the importance of careful planning of PUE interventions. As previously demonstrated in the literature, electricity alone cannot create economic growth; other enabling factors need to be in place when planning these interventions. Interventions to promote PUE also need to go beyond increasing electricity access to target women in particular. For example, interventions related to cooking fuels, such as Ghana's Liquefied Petroleum Gas (LPG) programme, would benefit female rather than male entrepreneurs, as women dominate the food preparation industry.

In spite of the different ways in which women's productivity could benefit from existing energy policies, in all three countries, female-owned enterprises had lower performance than male-owned enterprises in terms of profits, salaries and electricity consumption. Several reasons account for this. Women typically specialise in sectors with low average electricity (as opposed to energy) consumption. These include hairdressing, tailoring, restaurants and bakeries. They are often less profitable and less power intensive than male-dominated activities. However, when men and women operate in the same sector, their performance is similar. In rural economies, men dominated the most profitable activities along the value chain of fishing and agriculture. For example, in Tanzania, men were involved in selling agricultural crops and cultivation of cash crops, while women were involved in subsistence crop cultivation for household consumption. In Myanmar, men worked in the higher-value roles within the fishing industries, while women were involved in the lower-paid roles of processing fish. Sectoral segregation is largely due to gender norms that determine what are 'appropriate' income-generation activities for women. Women's limited access to capital and other resources also makes them more likely to specialise in lower-paid sectors. In all three countries, men's paid roles tend to involve heavy machinery and activities requiring physical strength (such as carpentry), while women's paid roles use less appliances and electricity overall (such as cooking or hairdressing).

Linked to sectoral segregation, women are also disadvantaged in access to the skills, financial and physical resources needed to start a business. In rural economies, women's educational attainment is lower than that of men, but this was not the case in urban Ghana. Access to capital was repeatedly mentioned as a key constraint for both men and women, but women had less capital to start with. Women also had lower ownership of high-wattage electric appliances, and lower ownership of land and buildings that could be used as collateral for a loan application. Lack of equipment was mentioned as a particular problem by women in Ghana, preventing them breaking into male-dominated sectors, as small power tools enable women to do work previously reserved for men due to their greater physical strength. There was also some evidence which showed that women's care responsibilities in the home limit their performance at work. For example, women work fewer paid hours than men, and run their businesses from home or nearby in order to attend to household responsibilities. Urban Ghana displayed a more gender equal society than rural Tanzania and Myanmar. Men had taken over some typically female responsibilities such as ironing and child care. However, cooking and washing remained distinctively in women's domain.

The relatively more equal Ghanaian society showed encouraging progress in some respects. Education was helping both men and women to challenge gender stereotypes about household responsibilities and the types of businesses that men and women can and should set up. For example, more women were getting into desirable formal employment in banks, the civil service or as school teachers, and more were taking up roles in science, technology, engineering and maths (STEM) professions. Even if women had lower capital to begin with, they showed significant economic empowerment, holding bank accounts more frequently than men, and being able to save and reinvest their business profits without diversion to the household. In this respect, the cultural norms of the region made men responsible for providing for the household, and men more often complained of being unable to save for their business after meeting family needs. Furthermore, facilitated by globalisation and exposure to new role models, both men and women were increasingly challenging traditional gender roles. Women in

traditionally male businesses were proud of what they had achieved, having been able to demonstrate that they can do as good a job as men. Many men appreciated women venturing into traditionally male jobs and showed delight when their preconceptions were proved wrong.

Recommendations

We present policy recommendations that take into account the diversity of our target regions and draw from their prevailing gaps and achievements towards gender equality in PUE. The recommendations are divided into two sets: (1) PUE interventions that support the activities that men and women currently do, without discriminating against either sex; and (2) PUE interventions that transcend and thereby transform segregation within and across sectors, moving towards greater equity in the use of energy at work.

To support men and women's PUE in their current roles, we recommend the following actions:

1. **Improve access to finance and equipment:** Men and women entrepreneurs both cited access to finance as the main constraint to business growth. Finance provision will require different strategies depending on context and gender relations to meet the business needs of female and male entrepreneurs.

2. **Provide energy management training:** Helping business owners to understand energy bills and metering charges, and how to achieve savings, could improve their energy efficiency and enable them to derive greater benefits from PUE.

3. **Improve reliability of supply:** Poor reliability is another key constraint to growth, as it causes delays in production, lost customers, lower sales, and damaged equipment. Businesses that can afford it are forced to use generators or solar home systems, starting a vicious cycle in which larger consumers abandon the grid, hence reducing the revenues of the power utility and its ability to invest to improve reliability.

4. **Support traditionally female trades with high-quality, affordable energy, not just electricity:** Female business owners need better and cheaper cooking fuels (such as LPG or improved cook stoves). There is also a need for interventions to support smaller-scale electricity users (e.g. progressive tariffs) or improve energy supply for subsistence agriculture (e.g. irrigation using water pumps). As supporting subsistence-based women's activities may not appeal to private investors, the public sector may need to fill this gap.

5. **Support traditionally male trades with improved high-quality, affordable energy as well as new technologies, but taking into account other business constraints.** Heavy consumers of electricity (mostly male-owned businesses) have benefited from improved supply in Ghana's light industrial zones, but these arrangements present other challenges that suppress profits (e.g. inability to invest in equipment, strong competition from neighbouring businesses, and distance to the town centre). Men in our sample used metabolic energy as their only energy source more often than women, because they could not afford to buy equipment. If physical strength is not required, both men and women can enter the trade. This should be a priority area for further support for PUE among men and women. Another priority would be to support both men and women to develop skills that are more advanced so that they could take up more specialised occupations where competition is less intense.

The following actions would support men and women to transcend their traditional roles and move towards gender equity in PUE:

6. **Increase provision and uptake of education and training.** Gender mainstreaming interventions should support changes in attitudes about what types of work men and women can and should do, in the workplace and at home. In many countries, higher education is allowing women to enter formal occupations that can bring stability and higher income, which can also reduce the pressures on men from having to be the 'breadwinners'.

7. **Support business owners to develop soft skills and gain exposure to role models who are overcoming occupational segregation:** Exposure to role models who have successfully transcended the limitations imposed by traditional gender roles can demonstrate what is possible. Confidence-building for women venturing into male trades has often come with the encouragement of male role models. Policies to increase exposure to women in decision-making positions or women in highly capitalised sectors could help erode occupational segregation. Examples include: affirmative action to set up quotas for women in training programmes and apprenticeships; mentoring programmes where women in powerful positions or running businesses in male trades counsel younger women; or mutual support networks/associations for women in male-dominated sectors or occupying positions of responsibility.

8. **Support women to scale up their businesses:** The small-scale character of women´s businesses acts as a drag on growth and keeps them as relatively low electricity consumers. Women can be supported to join together in associations to target customers together, access supplies at a lower cost, or increase their bargaining power with government and private investors.

9. **Increase access to transformational appliances:** Many women are not attracted to typically male sectors (such as milling or carpentry) as those tend to require substantial physical strength. Support for businesses in these sectors to upgrade, using new technologies that replace metabolic energy with electric power, could make it easier for women to cross over into those sectors, as apprentices, workers and entrepreneurs. A more detailed assessment is required of the role of specific appliances in aiding women to move into more profitable sectors or to higher value-added activities.

The choice of policy depends on the particular circumstances of the target region. For example, the first set of recommendations, targeting men and women´s current roles, is expected to achieve faster success, and particularly so in more traditional societies. The second set requires transformations at the community level but will lead to longer-lasting improvements. In the case of Bwisya, Tanzania, transformational interventions were already showing some initial successes. Women had started new electricity-consuming businesses after being exposed to training and awareness activities, as well as access to loans. Some men, on the other hand, were starting to change attitudes towards women's involvement in enterprises. In Ghana, there was also clear evidence that gender roles could change with time, education and exposure. In any case, much remains to be done in all settings, as deep-rooted preconceptions are still widespread. Whereas the first approach of supporting male and female businesses could be less attractive for profit-seeking private electricity suppliers, given the smaller consumption of female-owned enterprises, it could achieve faster and more direct benefits. The second approach, paying particular attention to women's needs, could contribute to improving women's economic empowerment as well as creating more demand for electricity services. However, it

requires the transformation of social norms, and acceptance by all in a community. Results are hence expected in the longer term.

1. INTRODUCTION

Access to modern energy, including electricity and clean cooking, is increasingly recognised as a key enabler of economic growth and poverty reduction in developing countries. Electricity, in particular, can drive economic and social development by increasing productivity, enabling new types of job-creating enterprises and reducing the drudgery of household workloads, freeing up time for paid work.

Productive use of energy (PUE) is particularly important for income generation and poverty reduction among consumers, but also essential for the financial viability of electricity suppliers, whether on or off-grid. When electricity is only used for lighting during a few hours in the evening – as often happens in poor rural communities – expensive power generation and distribution infrastructure remain idle for most of the day. This leaves electricity providers with two undesirable alternatives: either recover upfront investments by charging expensive tariffs for the few kWh consumed or charge affordable tariffs but face bankruptcy. When electricity is used productively for the whole of the working day, upfront costs can be shared among more kWh and cheaper tariffs are possible. At the same time, the resulting income from productive uses improves consumers' ability to pay, starting a virtuous circle of affordability and financial sustainability.

Harnessing the income-generation potential of electricity is not straightforward, though. So far, the literature on PUE has not provided conclusive evidence of the impact of electricity either on the creation of new enterprises or better performance of existing ones (as reviewed in Pueyo and Hanna 2015; Pueyo *et al.* 2013; Mayer-Tasch, Mukherjee and Reiche 2013). Most authors agree that electricity is a necessary but not sufficient condition for income generation and poverty reduction. The most cited complementary factors are: (1) access to finance for electric appliances (Khandker *et al.* 2012); (2) access to markets for the additional production (Peters, Vance and Harsdorff 2011); (3) skills for entrepreneurs to identify the new opportunities created by electricity and to prepare sound investment plans (Neelsen and Peters 2011); (4) access to other infrastructure or services (Kirubi *et al*. 2009); and (5) a high quality of the electricity supplied (Kooijman-van Dijk 2012; Kooijman-van Dijk and Clancy 2010).

Furthermore, ensuring that both men and women can benefit from the income-generation potential of electricity is another challenge. The literature on gender and energy has mainly focused on the realm of the household, where women experience a disproportionate burden of energy poverty in their role as carers (see, for example, reviews by Winther *et al.* 2017 and Rewald 2017). The literature on PUE and gender therefore focuses on women and takes the household as its main unit of analysis, looking at the labour supply effects emerging as electricity extends the length of the working day, allowing women to spend more time on paid and unpaid work. The PUE literature tends to agree that women's paid employment increases with electrification, and that women move out of agriculture to a larger extent than men. However, the evidence is thin and inconclusive with regards to the quality of these new activities and the impact on actual earnings (as reviewed in Pueyo and Maestre forthcoming). There is, however, a dearth of literature on gender and PUE in urban settings.

Existing literature, therefore, provides insufficient insights about the different benefits that men and women derive from the use of modern energy at work. This omission is significant for a number of reasons: because women are less likely than men to be employed; because women are more likely to earn lower wages than men; because women are more likely to run informal enterprises and from their homes; and because women are overrepresented in a narrow range of low productivity occupations (Addati *et al*. 2016; Campos *et al*. 2015; Morton 2014; de Haan 2016; Cirera and Qasim 2014). Women's productive activities continue to rely heavily on process heat and metabolic energy after electrification (Clancy and Dutta 2005). On the other hand, men occupy the most electricity-intensive sectors such as construction, manufacture and repair (Bardasi, Sabarwal and Terrell 2011; Campos *et al*. 2015). Further understanding of the gendered impact of modern energy, and in particular electricity, on productive uses is therefore essential to design gender-equitable interventions that pursue energy access and economic growth.

This research report provides empirical evidence from three case studies in Tanzania, Ghana and Myanmar to address the existing literature gap on gender and PUE. Three research questions are addressed: what are the differential benefits of PUE for men and women? What explains these differences? And which interventions can successfully address the constraints that women face to ensure that they benefit from PUE as much as men? Our case studies combine rural (Tanzania and Myanmar) and urban (Ghana) contexts, in two countries with relatively low rates of access to electricity (Tanzania and Myanmar) and another with relatively high access (Ghana). In Tanzania and Myanmar, more than 90 per cent of the population depends on traditional cooking fuels such as charcoal and firewood, whereas Ghana has made further progress in introducing modern cooking fuels. In terms of economic development, Ghana has the highest income per capita, while Tanzania has the lowest. Comparing three countries with such different circumstances provides opportunities to highlight persistent inequalities in PUE and other areas that can be transformed with economic development and urbanisation. More detailed information about each country case study is presented in three separate reports available from the Gender and Energy Research Programme.

The remainder of this report is structured as follows. Section 2 provides a conceptual framework based on reviewed literature. Section 3 gives detailed background about our case studies, while Section 4 describes the methodology. Section 5 presents the empirical evidence organised around our three research questions. Section 6 discusses this evidence, highlighting similarities and differences across countries, and providing policy recommendations, while Section 7 presents our concluding remarks.

2. CONCEPTUAL FRAMEWORK

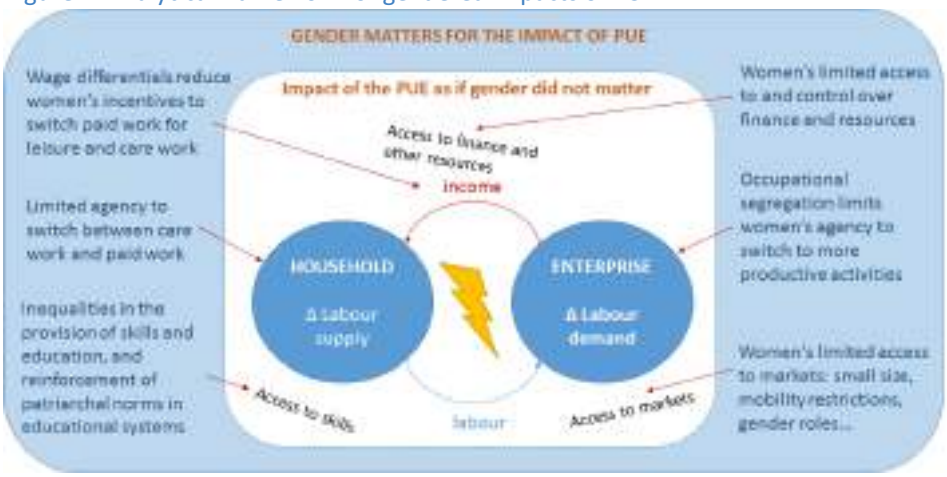
The conceptual framework used to analyse the new evidence (see Figure 1) draws from a review of the literature carried out as part of this project (Pueyo and Maestre forthcoming). The inner white square summarises the current status of the literature on PUE, which broadly overlooks gender at the enterprise level. Gendered literature about the impacts of PUE predominantly draws from neoclassical household economics, focusing on the time allocation dynamics that emerge in the household with the arrival

of electricity. Being mainly based on quantitative methods, the literature is unable to explain the gendered power relationships that influence, on the one hand, time allocation decisions, and on the other, the human and financial capital available for men and women starting new productive activities.

PUE literature has so far looked at enterprises as gender-neutral entities that can improve their performance through electrification, provided that some key enablers (including access to skills, finance and other resources, and markets) are in place. A significant body of gender and entrepreneurship literature shows, nevertheless, that women and men have different access to these key enablers. Gendered insights about the enterprises absorbing female labour supply could help explain why women get into lower-quality jobs than men after electrification, or why their wages do not increase, as highlighted by some literature.

The outer blue-shaded square in Figure 1 represents the insights provided by the literature on gender, entrepreneurship and labour markets, which help to disentangle many of the relationships unexplained in the PUE literature – for example, women's limited agency to decide time allocation, wage inequalities reducing women's incentives to switch from household work to paid work, or inequalities in access to skills, capital and markets, which enable the income-generation potential of electricity. The gendered study of enterprises absorbing labour and the gender constraints preventing women benefiting as much as men from PUE interventions remain as important gaps in the literature.

Figure 1: Analytical framework for gendered impacts of PUE



Source: Pueyo and Maestre (forthcoming)

We will use this framework to analyse the evidence collected. We place emphasis on gender imbalances in the labour mark and on the constraints preventing female-owned enterprises from becoming significant users of electricity. Only when these constraints are addressed can electricity meet its catalytic role for income generation. The review has also stressed the importance of the dominant social norms in which interventions operate, to explain why the same intervention works in some contexts but fails in others. We use a mixed-methods approach (as explained in Section 4, 'Methodology') to better understand the complex environments in which PUE takes place and suggest a number of indicators that should be collected with that aim.

3. BACKGROUND TO CASE STUDY COUNTRIES

Our empirical evidence draws from case studies in Tanzania, Ghana and Myanmar. The selection of the specific regional focus in each country was decided jointly with GIZ, through a partnership with local researchers. Thus, in each country, we targeted communities where GIZ was implementing PUE interventions or had done so in the past. This facilitated fieldwork logistics and the identification of key stakeholders.

Table 1 displays some key indicators for these three countries to emphasise their differences and similarities. The best performer for each indicator is highlighted in green, the worst in red. Both Ghana and Myanmar hold lower middle-income (LMI) status, whereas Tanzania is still a lower-income country, aiming to attain LMI status by 2025. Tanzania has one of the lowest electricity access rates in the world, with just 35 per cent of the population having a connection. On the other hand, Myanmar has the lowest level of access in Southeast Asia and would also be ranked last for Asia as well if it were not for North Korea. Tanzania, however, has been making rapid progress in increasing electrification rates and adopting off-grid solutions, being one of the rising stars in the SE4ALL Global Tracking Framework report (World Bank 2017). On the other hand, Myanmar launched the National Electrification Programme (NEP) (2016–2030), which expects to achieve universal electrification by 2030, mainly through grid extension.

Reliability of electricity supply is poor in all three countries. All experience frequent blackouts, which, in the case of the two African countries, can last for many hours. As a result, a large share of enterprises in Ghana and Tanzania use private generators to provide a back-up for the main grid, which may considerably raise the cost of electricity. Poor electricity supply is pinpointed as the biggest obstacle to grow for 25 per cent of enterprises in Tanzania and 19 per cent in Ghana. In Myanmar, the share is lower, at 13 per cent.

In terms of gender equality, all three countries rank in the bottom half of the Gender Inequality Index (GII), with Myanmar closest to the middle. Each of the three countries has enacted policies to promote women's social and economic empowerment, but women are still disadvantaged in labour markets.

Table 1: Key economic, gender and energy indicators for the three case study countries

	Tanzania	Ghana	Myanmar
Population (millions)	57.31	28.8	53.37
Gross national income (GNI) (current $ billions)	50.36	42.92	63.48
GNI per capita (current $)	910	1490	1190
Income group	Lower income	LMI	LMI
Human Development Index (HDI) 2017	154 rank	140 rank	148 rank
Gender Inequality Index (GII) (rank out of 187 countries)	130	131	106

Female share of employment in senior and middle management	n.a.	26.7	28.3
Access to electricity (% total)	33%	84%	59%
Rural access to electricity (%)	17%	71%	44%
Population without access to clean cooking (%)	>95%	71%	94%
Average number of blackouts per month	8.9	8.4	11
Average duration of blackouts (hours)	6.3	7.8	1.3
% enterprises with generators	43%	52.1%	15.4%
% enterprises choosing electricity as their biggest obstacle to growth	24.9%	18.7%	13.4%

Source: Energy Access Database www.iea.org/energyaccess/database/; World Development Indicators https://data.worldbank.org/products/wdi; World Bank Enterprise Surveys www.enterprisesurveys.org/

The remainder of this section describes the target regions and PUE interventions analysed in each country. In all three countries, research was conducted in collaboration with GIZ country offices, focusing on some of the energy, gender and PUE interventions they had supported: (1) improved electricity supply in light industrial zones in Ghana; (2) promotion of PUE and gender in villages supplied with solar mini-grids in Tanzania; and (3) promotion of mini-grids and entrepreneurship in Myanmar.

3.1. Tanzania

Our research focused on five villages located in three different islands in Lake Victoria:

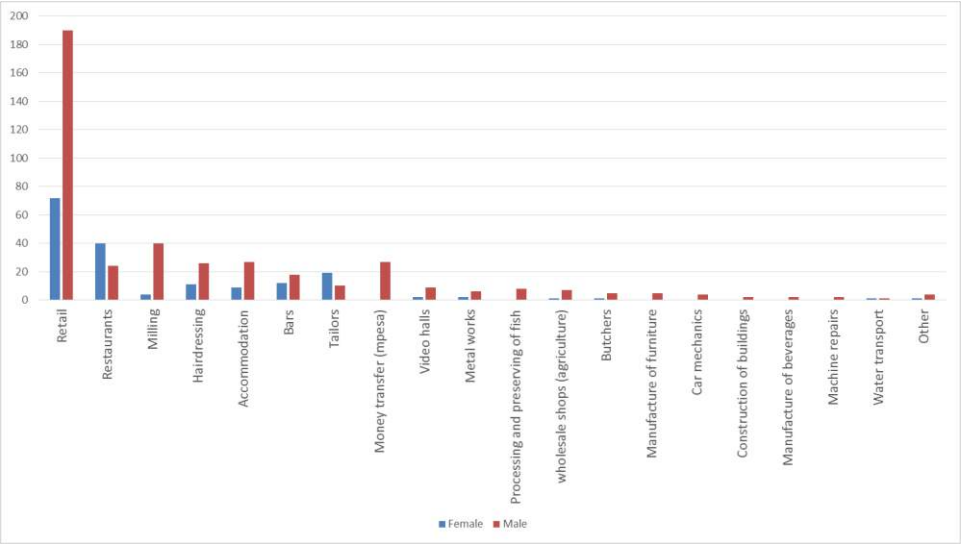
- Bwisya village, in Ukara island, where a mini-grid has been in operation for over a year and a gender programme has been implemented to support women entrepreneurs consuming electricity in their business.
- Murutunguru and Bugolola villages on Ukerewe island, which have been connected to the main grid for several years but where gender programmes have not been implemented.
- Sambi and Nabweko villages in Irugwa island, which lack access to electricity from the main grid or mini-grids, and have not received any gender programmes. Access to electricity in the village is possible through individual solar home systems or diesel/petrol small generators. Mini-grids were to be installed in the second half of 2018, after our fieldwork took place.

The economy of all villages in the area is highly dependent on fishing in Lake Victoria as well as small-scale subsistence agriculture. Fishing is a male-dominated activity, based on catches of what the communities call 'big fish' (tilapia and Nile perch) and sardines. Agriculture, on the other hand, is an important sector for women's economic activities, with the main crops being cassava, sweet potatoes and rice. Other economic activities include small restaurants, retail shops, or mobile money agents.

An enterprise census prepared as part of the research showed a majority of male-owned enterprises in the villages. Only 29 per cent of the total of 598 businesses are female-owned. Men dominate all productive activities, except for tailoring and food preparation, which are female-dominated. Retail trading is the most common activity across the five surveyed communities, representing 44 per cent. Manufacture is limited and typical of

rural settings, including food-related activities such as grain millers, butchers, bakers or fishmongers, as well as tailors, welders and carpenters. (See Figure 2 for the gendered distribution of businesses, classified according to the International Standard Industrial Classification of all Economic Activities- ISIC)

Figure 2: Enterprise census by owner's gender and type of activity (number of businesses)



Source: Authors´ own, based on business census

The solar mini-grid operating in Bwisya was installed and is managed by private company JUMEME Rural Power Supply Ltd, a joint venture between three European companies and a Tanzanian university, mainly financed through a European Union (EU) grant. The mini-grid currently serves 300 customers in Bwisya, but JUMEME aims to reach 13,000 customers in 9 islands within Lake Victoria and in the mainland regions of Katavi, Rukwa and Kigoma.

PUE is key for the financial sustainability of JUMEME's mini-grids. In Bwisya, even if only 16 per cent of customers are commercial and productive, they account for 80 per cent of electricity demand. Productive uses include retail shops, hospitality and personal services, as well as energy-intensive activities like milling, carpentry, bakeries or metal working. No fish processing activities take place in the island. JUMEME has supported local businesses with access to finance and equipment and contacts with end customers.

The 'Unlocking the Benefits of Energy for Women' project introduced a gender perspective in PUE from mini-grids in Bwisya. The project was developed in partnership, between GIZ Employment for Sustainable Development in Africa and JUMEME, to enhance equal social and economic opportunities for women and men as part of JUMEME's electrification project. It consists of affirmative actions in support of women starting and growing businesses. It began with a gender-focused baseline study of Bwisya in January 2017, after which the project activities were defined around three areas: (1) awareness-raising at community level; (2) mentoring women to develop electricity-consuming enterprises; and (3) changing attitudes in the community with regards to women's involvement in paid work. These activities were implemented for 14 months (November 2017 to December 2018) as a pilot for gender mainstreaming.

3.2. Ghana

This research looks at PUE and gender in three towns in Ghana's Brong Ahafo region: Techiman, Tuobodom[4] and Berekum. Brong Ahafo is a transition zone between the relatively poorer northern regions and the more densely populated and wealthier central and coastal regions, where the economic hubs of Kumasi and Accra are situated (Peters, Sievert and Vance 2013). Agriculture is the most important source of income, with commercial crops such as maize, yams, cassava, plantain and cocoa. The non-agriculture sector is dominated by trading and the surveyed towns have large markets operating at least once a week. Techiman in particular has one of the biggest markets in West Africa. Manufacturing activities include palm oil production, grain milling, woodworks, nuts roasting, tailoring, shoemaking, welding, and numerous car repair and maintenance services.

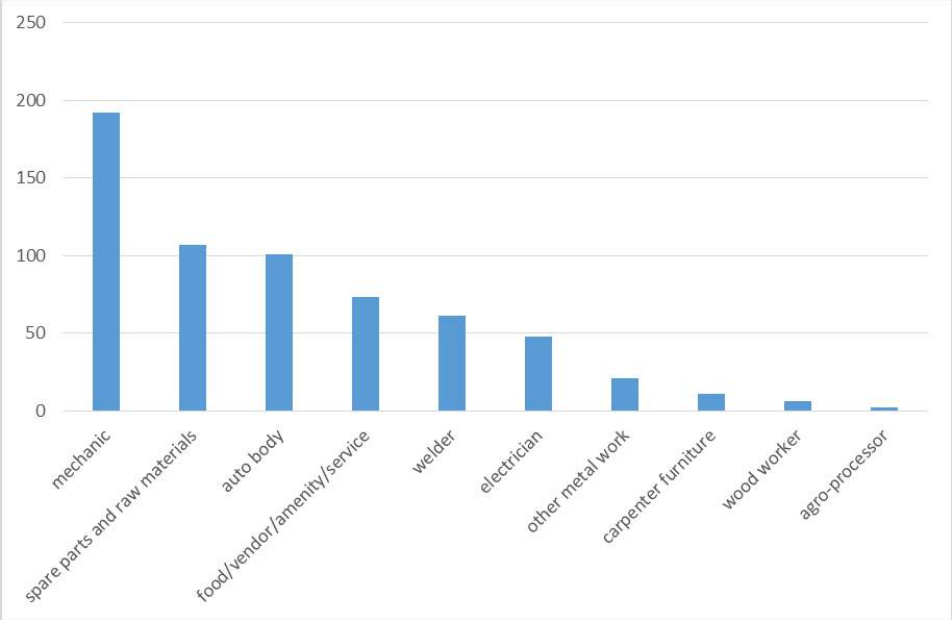
All three towns were targeted by the industrial zone development component of GIZ's Programme for Sustainable Economic Development, implemented from 2007. The promotion of light industrial zones was designed to expand Ghana's economic growth beyond the capital and major cities of the south. Some of the challenges faced by small and medium-sized enterprises (SMEs) in the targeted areas were: unsecure land tenure, which decreased willingness to invest; no access to infrastructure such as electricity and roads; unregulated business causing environmental degradation; and road congestion in the town centre. The programme provided entrepreneurs with land and business capabilities and served industrial zones with improved infrastructure, such as grid extension, road access, water supply and sanitation facilities. Enterprises also received business development services and the district government was offered technical assistance. The three main actors involved in implementation are as follows.

- Local governments and business associations: Identified and acquired land; prepared the land for infrastructure; provided access to roads, drains, water supply and latrines; and paid labour costs for electricity hardware installations.
- GIZ: Advised on planning, design, implementation and management of the sites; supported local economic development processes and set up dialogue platforms; procured and delivered the electricity hardware; supported management and environmental training.
- Utilities: Provided technical assistance for network design, cost estimates and installation.

Light industrial zones in Techiman (including Tuobodom) and Berekum clustered automotive maintenance and related industries and are managed by garage associations. However, since their creation, many other supporting businesses have joined, such as restaurants, shops and barbers. Figure 3 shows the number of businesses per sector jointly for all light industrial zones analysed as of December 2016. Car mechanic was the most common business, followed by spare parts sale and auto body works.

[4] Techiman and Tuobodom used to be a single municipality, but a new border was recently established. For that reason, some data are presented jointly for both towns.

Figure 3: Number of businesses per sector in Techiman and Berekum light industrial zones as of December 2016



Source: Authors' own, from GIZ monitoring data

Table 2 shows the main characteristics of the two towns and their light industrial zone. Even though Techiman municipality is larger, Berekum's light industrial zone hosts more enterprises.

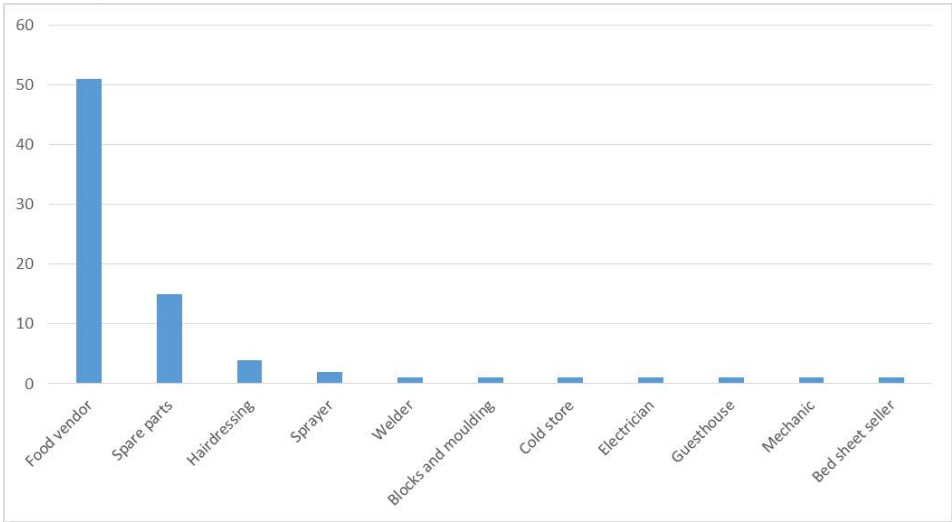
Table 2: Key characteristics of Techiman (including Tuobodom) and Berekum and their industrial zones

	Techiman-Tuobodom	Berekum
Population of municipality	206,856	129,628
Area of municipality (km2)	669.7	955
Date of grid connection	1990	1990
Implementation of light industrial zone	2007	2007
Number of enterprises at the site (December 2016)	160	477
Number of workers	974	2450
Number of female-owned enterprises	11 (7% of total)	72 (15% of total)
Number of enterprises connected to electricity	73 (46%)	200 (42%)

Source: Field survey, 2018 and GIZ monitoring data, 2017

Gender data included in the previous table were extracted from GIZ's monitoring records. Women's participation in businesses in these zones is very small, accounting for just 7 per cent of total enterprises in Techiman and 15 per cent in Berekum. As Figure 4 shows, food vending is the most common female activity, followed by the sale of spare parts.

Figure 4: Number of female-owned businesses in Techiman and Berekum light industrial zones, by sector, 2017



Source: Authors, from GIZ monitoring data

GIZ's rationale for supporting light industrial zones was that a service package (including infrastructure, training, access to microfinance and clustering of enterprises to take advantage of agglomeration effects) would be more effective than providing these services individually. Electricity in particular would improve business productivity, allowing the use of new equipment (Peters *et al.* 2013). However, two impact evaluations carried out in 2011 and 2013 did not show these positive results.

The first impact evaluation assessed the impact of the zones on business performance and energy usage. It included enterprises in Techiman, Berekum and Goaso-Min involved in manufacturing (welding and carpentry) and car repair (car body, upholstery, electricians, other metal work, and mechanics). A before–after comparison was used as counterfactual. Findings showed that access to land was the main reason why companies had relocated to the light industrial zone, with access to electricity a secondary reason. There were encouraging signs of investment picking up, as 44 per cent of firms with access to electricity purchased new equipment after relocation and increased their credit uptake. However, monthly profits and customers per week decreased, due to increased competition among clustered enterprises. Therefore, the zones had not led to positive impacts for companies, even if they had benefited from land and services (Peters *et al*. 2012).

The second impact evaluation extended the scope to include enterprises both in and out of the zones in Techiman, Berekum, Goaso Min and Nkoranza, and across a wider set of sectors, including services (hairdressing, communications, electrical services, mechanics and restaurants) and manufacturing (dressmaking, tailoring, metal works and carpentry). It described businesses' energy use patterns and analysed the impact of electricity use on performance. The counterfactual were firms not connected to electricity. It found no significant effect on performance, showing that electricity does not increase income by all means. Our research aims to extend the scope of previous evaluations by providing gender-disaggregated data and using a wider diversity of methods.

3.3. Myanmar

The research location in Myanmar focused both on villages with some access to stable electricity and those without, to assess the key drivers to unlock PUE for women. Five locations were selected in Shan estate, Bago region, Magway region and an island in the south. Among them, one village has been connected to the national grid for one year (Myaing); two villages have had mini-grids set up following a government call for proposals (Oak Pho and Kenti); and two locations have no access to electricity but plan to receive it soon (Hti Ne and Kan Gyi Taw). Table 3 provides further details about electricity supply in the three villages where it is available.

Table 3: Key characteristics of electricity supply in Oak Pho, Kan Ti and Myaing

	Oak Pho	**Kenti**	**Myaing**
Electricity source	Solar and diesel hybrid mini-grid	Solar and diesel hybrid mini-grid	Connected to the national grid
Provider	Private provider (T&T)	Private provider (Techno Hill)	Government
Capacity	20kW (30kW diesel back-up)	63kW (50kW diesel back-up)	N/A
Households connected	122 HH of 276 (63 HH committed)	300 HH of 350	380 HH of 420
Installation costs per household	200,000 Ks	350,000 Ks	250,000 Ks (per meter box)
Unit costs	500 Ks per unit	350 Ks per unit	35 Ks per unit
Year of connection	2017	2017	2016

Source: Fieldwork, 2018

Low electricity tariffs from the main grid, at 35 kyat per KWh ($0.02 /kWh), contrast with the relatively high mini-grid tariffs. Subsidies to the national grid tariffs are unequally distributed, both geographically and across income groups, given the country's low and varying levels of electricity access. Hence, most of the subsidies go to better-off households in Myanmar's biggest cities, Yangon and Mandalay.

The two private mini-grids in Oak Pho and Kenti have been installed under the government's Rural Electrification Plan, with technical support from GIZ. Infrastructure was financed in a 60:20:20 ratio, where the Department for Rural Development (supported by the World Bank and GIZ) provided 60 per cent, the community contributed 20 per cent and the private operator contributed the remaining 20 per cent.

In Oak Pho, Talent & Technology (T&T) installed a 20 kW solar mini-grid with a 30 kW diesel generator as back-up. It is planning to hand over the management of the mini-grid plant to the village after five years. In 2016, during the feasibility study, 185 households (out of 276) agreed to contribute the 20 per cent (200,000 Ks/household) in a 4-stage instalment plan, with the last to be paid after connection. Currently, 125 (out of the 185) households have been connected to the mini-grid. T&T provides two types of meters, for home use and commercial use. At the time of our research, the T&T Director confirmed

that the company had provided 33 commercial use meters and 125 home use meters since 2017.

Techno Hill Engineering installed its solar mini-grid in July 2017 in Kenti, with a 63 kW capacity and 50 kW diesel back-up. It has plans to add 61 kW more capacity in 2019. Given the expansion plans, the company is negotiating when to handover the plant management (in 8 or 15 years). Techno Hill, together with Pact Myanmar (an international NGO), has provided some training for villagers in order to promote PUE, linked to access to finance to pay for installation costs or new equipment to start new businesses. Most of these businesses are male-owned.

4. METHODOLOGY

The analysis in Ghana and Tanzania used a mixed-methods approach, whereby quantitative data were drawn from an enterprise survey and qualitative data from semi-structured interviews (SSIs), key informant interviews (KIIs) and participatory focus group discussions (FGDs). In Myanmar, only qualitative methods were used due to the difficulty in finding research partners able to provide high-quality quantitative data. Mixed-methods approaches provide the rigour required in complex environments such as our three target countries, where randomisation of PUE interventions is not possible and where several gender and/or entrepreneurship programmes have already taken place, which makes it difficult to isolate their effects (Chambers 2017).

The analytical strategy in each country was as follows.

- Tanzania: We compared outcomes of male- and female-owned enterprises located in three regions – one with access to electricity from mini-grids and with gender interventions (Bwisya), another only with access to grid electricity (Murutunguru), and another without access to grid or mini-grid electricity, and with no gender interventions (Irugwa).
- Ghana: We compared outcomes of male- and female-owned enterprises located inside and outside light industrial zones in three towns with grid electricity: Techiman, Tuobodom and Berekum.
- Myanmar: We compared uses of energy in villages that currently have access to energy for productive uses with those that are still not connected to any stable source of electricity. The five surveyed villages were clustered in two groups according to their supply systems: (1) Myaing, Oak Pho and Kenti village, which have access to stable sources of energy that are used for productive purposes; and (2) Hti Ne and Kan Gyi Taw, which have no stable access to electricity and no productive uses.

The same research tools were used across the three countries to facilitate comparison of results. They included an enterprise census, enterprise questionnaire, guidelines for KIIs and SSIs, and four participatory FGDs (which covered community and energy mapping, activity and energy use mapping, access to and control over resources, and gendered value chains). Table 4 shows the sample size for each research tool, disaggregated by gender.

Table 4: Sample size by research tool and country

	Tanzania	Ghana	Myanmar
Enterprise questionnaire	**316** F: 118 M: 198	**400** F: 147 M: 253	-
Key informant interviews	**10** F: 2 M: 8	**10** F: 3 M: 7	**17** F: 3 M: 14
Semi-structured interviews	**26** F: 13 M: 13	**40** F: 20 M: 20	**33** F: 17 M: 16
Focus group discussions	**74** F:36 M: 38	**80** F:35 M: 45	**87** F: 46 M: 41

In Tanzania, the sampling frame was created drawing from the full census elaborated by the researchers, including all the sectors and oversampling of female-owned enterprises. In Ghana, in the absence of an up-to-date census, we drew the sampling frame light industrial zone monitoring data from GIZ and from an old baseline prepared by GIZ before its intervention in the zones. Given the large size of the population of enterprises in Ghana, we preselected 11 sectors of operation, based on their availability in the area, but excluding small-scale retail.

For Ghana and Tanzania, where quantitative data were collected, the analysis of enterprise data starts with descriptive statistics, showing differences in means of a number of indicators for male- and female-owned enterprises, and for different regions. Descriptive data are organised around the three research questions. First, we show differences in energy consumption patterns for productive uses by male- and female-owned enterprises. Then we look at data to support or refute the following hypotheses about gender differences: in business size and performance; in access to financial and physical capital and skills; in domestic care responsibilities; in motivations to run businesses; and in occupational segregation.

Following the descriptive statistics, the report presents results of several ordinary least square (OLS) regressions looking at outcomes of interest related to enterprise performance and energy consumption. An experimental design was not possible, due to being unable to randomise electricity provision in our context. Quasi-experimental approaches were challenging as well, due to the difficulty of finding enterprises not connected to electricity that share all other characteristics with those connected, or credible instrumental variables. Our OLS results, therefore, can only be used to establish whether the correlations among our variables of interest are statistically significant, without the possibility of claiming for causality. The model used for this analysis is presented in Equation 1:

$$y_i = \alpha_i + \beta_i X_i + \gamma Female_i + \delta Electricity_i + \theta Industrial\ Zone_i + \varepsilon_i \quad [5]$$

[5] For all outcome variables relative to electricity, the variable $Electricity$ is omitted.

The dependent variables y_i are a set of business-related indicators about economic performance (including profits, customers, sales, opening hours and business expenditure) and energy consumption (measured as monetary expenditure for energy and electricity). The paper details the results for monthly profits, energy expenditure, and electricity expenditure.[6]

The list of covariates in X includes a set of control variables accounting for business, individual and household characteristics. Table 5 summarises the list of control variables, common for all estimated regressions.

Table 5: List of control variables

Business	Individual	Household
Number of workers	Age	Number of children
Starting capital	No education/primary Education	Number of older people
Member of an association	Migrant[7]	
Officially registered	Married	
Keep books	Bank account	
Permanent building		
Requested loan		

The dummy variables $Electricity$ and $Female$ account for, respectively, whether the business uses electricity and whether the business is female-owned. The variable $Industrial\ Zone$ is only applicable for the Ghanaian case study and reflects whether the business is within an industrial zone. Finally, all sample regressions include sector and region fixed effects. For sector fixed effects, in Tanzania we take retail, and in Ghana 'Processing and preserving of food and vegetables' as the sectors of reference, against which performance of the other sectors is compared. These sectors were selected because both men and women were represented and there were many observations. For the regional fixed effects, Bwisya in Tanzania and Berekum in Ghana were taken as the reference regions.

Qualitative data analysis was completed using a coding strategy that was similar for all three case studies. The information gathered through FGDs, SSIs and KIIs was transcribed and then organised around themes to provide answers to our research questions. The qualitative data analysis used purposively developed coding framework, based on our conceptual framework (Pueyo and Maestre forthcoming). The joint analysis of quantitative and qualitative data allowed for cross-fertilisation and triangulation and provided for more robust responses to the questions.

[6] Results with other economic and energy indicators are reported in the Appendix

[7] Every individual not born in the same village where the business is located is defined as migrant

5. RESULTS

5.1. Do men and women benefit differently from PUE?

Case studies of PUE interventions in Ghana and Tanzania, for which we collected quantitative data, showed that male-dominated sectors were more likely to benefit than female-dominated ones from improvements in electricity supply. This is because men typically operate more and larger enterprises, which consume more electricity than female-owned enterprises, which instead dominate cooking fuels such as firewood, charcoal and liquefied petroleum gas (LPG). In Myanmar, across the five study sites, men and women use energy differently, with men more likely to benefit from access to electricity interventions. Men own more businesses than women and require higher quantities of energy. Furthermore, in terms of energy sources, men use electricity and diesel mostly, whereas women tend to use charcoal and firewood. According to the FGDs, in the three communities with access to electricity, most PUE involve male-owned businesses, and the diversity of male-owned businesses is greater than female-owned ones, except in Oak Pho.

Table 6 shows the types of fuel used by male- and female-owned enterprises in Tanzania and Ghana, with significant differences highlighted in bold[8]. Electricity is the most commonly used fuel by men and women in both countries, although some villages in Tanzania have only recently got access. Still, significantly more men use electricity than women. With regards to cooking fuels, in both countries charcoal is the most frequently used, and is dominated by women. Whereas Ghanaian women have significant access to LPG, this has not reached Tanzanian villages. Men instead dominate the use of diesel and, in the case of Ghana, a significantly higher share of men use only physical energy for work.

Even though quantitative data are not available for Myanmar, qualitative data display a similar pattern. Women were the main users of firewood and charcoal for cooking and ironing, while men were the main users of diesel to run generators. For example, in Kenti, a service provider explained that 'since women stay at home [they] use electricity to cook and to light oil lamps as offertory [for ceremonies in the temple]. Men use it for welding and for their works. Women also use it for lifting water because they are always at home. Women do not use it much for business purposes…'

Table 6: Share of enterprises using each type of energy in Ghana and Tanzania

	Ghana			Tanzania		
	All	Male-owned	Female-owned	All	Male-owned	Female-owned
None	**14%**	**18%**	**6%**	14%	13%	16%
Dry cell batteries	**3%**	**1%**	**6%**	11%	11%	9%
Rechargeable battery	1.5%	2%	1%	6%	5%	7%
Gas (LPG)	**13%**	**7%**	**23%**	0.3%	0%	1%
Diesel/ petrol	7%	8%	4%	**5%**	**9%**	**0%**
Kerosene	-	-	-	1%	0.5%	2%

[8] We did not collect quantitative data from study sites in Myanmar, hence they are not included in the table.

Charcoal	**25%**	**5%**	**59%**	**17%**	**9%**	**31%**
Firewood	**10%**	**3%**	**23%**	**11%**	**5%**	**21%**
Candles	-	-	-	3%	2%	4%
Electricity	**68%**	**74%**	**60%**	**66%**	**73%**	**55%**

Note: figures in bold highlight statistically significant differences between male- and female-owned enterprises

Table 7 shows average monthly expenditure on different types of fuels for both countries. The totals show differences in expenditure across countries – for example, higher expenditure on firewood, electricity and LPG in Ghana compared to Tanzania, but similar expenditure on charcoal. In both countries, male-owned enterprises spend more on electricity, but the difference is only significant for Ghana. On the other hand, in Ghana, among businesses using cooking fuels, women spend less than men on charcoal and firewood, but the difference is not statistically significant. In Tanzania, female-owned enterprises using cooking fuels spend more than men, and the difference is statistically significant for firewood. Total energy expenditure is not significantly different between women and men, as women's lower electricity expenditure is offset by higher expenditure on cooking fuels. Another interesting result is that energy expenditure in Tanzania is higher than in Ghana, in spite of having smaller and less capitalised enterprises. This implies that the cost of energy is higher in Tanzanian islands, probably due to the higher cost of reaching remote rural locations.

Table 7: Average monthly expenditure on different fuels, by gender ($)[9]

	Ghana			Tanzania		
	All	Male	Female	All	Male	Female
Dry cell batteries	3	7	2	4	4	2
Rechargeable battery	5	1	15	6	10	1
Gas (LPG)	38	26	45	10	-	-
Diesel/ petrol	25	31	5	72	-	-
Kerosene	-	-	-	4	10	1
Charcoal	20	30	18	21	14	24
Firewood	43	58	40	**19**	**11**	**22**
Candles	-	-	-	2	2	2
Electricity	**32**	**38**	**19**	24	30	11
Total energy expenditure	56	56	56	71	76	60

Note: figures in bold highlight significant differences between male- and female-owned enterprises

Table 8 shows the number of hours that each type of fuel is used, by gender. Results for this indicator differ by countries. In Ghana, women use electricity for longer than men, while in Tanzania the opposite is true. In both cases, the difference is statistically significant.

[9] Conversion rates applied throughout the paper are 1TZS = 0.00044; 1 GHC = $0.2, as of 12 October 2018

Table 8: Daily use of each type of energy, by gender (hours)

	Ghana			Tanzania		
	All	Male	Female	All	Male	Female
Dry cell batteries	3.9	6.3	3.1	3.7	4.0	3.2
Rechargeable battery	0	0.0	0.0	10.3	10.5	10.0
Gas (LPG)	5.8	5.8	5.8	3	-	-
Diesel/ petrol	4.8	5.5	2.3	8.8	-	-
Kerosene	-	-	-	2.7	3.0	2.5
Charcoal	6.3	6.8	6.2	6.2	5.2	6.6
Firewood	7.3	7.7	7.2	**6.1**	**4.2**	**6.8**
Electricity	**9.6**	**9.1**	**10.7**	**10.7**	**11.4**	**9.2**

Note: figures in bold highlight significant differences between male- and female-owned enterprises

Ownership of electric appliances was common in Ghana, but marginal in Tanzania. With regard to characteristics of electricity supply, in Tanzania our sample displayed three different types, depending on the island where the enterprises were located. Table 9 shows that mini-grids offer higher-quality service, with greater availability and less outages than the main grid. However, costs are significantly higher than the main grid per kWh, although they require a lower connection fee. Solar home systems (SHS) appear as a convenient alternative in the island without grid options. They offer reasonable upfront costs and a good quality of service, with no consumption cost. Their disadvantages are low peak capacity, hence lower possibilities of use, and lower availability.

High costs of mini-grids were often raised as a problem by villagers in our interviews. For example, a woman running a guest house said, 'High electricity costs are a barrier for me to diversify to other businesses, such as horticulture, requiring a pressure pump'. A female food vendor from the same village, not connected to electricity, reported that:

> *Many people who use electricity are complaining about its high cost, but if the price dropped, I would aspire to use it as it would improve my health, cooking speed, and would allow me to do many things at the same time.*

A male welder in the village echoed that view:

> *My main dislike from this business is the high cost of electricity. I am paying 14,000 TZS [Tanzanian shillings] per week regardless of having orders for welding or not. Some weeks I pay from my own pocket… Many people here are convincing me to stop using electricity from JUMEME, but I feel sorry for my grandson who has started this welding as his employment.*

Users of electricity from the main grid in Ukerewe island complained about its poor reliability. For example, a miller indicated that frequent power cuts make him lose business, while an entrepreneur running several businesses was planning to purchase a solar system as a back-up for the main grid.

Finally, the main complaint by SHS users was low power output. For example, a male restaurant owner in Tanzania explained:

I use solar power for lighting, but it is not capable of running entertainment in my work like television or radio and can switch off any time… I think I could attract more customers by having a television and cold drinks.

A male pharmacist aspired 'to use electricity from the main grid as it would help me to operate advanced equipment when doing various medical tests. I could store cool drinks and medicine which needs cool temperatures.'

Table 9: Characteristics of electricity supply in Tanzania

	Main grid	Mini-grid	SHS
Peak capacity (W)	240.1	2704.76	116.6
Availability (hours per day)	19.3	22.9	14.1
Average number of outages per week	2.51	0.35	0.04
Average duration of outages (hours)	7.94	0.28	0.1
Upfront investment - connection fee ($)	143.7	22.7	212.8
Tariff per kWh ($)	0.14	1.18	--

Table 10 shows characteristics of electricity supply in Ghana, by gender. Outages are prevalent, and more so in female-owned enterprises, probably due to their location outside of light industrial zones. The duration of outages is shorter than in Tanzania, and the upfront connection costs are lower. Consumption fees, however, are similar to those of Tanzania's main grid.

Table 10: Characteristics of electricity supply in Ghana

	Gender differences			
	Male	Female	Diff	p-value
Availability (hours per day)	9.24	9.64	-0.40	0.552
Availability in the evening (hours)	7.32	7.16	0.17	0.738
Average number of outages per week	2.63	5.03	-2.39	0.000
Average duration of outages (hours)	3.50	3.87	-0.37	0.410
Upfront investment - connection fee ($)	82	47.2	34.82	0.039
Tariff per kWh ($)	0.14	0.14		

Poor reliability of supply was a concern for businesses in all three countries. In Ghana, for example, a car mechanic explained, 'When someone has given his car to be done and for the past three days the lights have been off, there is a problem because the person needs the car for work and you have seized it'. A female paint sprayer shared her frustration:

If power is reliable, you are able to meet the deadline as promised to your customers, thereby keeping the bond between you and the customer. He or she will pay for the services happily, but when the light goes off, they are highly disappointed and may reduce the price agreed.

A hairdresser also explained that 'when potential customers find there is no power, they just leave, and we can spend three days without business'. Not only do power cuts reduce sales, but they can also damage equipment, as the same hairdresser commented: 'The straighteners are damaged because of on-and-off power'. To deal with frequent outages, some businesses aspire to purchase diesel-powered machines or solar PV systems as a back-up for the grid. As a female grain miller from Berekum said:

> *Due to frequent light out, I plan on getting the diesel version of the machine… This has long been my dream… but my best wish is that the government minimises power cuts and, if possible, eliminates them because it is really worrying*.

The use of electricity brought many benefits for entrepreneurs in all three countries. Modelling results presented in Section 4.3 consistently show better business performance outcomes for enterprises. In Tanzania, where enterprises had only recently obtained electricity, the benefits were more evident. For example, the female owner of a guesthouse in Bwisya was now using electricity for lighting, ironing, TV, radio and water pumping. She estimated that the cost of water supply after the arrival of electricity was one-third of what it was before, when water had to be carried manually from the lake to the guesthouse. She noted: 'Electricity is very important to make my business sustainable and profitable as everything needs power'. Two women in Bwisya explained that they had started a number of activities that would not have been possible without electricity, including making ice cream, popcorn and smoothies, and a laundry shop that uses an electric washing machine to provide services to itinerant fishermen. As with the cases previously described, women's new activities normally relate to their domestic roles. One female tailor in Bwisya described how, after purchasing an electric sewing machine and being trained to use it, she is able to offer more types of sewing styles and embroidery than her competitors. This has allowed her to increase her income from 80,000 TZS, which she made selling children's clothes, to 200,000 TZS, with her new products. An additional advantage is that embroidery products are not seasonal, which gives her a more stable income. Finally, a beautician in Bwisya said that since she started using electricity and purchased an electric dryer, her monthly income had risen to around 300,000 TZS.

Men in Tanzania also described the benefits that electricity had brought to their businesses. For example, a miller connected to the main grid in Bugolola (Ukerewe) indicates that 'the availability of the national grid has made it possible for my business to dramatically reduce costs as compared to diesel or petrol. I can now produce large quantities in a short time thanks to electricity.' An entrepreneur running several businesses in Murutunguru and connected to the main grid explained, 'I use electricity to operate the saloon equipment's such as TV, clippers, shaving machines, and radio, and bar equipment (fridge, freezer and radio). Electricity is everything if you want to do profitable businesses.'

Entrepreneurs in Myanmar described several benefits. For example, a woman in Kenti said: 'Electricity is pretty helpful. I now can freeze jelly that I buy at 50 ks in the fridge and I can sell iced-jelly for 100 ks. With the profit I make, I can pay the electricity bill.' A female tailor in Oak Pho mentioned increased income as well, by doubling the amount of clothes she can finish in one day '… I could finish three or four pieces of clothing in the past, but now I can finish five or six pieces in the same time. I earn more than in the past. It is better.' A tailor and hairdresser in Kenti explained:

> *It is about six years that I started making clothes and four years that I started straightening hair. In the past, I used an engine dynamo to straighten the hair, so it was not convenient. Later, I bought a Honda portable generator. Now, it is so convenient that we have got solar electricity*.

A man from Myaing explained 'the carpenters are improving. Before, it took two to three days to finish one task as they had to work by hand. Now, they are faster as they work with machines.'

In summary, in all our study locations, men and women benefit from the use of electricity at work, but men are more likely to be targeted by PUE interventions as they own most enterprises, are more likely to use electricity than women, and spend more on it. Women instead use cooking fuels (charcoal, firewood, LPG) more frequently than men, and spend more on them. Taking into account all fuels, energy expenditure is similar across genders, but when PUE interventions focus only on electricity, they are more likely to reach men. In Ghana, men more frequently use just their physical energy for their businesses. Reliability of supply was a key concern for entrepreneurs from all our case study countries and could cause significant losses. This evidence contributes new findings to the literature, as it offers quantitative and qualitative data on the differential outcomes for women and men of current approaches to PUE, showing how male-owned enterprises are more intensive users of electricity than female-owned enterprises.

5.2. Which gender constraints affect women's chances of benefiting from PUE?

Here, we explore the reasons behind gendered patterns of energy consumption for productive purposes. Drawing from the literature on gender and entrepreneurship, and gender and PUE (as reviewed in Pueyo and Maestre forthcoming), evidence is organised around five different areas – namely, gender differences in (1) size and profitability of enterprises; (2) access to skills and resources; (3) care responsibilities; (4) motivations; and (5) occupational segregation.

5.2.1. Differences in size and profitability of male- and female-owned enterprises

Ghanaian and Tanzanian enterprises are very different in size. Table 11 presents Tanzanian enterprises as mainly survivalist (i.e. providing the bare minimum to cover basic needs), while Ghanaian enterprises show a bigger potential. In Tanzania, male-owned enterprises perform significantly better than female-owned enterprises for all indicators except customers in the low season and annual profits. In the last two cases, male-owned enterprises also outperform female-owned enterprises, but the difference is not statistically significant due to a large standard deviation. In Ghana, on the other hand, male-owned enterprises outperform female-owned enterprises in sales and profits, but the difference is not statistically significant. Female-owned enterprises do, however, have a significantly higher number of customers than male-owned enterprises. The evidence of women's enterprises performing worse than men's is hence weaker in Ghana than in Tanzania. However, Ghana's sample excluded retail trading, which is typically very small and female dominated, whereas Tanzania's sample included all sectors.

Table 11: Business performance indicators by gender ($) (mean)

	Ghana		Tanzania	
	Male	Female	Male	Female
Sales in high season (weekly)	496.2	370.4	**4.8**	**1.0**
Sales in low season (weekly)	173.8	173.2	**1.6**	**0.3**
Customers in high season (weekly)	**13.2**	**32.2**	**42.2**	**32.2**
Customers in low season (weekly)	**6.6**	**18.6**	16.5	12.2
Profit (last month)	253.4	193.2	**83.9**	**45.2**
Profit (annual)	2841.4	2338.4	701.7	471.5
Expenses (monthly)	552.5	568.3	**1.3**	**0.6**

Note: figures in bold highlight statistically significant differences between male- and female-owned enterprises

Most enterprises in Tanzania had no employees apart from the owner, but men entrepreneurs had twice as many employees than women (on average).[10] Ghanaian enterprises, as evidenced by staff numbers (Table 12) and revenue figures (Table 11), are larger. Female-owned enterprises in Ghana have more employees. However, employees in female-owned enterprises reported significantly lower salaries than those in male-owned enterprises. It seems that men typically hire men, and women typically hire women.

Table 12: Gender differences in employees (Ghana)

	Male	Female	Diff.	p-value
Number of workers	**2.8**	**3.6**	**-0.8**	**0.001**
Female workers	**0.2**	**3.3**	**-3.0**	**0.000**
Male workers	**2.6**	**0.3**	**2.2**	**0.000**
Weekly salary of workers (GHC)	**201.7**	**92.5**	**109.3**	**0.000**

Note: figures in bold highlight statistically significant differences between male- and female-owned enterprises

Whereas male-owned enterprises reported better management practices than female-owned enterprises in Tanzania (businesses are registered and keep accounting books), we observed no such differences in Ghana. In Tanzania, women indicated that they were particularly disadvantaged by business registration policies due to the smaller size of their businesses, and were more vulnerable to harassment by officers. In Ghana, male-owned enterprises more frequently organise in business associations, which are typically trade associations. According to the President of the Association of Small Scale Industry in a Ghanaian town, benefits of membership include: 'pooling resources for specialised training, engaging with the authorities to get fair tax bills, organising apprenticeships, and targeting markets together – for example, by persuading local institutions to buy local'. In Tanzania, women are more frequently part of associations, mainly village saving groups.

[10] Male-owned enterprises had an average of 0.43 employees, while female-owned enterprises had 0.22 employees on average.

Table 13: Business practices by gender of entrepreneur (% of enterprises)

	Ghana		Tanzania	
	Male	Female	Male	Female
Formal registration	20.2%	17.7%	**57.8%**	**37.0%**
Keeps accounting books	15.4%	16.3%	**45.1%**	**33.9%**
Member of an association	**65.6%**	**47.6%**	**23.0%**	**42.5%**

Note: figures in bold highlight statistically significant differences between male- and female-owned enterprises

Finally, Ghanaian companies are more open to external markets than those in Lake Victoria (Tanzania). Whereas more than 50 per cent of enterprises in Brong Ahafo sell outside their district, and 10 per cent outside their country, just 5 per cent of the Tanzanian sample ventured outside their district. In Tanzania, there are significant gender differences in access to external markets, but these do not exist in Ghana.

Table 14: Access to external markets (% of enterprises selling to each market)

	Ghana		Tanzania	
	Male	Female	Male	Female
Customers from this village	99.6%	99.3%	84.3%	90.6%
Customers from outside the village, same district	84.2%	83.7%	**49.0%**	**39.4%**
Customers from outside district in same country	52.6%	48.3%	**6.9%**	**0.8%**
Customers from outside country	9.5%	11.6%	1.0%	0.0%

Note: figures in bold highlight statistically significant differences between male- and female-owned enterprises

Qualitative data from Myanmar show that female-owned enterprises tend to be home based, and with no employees. Furthermore, under the same conditions, men are paid more than women as labourers, often explained by their strength or capacity to do the 'hard work'. A key informant from a civil society organisation (CSO) mentioned, 'Men are still earning more than women. There still are less job opportunities for women than men', and a female from Kan Gyi Taw explained that, 'Men need to use more physical strength. They do hard stuff while women's work is easier. So, they earn more.'

In summary, male-owned enterprises have higher average profits than female-owned enterprises, and male employees earn more than female employees in the three country studies. The results for Tanzania are in line with the literature, indicating that women entrepreneurs are concentrated in low productivity, low profit, low technology, and low-growth sectors, and are overrepresented in small and informal enterprises (de Haan 2016; Cirera and Qasim 2014; Klapper and Parker 2011; Dejene 2007; Hunt and Samman 2016). However, gender differences are, in most cases, not statistically significant, or not particularly biased against women in Ghana, except in the case of women's salaries.

5.2.2. Differences in access to capital and skills

Reviewed literature indicates that women's lower access to and control over resources such as finance, land or inputs affects their ability to gather enough capital to create and

grow their businesses or to buy domestic labour-saving equipment that would increase their time available for paid work (Cecelski 2005; Nordman and Vaillant 2014; Baruah 2015; Eyben 2013; Chopra 2015; Maestre and Thorpe 2016).

Tanzanian enterprises have lower and more unequal access to financial services than their Ghanaian counterparts. More than 75 per cent of enterprises in Ghana have bank accounts and almost 40 per cent have requested loans, most of which were granted. However, only 35 per cent of enterprises in Tanzania have bank accounts and 19 per cent have requested loans (again, most of which were granted). In Ghana, significantly more women than men hold bank accounts, while the opposite is the case in Tanzania. However, in both countries, women have more frequently requested loans but the difference with men is not statistically significant. In both countries, male-owned enterprises enjoy higher starting capital, but the difference is only statistically significant in Tanzania.

Table 15: Access to capital and financial services, by gender

	Ghana			Tanzania		
	All	Male	Female	All	Male	Female
Starting capital (USD)	669	739	550	**709**	**947**	**312**
Own bank account	**76%**	**73%**	**82%**	**34.7%**	**43%**	**22%**
Requested loan	38%	36%	43%	19%	17%	22%
Loan granted	93%	94%	92%	84%	90%	76%

Asset ownership or availability figures again show that Ghanaian female entrepreneurs have roughly equal access to land and buildings and only have lower ownership of cars. On the other hand, female entrepreneurs in Tanzania have significantly fewer valuable assets than male entrepreneurs.

Table 16: Asset availability in businesses, by gender

	Ghana		Tanzania	
	Male	Female	Male	Female
Land plot/farm	66.8%	62.6%	**54.9%**	**35.4%**
Buildings	53.4%	46.9%	**57.4%**	**43.3%**
Car	**24.9%**	**8.8%**	**2.5%**	**0.0%**
Motorcycle	0.4%	0.7%	**12.3%**	**4.7%**
Boat	-	-	**4.4%**	**0.8%**
Bicycle	66.8%	62.6%	**16.7%**	**7.1%**

Access to capital was the most important constraint for enterprises in both countries, regardless of gender. In Tanzania, some interviewees highlighted women's difficulties in raising capital for business. For example, a male entrepreneur said, 'men are well privileged to undertake business as they can acquire loans much easier than women', while a female guesthouse owner agreed with the view that 'men can easily acquire loans and are trusted more than women'. This opinion was echoed by many of our key informants. For example, a female accountant from the hydropower plant LUMAMA indicated that 'women depend more heavily on agriculture; their income is very seasonal and dependent on the availability of markets for their products. This makes them not creditworthy.' In a similar manner, TANESCO's representative in Ukerewe said, 'women

do not venture into the opportunities created by electricity mostly due to lack of capital'. Sambi's (male) village executive officer added: 'because Sambi community is strongly patriarchal, sometimes women do not have the right to take credit. Most credit schemes require collateral and women do not have the right to own land.' Women often get involved in informal savings groups or village banks to overcome this constraint.

In Ghana, women working in traditionally male trades commented on the difficulties in raising the finance required to buy appliances and land. Access to machinery could have a transformational impact for women, given them access to activities typically reserved for men:

> *If they want females to be engaged in male activities, the government must support the females with machines. The machines help, and you don't need your physical energy to cut wood. When you don't have machines, the work is so difficult. But before you need to look for land and set up a shop. So, when women consider all these, they just settle for hairdressing… You can even operate from your veranda.*
> (Woman carpenter, Techiman)

Men also face similar challenges in raising finance to buy equipment, but they can more easily use metabolic energy in place of it. As one man explained:

> *If I had money, I would have purchased a lot more tools. Because the cash inflow is inconsistent, we are unable to save money to buy better machines. I really need an electric machine and a grinding machine. No matter how good you are at the job, without the tools, there is nothing you can do… But if you don't have machines, you can hire them*.
> (Male car mechanic, Techiman)

Contradicting previous research (de Mel, McKenzie and Woodruff 2009), some respondents said that men's business profits are more likely to be captured by household needs than women's:

> *Female businesses are the ones that usually grow faster than those of men. The reason is that, if she is a married woman, she doesn't spend her revenue on anything. She is always reinvesting it back into the business but for a married man, you are responsible for the household expenses. She can say she doesn't have money, but you can't. You have to manage for the business to survive as well as bring something home. This is why businesses of men do not grow as fast as those of women.*
> (Male welder, Berekum)

> *When women come for a service, they put it into the right place, but men sometimes divert the funds. When women get support for their businesses, they and their families look happier*.
> (Head of Business Advisory Centre, Techiman)

It seems, therefore, that women have lower access to capital to start with, but are more able to save and reinvest in their businesses to make them grow. As a female soap maker

in Techiman explained: 'When a man decides to take up this job, he easily expands because of the bigger start-up capital, but for the females they start from somewhere and grow into a bigger business'.

In Myanmar, ownership of assets tends to be under the man's name, as the head of the household, making it difficult for women to access capital or other resources. This means that for women who want to start a new business, they tend to require men's permission to do so. A key informant from the government indicated that 'Only one member from one household is given a loan and this is typically the head of household, who is a man. Women may be doing all the work in a business, but the store will be under the husband's name.'

In all three countries, we conducted participatory FGDs to understand gender differences in access to and control over resources. In these discussions, 'access' was defined as the opportunity to use a resource, while 'control' represented the full authority to make decisions about the use of a resource (i.e. buy, sell or modify it). In all cases men displayed greater access to and control over most resources, with the exception of cooking fuels and appliances.[11] In Ghana, women controlled more resources than in other countries, including electric appliances such as fridges and televisions (the latter also controlled by women in Myanmar). The most valuable assets, such as land, buildings, vehicles, heavy machinery, furniture and livestock, are controlled by men. In farms, women control low-value animals (such as poultry) and low-value crops (such as sweet potatoes and tomatoes). Access to and control over fishing-related assets in Tanzania and Myanmar are exclusively male, while in Tanzania it is even taboo for women to use or repair fishing boats or equipment. On the other hand, women, who dominate subsistence agriculture, do not have the decision-making power to sell some crops to gain additional income. If they do, they must do so without their husband's knowledge. According to a female farmer from Sambi (Tanzania): 'after harvesting and storing crops at home, we do not have power to make decisions about selling them'. This unequal distribution of resources was attributed to the patriarchal system that rules society. For instance, one woman in Bwisya (Tanzania) said 'men have all the power for decision-making'. However, in all three countries, women reported having control over the income earned in their own businesses.

The quality of education provision is also closely related to young women's ability to access decent work (Hunt and Samman 2016). Gendered data on education among enterprise owners in our sample (Table 22) show that those in Ghana are close to gender equality, while gender differences persist in Tanzania. Overall, enterprise owners in Ghana also have higher educational attainment, with most respondents having at least secondary education, while most in Tanzania have only primary education.

Progress towards equality in education was validated in our interviews with employees and key informants in Ghana. For example, Berekum's municipal chief executive observed: 'Things have changed drastically as far as the education of Ghanaian children. Gone are the days when education was restricted to the boys alone here in Berekum.' The municipal planning officer in Techiman echoed this view: 'When it comes to school enrolment, you have gender-disaggregated data showing that the ratio is almost 1 to 1.'

[11] Scores given in the three countries during this exercise are included in Annex 1.

In Tanzania, however, interviewees reported that education is still biased in favour of boys and men, as a male entrepreneur form Murutunguru explained: 'Most women are not exposed to entrepreneurship training, because they have to remain at home taking care of children'. A female accountant from the LUMAMA hydropower project indicated that she is the only female employee in a team of 10 staff. Even if the job advert was open to everyone, she was the only woman who applied. She was then trained for over a year and now has a good job. The Bwisya ward officer referred to women's lack of confidence, as they do not think they will be able to do some jobs successfully, and hence do not apply for them. Most women interviewed had acquired the skills needed to do their job by observing relatives or other workers, and by learning by doing – sometimes working for free with a relative. They did not learn those skills through formal education. In the words of the Bwisya village chairman, 'Women do not have plans on what they want to do. Often they just repeat what their fellows do.' Learning by doing, and replication of relatives' jobs, was also the case for most of the men interviewed.

In Myanmar, the men and women interviewed both had low education levels. Those with higher education ended up going to the city to look for a job. Traditional skills for certain businesses (tailor, carpenter) were passed on by older generations or provided by CSOs or the government.

Table 17: Education of business owner, analysis of variance (ANOVA), by gender

	Ghana			Tanzania		
	All	**Male**	**Female**	**All**	**Male**	**Female**
None	15.8%	16.6%	14.3%	4.2%	3.9%	4.7%
Primary	10.5%	11.1%	9.5%	**71.6%**	**65.7%**	**81.1%**
Secondary	52.5%	50.6%	55.8%	**18.1%**	**22.1%**	**11.8%**
High school	13.5%	15.4%	10.2%	1.2%	1.5%	0.8%
Vocational	4.0%	3.2%	5.4%	2.1%	2.9%	0.8%
University degree	3.8%	3.2%	4.8 %	**2.7%**	**3.9%**	**0.8%**

Several trades in Ghana organise apprenticeship schemes to support young people to gain the necessary skills to open their own businesses or be employed in existing ones. Apprenticeship programmes in male-owned businesses such as auto mechanics appear longer and more expensive than those in typically female trades such as tailoring or hairdressing, implying lower barriers of entry for female trades. However, chairmen of these associations worry that even after an apprenticeship, the young people involved will not be able to work due to lack of capital with which to open a business.

5.2.3. Differences in care responsibilities

The literature cites unbalanced care responsibilities as one of the reasons why women operate in smaller survivalist enterprises, closer to home or home based (Kabeer, Mahmud and Tasneem 2011; Nordman and Vaillant 2014; Razavi 2007). In our sample, however, when requested to identify the two most important constraints to the growth of their business, very few women respondents highlighted care responsibilities, with most pointing to financial constraints. On the other hand, women in all three countries more frequently ran their business from home, and more frequently mentioned the need to be close to home as the rationale for their business location (Tables 18 and 19). Women in Tanzania appear more attached to their home responsibilities – more frequently

working from home or nearby to be able to attend to their families. However, most women respondents, as with male respondents, operate from a permanent building outside of their home, and chose their location in order to attract customers.

Table 18: Business characteristics, location and physical structure, by gender

	Ghana		Tanzania	
	Male	Female	Male	Female
Home-based enterprise (in or outside the home)	**3.2%**	**12.9%**	13.7%	20.5%
No structure (i.e. blanket or mobile display) in a public space	0.4%	1.4%	4.9%	7.9%
Mobile stand or structure in a public space (i.e. cart, trolley, etc.)	18.2%	23.1%	5.4%	9.4%
Permanent building structure (shop)	**78.3%**	**62.6 %**	**76.0%**	**62.2%**

Table 19: Reasons for choosing business location

	Ghana		Tanzania	
	Male	Female	Male	Female
It is close to home so I can combine work with caring for my family	**4.3%**	**16.3%**	**14.5%**	**29.0%**
It is a good place to attract customers	45.9%	42.2%	**69.1%**	**51.6%**
I was told to take this location (i.e. allocated by municipality)	3.2%	0.7%	2.4%	3.2%
Available for hire	**34.8%**	**19.0%**	6.3%	6.5%
Inherited this location	**4.7%**	**9.5%**	2.9%	4.0%
Had no alternative	**4.7%**	**10.2%**	3.9%	3.2%
Other	2.4%	2.0%	1.0%	2.4%

In both African countries, women also worked significantly shorter hours than men (approximately 1 hour less every day), which could be due to their greater care responsibilities.

Qualitative data offered further insights about the care burden of women in the region compared to men, and its impact on paid work opportunities. Across all countries and study sites, the social organisation of care was women's role. Women's responsibility for care had become internalised, with women considering themselves better at caring and men believing that they could not provide care. Instead, men perceived their responsibility as providing for the family, hence internalising the role of breadwinner. Women are considered responsible for collecting firewood and fetching water, caring for and feeding children, cleaning the house, washing clothes and dishes, cooking, planting crops, and feeding and caring for animals. In rural settings, men also support farming for family consumption and cattle-rearing. In Myanmar, when men were asked about the benefits of energy use for women, they constantly referred to women as caretakers not as workers: 'at the moment [after electricity] it is better for women as there is light in the house. Before, they had to wake up early to make a fire and cook. Now, some women can prepare it in advance in the rice cooker.' Participants in rural Tanzania and Myanmar adhered more closely to traditional gender norms, whereas in urban Ghana there were many instances in which these norms were being challenged.

In Ghana, the most advanced country with regards to gender equality, men engage in more household activities (such as ironing, looking after children or cleaning) than in the other two countries. Moreover, many men expressed dissatisfaction about the burden of being the only one responsible to provide for their families, but some women contested that view, indicating that they contribute as much as men to their household's finance:

> *In this era, both men and women contribute financially to housekeeping*. (Female petty trader from Techiman, mother of three)
>
> *Things have greatly changed in our time. It is no longer the way it used to be where women depend on men. Now women are equally sharing in the household financial responsibilities.*
> (Female hairdresser, mother of one, from Techiman)
>
> *A woman will do as much as the man. If a man does not have money, as a mother you need to use whatever means to ensure that the children eat. Both men and women work very hard to be financially responsible for their households, so the men cannot say they are under pressure. Women in Ghana are more concerned about their children than men*.
>
> (56-year-old woman, operating a street food stall in Techiman, mother of six and looking after grandchildren)

The same respondent continued:

> *… men after marrying will go for 'side chicks' or other women apart from their wives, so if they say they are under pressure, who put them under pressure? It is their own doing. They should stop lamenting… I don't agree with him because household chores are not for just the wife or children. If the woman has difficulties, the man can help the woman*.

In any case, it was clear that even women who did paid work still had responsibility for caring activities in the household. The only way to reduce this burden was to earn enough to pay for help. The Ghanaian case also showed that even when attitudes to household responsibilities changed, some activities remained distinctively women's responsibility (particularly washing clothes and cooking):

> *For women, most of our time is used on food preparation. If a woman is in church and the pastor is preaching, a woman will be counting down to get home to prepare food for the family.*
> (56-year-old woman, operating chop bar in Techiman, mother of six)
>
> *What I can't do is washing my wife and children's clothes… For someone who is married, washing is not my work. Besides, when the neighbours see you washing, they will talk. They will say my wife has fooled me and I am now washing for her*.
> (41-year-old man, father of three, working on electronics in Berekum)
>
> *Washing, especially washing for men, is not very easy*.
> (Female petty trader from Techiman)

Because I am a married woman, I have to wash my husband's things so by the time I am done, the time to go to work will be all gone.
(Female paint sprayer in Berekum)

In Myanmar, across all the study sites, the social organisation of care was clearly a woman's role, and men did not support women in unpaid care activities. Women in Myanmar are required to multi-task, performing multiple paid and unpaid activities at the same time: cooking, fetching water, collecting firewood, caring for children, cleaning the house, taking care of livestock, farming, or running a business. Men, on the other hand, are responsible for income-generating and leisure activities. Women's main priority is to do unpaid care work, with paid work only a secondary concern. Men were perceived as breadwinners and women's paid work was considered less relevant than men's. For example, a woman from Oak Pho explained, 'after I finished my school, I wanted to attend sewing training, but my father refused, as there was nobody to do housework'.

Interestingly, the use of electric appliances could switch gender roles for household tasks, with some men in Ghana indicating that they are now in charge of ironing. Also, experiencing the hardship of household chores could persuade men to purchase time-saving appliances:

My wife got boils on her hand and washing was very difficult. I live with just my wife, so I had to do the washing. I didn't like it, so I had to buy a washing machine.
(41-year-old man, father of three, working on electronics in Berekum)

A clear message emerging from the discussions was the importance of exposure to different experiences and ideas as a prerequisite for gender norms to change:

I know a bank manager at Sunyani, who will wake up in the morning, wash his baby and wife's clothing while his wife stays in the kitchen preparing breakfast. When he is done, he dresses and goes to work. This makes it easier for both of them to go to work early. The men are supposed to help in household chores.
(Female petty trader from Techiman)

Today's discussion has opened my understanding of how I can be of help to my wife at home, so we can all live peacefully and grow together. I would also like to urge my fellow men to assist their wives in domestic chores in order to enhance the welfare of both men and women.
(Male worker from Techiman)

From what we have done today, I have realised men can help women in their work. So, we are going to tell the men who are home to help the women to develop.
(34-year-old female auto mechanic, Berekum)

5.2.4. Differences in motivations

Previous literature has highlighted men and women's different motivations for running a business as a cause for differences in their performance (Banerjee *et al*. 2015; Minniti

2010; Nagler and Naudé 2014). Hence, women would typically run survivalist enterprises aiming to cover daily household needs, whereas men would be more ambitious and growth-oriented. Table 20 shows that this hypothesis seems correct in Tanzania, where, in their responses about motivations to run enterprises, men appear more driven by ambition whereas women appear more driven by necessity. However, this hypothesis is refuted in the case of Ghana, where men and women exhibit similar motivations. In Myanmar, entrepreneurs' motivations were mainly to continue the family business, follow a personal interest, or convenience. Those following a personal interest were mostly men (carpenter, builder, photographer) and those choosing convenience were mostly women, working from their own homes so that they could earn extra income and take care of the children at the same time.

Table 20: Motivations for running a business (share of enterprises by gender)

	Ghana		Tanzania	
	Male	Female	Male	Female
Affording daily food needs	21.7%	18.4%	**18.4%**	**32.3%**
Contribute to home expenses	15.8%	16.3%	**14.5%**	**26.6%**
Needs for children	9.1%	14.3%	8.2%	12.9%
Independence	13.8%	11.6%	11.1%	9.7%
To have something to do	14.2%	13.6%	4.3%	8.1%
It was my ambition	24.1%	25.2%	**30.9%**	**5.6%**
I could not find another job	1.2%	0.7%	5.3%	1.6%

In Tanzania, it emerged that most men and women working in food preparation (a typically female activity) had chosen this business as a last resort, not having many other alternatives. Food preparation has very low barriers of entry, with low capital and skill requirements.

In Ghana, preconceptions of women as risk averse were challenged:

> *Market women take a lot of risks, they travel long distances taking their products and when they get to their destination towns, they might end up even sleeping in the stations. Some of these women are raped in those lorry stations and some of the goods they sell are perishable but still they take the risk to go and bring it.* (Ministry of Gender, Child and Social Protection Officer for Brong Ahafo region, female)

In both African countries, nearly all businesses (whether male- or female-owned) declared their desire to grow. Respondents in Ghana had different ideas on how to achieve this, but respondents in Tanzania had fairly similar ideas (Table 21). Expanding the products offered was the preferred option in Tanzania, whereas the most popular options in Ghana were typically more capital intensive, such as purchasing new equipment or moving to a better space.

Table 21: Growth ideas (% of enterprises)

	Ghana		Tanzania	
	Male	Female	Male	Female
Expand the range of products on offer	**50.2%**	**31.3%**	29.2%	32.0%
Increase production	54.2%	58.5%	22.6%	25.6%

Invest in new equipment	57.7%	54.4%	18.5%	18.4%
Improve to a better or bigger space	54.9%	62.6%	12.8%	12.0%
Hire more staff	25.3%	29.3%	0.5%	0.0%
Open another enterprise in the area	**22.5%**	**11.6%**	15.4%	11.2%
Don't know	2.8%	1.4%	1.0%	0.8%

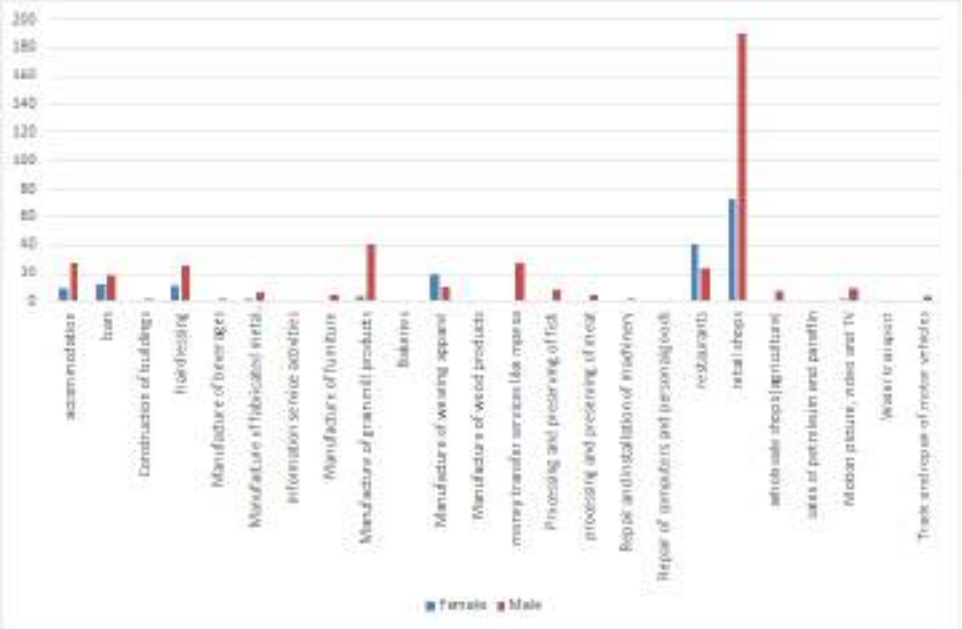
There was no shortage of ideas in all study sites on how to grow a business, but all respondents highlighted lack of capital as the reason why they had not put these ideas into action.

5.2.5. Gendered occupational segregation

The last and most striking reason why men and women display different energy use patterns at work is occupational segregation. There is evidence showing that the sectors in which women operate are a major determinant of gender differences in business performance (de Mel *et al*. 2009; Nichter and Goldmark 2009; Rijkers and Costa 2012; Hallward-Driemeier 2013; Bardasi *et al.* 2011). Gender norms determine the types of sectors in which men and women operate and the tasks they undertake within sectors. There were many commonalities in our research in what was deemed 'appropriate' work for women across the three countries. In rural contexts, men dominate the key sources of agricultural income, such as fishing and cultivation of cash crops. Women are heavily involved in subsistence agriculture. In the services sector, women work in small retail, tailoring, hairdressing or food preparation. Men undertake a wider range of activities in services and manufacturing, often involving physical energy, which can be replaced with electricity or diesel engines. Some of these male-dominated, energy-intensive activities include milling, carpentry, metal works or vehicle repair and maintenance. In rural settings, however, we also observed non-physical activities such as money transfer services, or video halls or guest houses mainly run by men.

Figure 5 shows the distribution of men's and women's enterprises across sectors in Tanzania, evidencing women's role in just a handful of sectors.

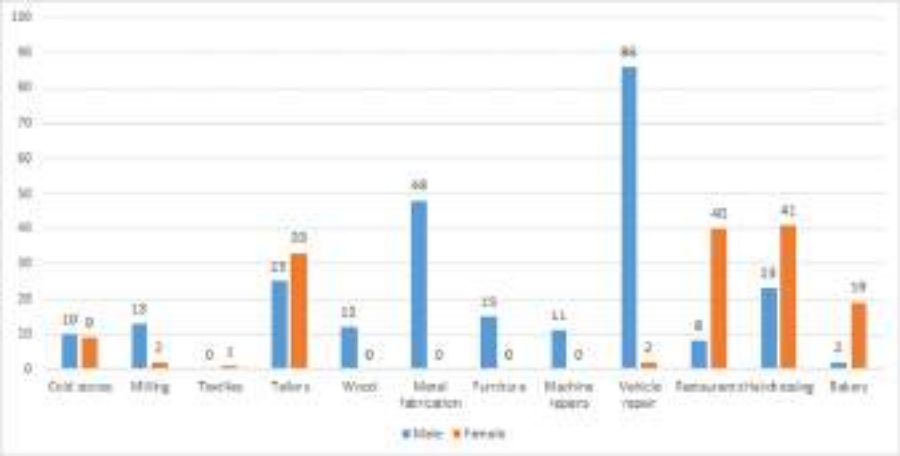
Figure 5: Number of enterprises by owner's gender and sector of activity (Tanzania)



Source: Authors' own, Business Census 2018

Figure 6 shows a similar pattern in a more sophisticated urban economy, in which only 11 sectors were selected as part of our sample. As in Tanzania's rural economies, women dominate restaurants and tailoring, as well as hairdressing.

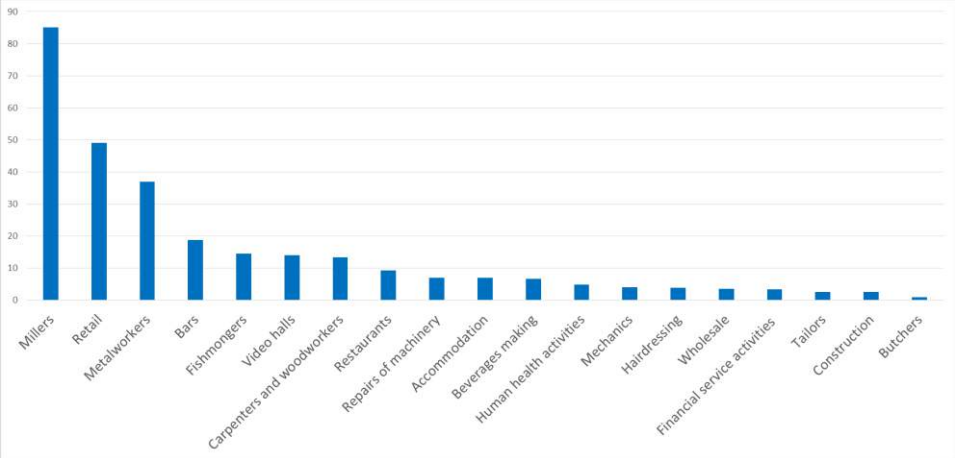
Figure 6: Number of enterprises by owner's gender and sector of activity (Ghana)



Source: Authors' own, Business Census 2018

Sectoral segregation is important from an energy consumption point of view, because the type of fuel and amount consumed is in great part determined by the sector of operation. Figure 7 shows that men dominated trades such as milling and metal works, which are the largest energy consumers in Tanzanian villages.

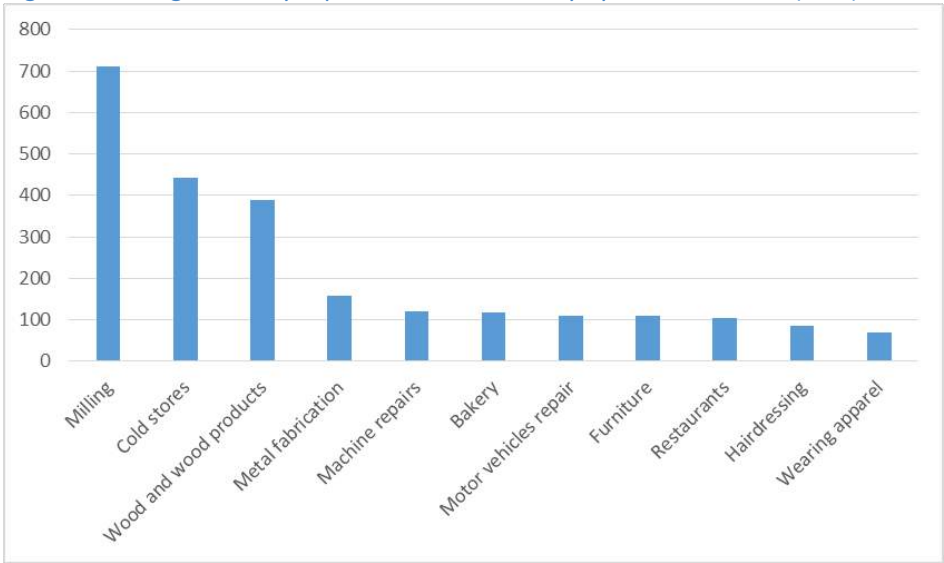
Figure 7: Average weekly expenditure on electricity by sector in Tanzania ('000 TZS)



Source: Authors' own, Field Survey 2018

In Ghana, milling, cold stores, woodworks and metal fabrication are among the top energy consumers (Figure 8). Only cold stores have significant female representation.

Figure 8: Average monthly expenditure on electricity by sector in Ghana (GHC)



Source: Authors' own, Field Survey 2018

This gender pattern disappears when we consider total energy consumption, and female-owned enterprises such as restaurants or bakeries alternate with male ones like milling and carpentry.

Within sectors, women typically earn less than men. For example, they occupy the least profitable activities in the value chain of fishing and milling, the two key sectors of the Lake Victoria islands' economy. In Myanmar villages, the idea that male labourers in the agriculture sector should earn more than women was also widespread. Salaries of male labourers were almost 50 per cent more than female labourers' salaries. One man mentioned, 'Of course, here women cannot earn as much as men. They earn 2,000 for working one morning, but men earn 3,000.' This is also the case in the formal sector, where women's role is still secondary:

In formal settings most women are in junior staff positions such as secretaries, cleaners, labourers… At that level they don't take decisions, they just obey instructions. So, if you go to heads of department meetings you end up being the only female. In informal settings women are mostly engaged in hairdressing, dress-making, sweepers, cleaners, petty trading and the like. They are also into farming but not into cash crops, only into peppers, onions, tomatoes… those small crops that can be grown around the house and don't fetch much. The cashew and the cocoa are male dominated and even if you see women, they are supporting their husbands.
(Female official from the Ministry of Gender, Child and Social Protection, Sunyani, Ghana)

Occupational segregation derives from socially constructed as well as biological differences between men and women. According to respondents, men are physically strong, while women are 'weak' and have to stop working during pregnancy and after childbirth. Women were also seen to be better at cooking and cleaning than men, and less able to understand how to operate machinery. Other factors also came into play in terms of choice of activity for women in Tanzania, such as the risk of sexual harassment when working after sunset, mobility restrictions to engage with suppliers and clients outside the home town or village, or the social stigma of working around men.

There was some promising evidence of change in gender norms among Lake Victoria's island communities, as women begin to undertake activities and professions traditionally regarded as men's domain:

When you compare the previous years and now, I see women being recognised and appreciated because now there are families depending on women's income. Before, women were recognised only because their parents paid a dowry, but now educated women support families and the community has realised that.
(Sambi village executive officer)

Now women are more aware of their rights. For example, there are several women who come to my office claiming their rights if the father of their children is not providing for them.
(Bwisya ward executive officer)

There are some traditions that say that women should not do some kind of activities but nowadays they are changing. For example, some of my family members did not agree with me to work in the barber industry. They thought that is not for women but men. But now they see the improvement.
(Female barber, Nabweko)

I have heard that now women are joining engineering work, so it may happen that in the future there will be women who will be investing in this work.
(Male welder and miller, Bugolola)

In Ghana, these changes were even more evident. Ghanaian market women have a reputation as strong traders. Furthermore, with education and globalisation,

interviewees had been exposed to several instances of women surpassing their traditional roles. Men regarded this with admiration and respect, rather than as a threat.

> *Recently when I went to Accra, the VIP bus I boarded was driven by a woman. I was surprised initially when the woman came into the steering wheel. I nearly went down. Psychologically I was not comfortable, how can a woman drive me to Kumasi? But she was doing very well, she was very careful too and the zeal she was putting, I mean I was clapping! So, when I dropped down, I said: 'Mama, God bless you'*.
> (Chief development planning officer, male, Techiman)

> *When I went to the school for monitoring the headmaster of our programme on building and construction, he was full of praise for one of the trainee ladies. He couldn't imagine that she could lift blocks and start building by herself. He was so amazed. When the girl started performing, the boys saw that girls too can do it. They had to see to believe*.
> (Female official, Ministry of Gender, Child and Social Protection)

> *There are female technicians that are able to climb up to transformer level, they come and check the faultiness of meters, perform meter calibrations and they're working very well. It was in the old days that people didn't like or women didn't like pursuing technical programmes and science courses, but now you can see they dominate in many of these courses.*
> (Northern Electricity Development Company (NEDCo) representative, Berekum)

> *If the women do the carpentry work, they can do it and do it better. Because at certain times, it does not need much strength, it needs skills.*
> (Male carpenter, Berekum)

> *I think both men and women have the same brain, so if you put your mind to it you can do it, except when it comes to strength.*
> (Male care mechanic, Techiman)

> *When I was in Kumasi, three of the masters were females and were giving instructions to male and female apprentices, but men did the lifting work.*
> (Male car mechanic, Techiman)

> *When you come to the political arena, gone are the days when politics was purely reserved for men. At the moment we have women becoming MPs, women becoming even Chief Justice.*
> (Chief executive officer, Berekum)

There was a feeling of pride among women doing traditionally male jobs, because they had been able to show that they could do the work equally well:

> *Some people come to see you doing that job and they become happy and give you more work because you are a female... Everyone is happy that this sister is doing this work. I am happy if someone says something good about it.*
> (Female auto mechanic, Techiman)

I enjoy the work a lot because you wouldn't see many women doing it. People sometimes ask me why I am into this job as a woman, but I usually say to myself that these people do not know what they ae saying.
(Female paint sprayer, Berekum)

You are happy because you can also say you are the one who did it.
(Female paint sprayer, Berekum)

I really feel proud of my job. People even call me by the name of my business… At the beginning, men were surprised and some came to check me out. I believe women can also do men's work and even do it better than them.
(Female miller, Berekum)

When some people see you in the working gear, they like you and even give you money. It motivates me to work. Sometimes when I am by a car working you won't see that I am tired. When you see me working on the car, you wouldn't even think it is me. When someone comes to see you doing the job, they are marvelled because I am a female doing this kind of work. The work is nice, and it is beautiful when a female is doing it.
(Female paint sprayer, Techiman)

INTERVIEWER: When you walk around Techiman township and people who know you as a female carpenter look at you, do you feel shy?
RESPONDENT: No, I don't feel shy. I feel proud. I'm excited about the work. Even my family members are excited about my work. They even say that 'my sister is the one doing carpentry here'.
(Female carpenter, Techiman)

Many men agreed that they would prefer to pay a woman over a man doing car services or carpentry:

One advantage the women have is, over here, the females don't like learning a vocation so, if one of them is able to go through and she opens her shop, men prefer patronising their services.
(Male sprayer, Berekum)

Women will get more customers. When a woman does something, men like to go there. If a woman owns a bar, men usually go there.
(Male carpenter, Berekum)

But the same has also happened with men venturing into traditionally female jobs:

When the males learn (hairdressing) they get a lot of customers because it is not common, so it helps them.
(Woman hairdresser, Berekum)

A common element among most women who had taken up jobs in male-dominated sectors was the influence of male role models, or exposure to the sector from family and friends:

> *I used to sell yams alongside this milling business inherited from my father but fully resorted to the milling after the death of my father… I had a customer at Kumasi magazine who died a month ago; he taught me how to assemble the station because I had been cheated by repairers… I took inspiration from a man who came for a funeral in this town. After I had discussed with him my interest in milling, he promised to give me the machine to start the business. He lavishes praises on me anytime he comes around. I can say it is that motor which coined the whole business.*
> (Female corn miller, Techiman)

> *I was one day chatting with a friend and she told me that her father said someone has sprayed her motorcycle. A female had sprayed his motorcycle! And when she completed it, it was very nice. So, her father said he will let her train as a sprayer. At that time, I didn't know about the spraying vocation. I didn't know what it entails but I took a decision that I will also do that thing. So, when I completed school and my parents told me that there was no money, I told myself I will learn this job.*
> (Female paint sprayer, Berekum)

> *A woman trader came to our village. We were chatting, and she said that her daughter was going to train as a sprayer. So, when she said that, I said 'wow, this woman has spoken about this job and made me happy'. I said that if her daughter is going to learn spraying, then I will also learn spraying.*
> (Female paint sprayer, Berekum)

> *What motivated me is that my male sibling came to do it and I came after him.*
> (Female paint sprayer, Techiman)

> *I had a teacher of social studies… Now he teaches at Techiman Secondary. He taught me freely. He had wished to support me financially to further my education, but that did not happen. So, when he realised that I was learning a male job, he was the only one who came to the workplace and visited me and encouraged me. He said that if I worked hard, I would be equal to my colleagues furthering their education.*
> (Female carpenter, Techiman)

In summary, gender norms that determine appropriate productive activities for men and women are a key determinant of energy consumption patterns. These norms are strongly rooted in communities and take a long time to change. However, some communities are showing that through education or exposure to role models, women can cross over into male-dominated sectors or occupy positions of higher responsibility in mixed sectors.

5.3. Summary of modelling results in Ghana and Tanzania

This section compares the results for Ghana and Tanzania of the model specified in equation 1, Section 4 (page 32), with monthly profit, energy expenditure and electricity

expenditure as dependent variables. Results for other variables (opening hours, sales, number of customers, business expenditure, hours per day of electricity use) are included in the annex 2.

Dependent variables are expressed in natural logarithm (LN), hence coefficients of the independent variables in the subsequent tables have to be multiplied by 100 and be interpreted as percentage change in the outcome variable when continuous variables increase by 1, or when the value of dummy variables is 1, ceteris paribus. Results are presented for the entire sample, and then separately for just male-owned enterprises and just female-owned enterprises, to identify gender differences in the impact of variables. To rule out the presence of collinearity in explanatory variables, their correlation coefficients were looked at, without finding any high value.

We begin by discussing the results of business performance indicators. Results for monthly profits are presented in Table 22 (Ghana) and Table 23 (Tanzania), in the first column for the whole sample, and in the other two columns separately for male-owned and female-owned enterprises. In both countries, our variable of interest 'being a female owner' has a negative effect on profits, but it is only statistically significant in Ghana. In both countries, businesses using electricity obtain significantly higher profits than those that do not. Furthermore, the positive impact of using electricity is consistent across genders, and larger for women than men in the case of Ghana. Therefore, while both societies are unbalanced with respect to female entrepreneurial activity, the data suggests that electricity is inclusive. In Ghana, being inside a light industrial zone was another variable of interest, and it shows a negative and significant coefficient, which becomes even more negative for female-owned businesses. In Tanzania, the intervention of interest took place in Bwisya, where we observe a higher positive impact of electricity than in other regions.

We do not observe similar results with regards to the impact of individual characteristics on profits. In Ghana, older, and migrant enterprise owners, and those who hold bank accounts obtain significantly higher profits. In Tanzania, more educated enterprise owners do so. Among household characteristics, being married has a negative impact in Tanzania, but positive in Ghana. The number of children has a positive impact on profits in Tanzania, driven by male entrepreneurs. However, in Ghana, the number of children is negatively correlated with profits. Being formally registered is, in both countries, positively and significantly correlated with profits. Keeping accounting books has a positive coefficient in both countries but is only statistically significant for Tanzania. Finally, enterprises with higher starting capital obtain more profits in Ghana, but their impact is not significant in Tanzania. Fixed effects indicate that restaurants perform better than most other sectors, ceteris paribus. Hence this predominantly female sector does not display worse profits than the rest, when all other factors are taken into account.

Table 22: Ordinary least square (OLS) results, LN last month profit – Ghana

	(2)	(2.1)	(2.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.055***	0.058***	0.055***
	(0.008)	(0.013)	(0.008)
No education/primary education	-0.017	0.151	-0.285
	(0.146)	(0.193)	(0.222)
Migrant	0.304**	0.415**	0.053
	(0.135)	(0.181)	(0.198)
Bank account	0.955***	0.933***	0.686***
	(0.149)	(0.201)	(0.244)
Requested loan	0.215	0.329	-0.040
	(0.150)	(0.201)	(0.204)
Household characteristics			
Number of children	-0.150***	-0.227***	-0.051
	(0.049)	(0.076)	(0.044)
Number of older people	0.008	-0.007	0.021
	(0.023)	(0.054)	(0.024)
Married	0.304**	0.242	0.404**
	(0.153)	(0.267)	(0.195)
Business characteristics			
Female owner	**-0.333***		
	(0.199)		
Electricity	**0.623*****	**0.498****	**0.701*****
	(0.146)	**(0.230)**	**(0.208)**
Industrial zone	**-0.588*****	**-0.444***	**-1.014****
	(0.194)	**(0.236)**	**(0.417)**
Member of association	0.167	0.252	0.011
	(0.154)	(0.228)	(0.190)
Registered business	0.356**	0.339	0.304
	(0.180)	(0.236)	(0.236)
Starting capital ('000th)	0.003**	0.002	0.005**
	(0.001)	(0.001)	(0.002)
Permanent structure	0.422**	0.375	0.575***
	(0.163)	(0.229)	(0.219)
Keep book	0.238	0.395	0.093
	(0.204)	(0.292)	(0.276)
Number of workers	-0.010	0.068	-0.043
	(0.030)	(0.049)	(0.038)
Observations	393	248	145
R-squared	0.963	0.960	0.976
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 23: OLS results, LN last month profit – Tanzania

	(1)	(1.1)	(1.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	-0.006	-0.010	-0.008
	(0.005)	(0.008)	(0.007)
No education/primary education	-0.347**	-0.360**	-0.237
	(0.138)	(0.157)	(0.290)
Migrant	-0.159	-0.295	0.202
	(0.144)	(0.198)	(0.233)
Bank account	-0.024	0.016	0.126
	(0.185)	(0.241)	(0.296)
Household characteristics			
Number of children	0.033*	0.045**	0.067
	(0.019)	(0.023)	(0.049)
Number of older people	-0.002	0.028	-0.049
	(0.035)	(0.040)	(0.056)
Married	-0.257*	-0.330*	-0.105
	(0.153)	(0.191)	(0.249)
Business characteristics			
Female owner	**-0.167**		
	(0.163)		
Electricity	**0.312****	0.338*	0.305
	(0.147)	(0.198)	(0.334)
Member of association	-0.010	-0.058	0.020
	(0.161)	(0.246)	(0.288)
Registered business	0.371***	0.391**	0.357
	(0.139)	(0.181)	(0.233)
Starting capital ('000th)	0.001	0.001	0.000
	(0.001)	(0.002)	(0.002)
Permanent structure	-0.115	-0.128	-0.146
	(0.148)	(0.193)	(0.281)
Keep book	0.334**	0.568***	-0.230
	(0.160)	(0.201)	(0.355)
Number of workers	0.199*	0.237	0.020
	(0.108)	(0.143)	(0.145)
Observations	328	201	127
R-squared	0.340	0.344	0.468
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results for other business performance variables are presented in the annex 2, but we summarise here their differences and similarities. In both countries, using electricity is always positively correlated to performance indicators such as opening hours, sales and customers, and is statistically significant in most cases. The sign for female ownership, however, varies, and is not statistically significant in most cases, showing that when women face disadvantages, these are already taken into account by other explanatory variables. In Ghana, businesses located in a light industrial zone always show worse results than other firms, and the negative impact is statistically significant in most cases. In Tanzania, being a female enterprise owner carries more positive effect in Bwisya than

in other regions, showing the positive effect of gender mainstreaming interventions in the village.

Among control variables, in Ghana, age, migrant and married status, holding bank accounts, business formal registration and starting capital have consistently positive impacts on business performance indicators other than profit. The number of children and elderly people in the household, which are proxies for care burden, also display negative signs, and in most cases are statistically significant for children. In Tanzania, the sign of the different variables remains consistently positive and sometimes statistically significant for migrants, bank account holders, those whose business is registered, have high starting capital, operate from a permanent structure, and keep accounting books.

We now focus on results for energy consumption variables, including: energy expenditure, electricity expenditure, and number of hours of use of electricity. Results for energy consumption display opposite signs for our variable of interest 'using electricity' in Ghana and Tanzania. Whereas in Ghana, using electricity is positively and significantly correlated with energy bills, in Tanzania, businesses that use electricity have significantly lower energy bills – more so in villages served by the cheaper main grid, but also in villages supplied with mini-grids and solar home systems. This opposite effect is not due to the higher cost of electricity in Ghana. It must, therefore, be due to the more intensive use of electricity, with more electric appliances in Ghana. This assumption is backed with data about appliance ownership, which is considerably higher among Ghanaian enterprises. Thus, in Tanzania, using electricity appears to have cost-reducing effects for businesses that have been using it for a relatively short time. In Ghana, however, where businesses have been using electricity for more than a decade, it increases costs because it is used more intensively with more appliances. This cost-increasing effect is larger for male-owned businesses. But, as seen in the previous results, using electricity also significantly increases profits, sales and other business performance indicators. Among other variables of interest, 'female ownership' has a negative but not significant impact on energy expenditure in both countries, and location in industrial zones within Ghana has no significant impact on energy consumption either.

Younger entrepreneurs, registered businesses, and businesses with higher starting capital display significantly higher energy expenditure in Tanzania. In Ghana, conversely, older entrepreneurs and enterprises with a higher number of workers have higher energy expenditure. Sectoral fixed effects capture some of the variation in energy expenditure.

Table 24: OLS results, total energy expenditure – Ghana

	(2)	(2.1)	(2.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.017**	-0.003	0.041***
	(0.007)	(0.009)	(0.011)
No education/primary education	0.023	0.405**	-0.015
	(0.162)	(0.201)	(0.235)
Migrant	-0.073	-0.161	-0.042
	(0.148)	(0.173)	(0.254)
Married	0.088	0.307	-0.107
	(0.157)	(0.210)	(0.216)
Bank account	-0.101	-0.020	0.082
	(0.186)	(0.211)	(0.332)
Household characteristics			
Number of children	0.016	0.032	-0.009
	(0.044)	(0.057)	(0.071)
Number of older people	-0.019	0.038	-0.004
	(0.030)	(0.056)	(0.026)
Business characteristics			
Female owner	**-0.202**		
	(0.198)		
Electricity	**2.365*** **	**3.289*** **	**1.386*** **
	(0.198)	**(0.264)**	**(0.302)**
Industrial zone	**0.143**	**-0.049**	**0.725***
	(0.234)	**(0.258)**	**(0.406)**
Member of association	-0.149	-0.233	0.259
	(0.161)	(0.217)	(0.214)
Registered business	0.156	0.341	-0.352
	(0.197)	(0.226)	(0.289)
Starting capital ('000th)	-0.000	-0.001	0.001
	(0.001)	(0.002)	(0.002)
Requested loan	0.083	0.148	-0.038
	(0.151)	(0.175)	(0.250)
Permanent structure	-0.080	0.034	0.126
	(0.186)	(0.228)	(0.299)
Keep book	0.110	0.131	0.259
	(0.218)	(0.228)	(0.367)
Number of workers	0.075**	0.088	0.020
	(0.032)	(0.056)	(0.039)
Observations	396	250	146
R-squared	0.908	0.922	0.933
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 25: OLS results, total energy expenditure – Tanzania

	(2)	(2.1)	(2.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	-0.023***	-0.024*	-0.013
	(0.008)	(0.013)	(0.013)
No education/primary education	0.029	0.024	-0.133
	(0.248)	(0.296)	(0.441)
Migrant	-0.245	-0.643**	0.388
	(0.231)	(0.299)	(0.405)
Married	-0.025	0.245	-0.363
	(0.256)	(0.411)	(0.353)
Bank account	0.116	0.140	-0.101
	(0.246)	(0.308)	(0.441)
Household characteristics			
Number of children	0.023	-0.015	0.014
	(0.030)	(0.036)	(0.063)
Number of older people	-0.053	-0.059	-0.090
	(0.066)	(0.085)	(0.107)
Business characteristics			
Female owner	-0.234		
	(0.262)		
Electricity	-1.440***	-1.238***	-1.909***
	(0.241)	(0.340)	(0.405)
Member of association	0.022	0.383	0.022
	(0.234)	(0.339)	(0.234)
Registered business	0.572**	0.491	0.572**
	(0.229)	(0.301)	(0.229)
Starting capital ('000th)	0.003*	0.003	0.001
	(0.002)	(0.002)	(0.003)
Permanent structure	-0.219	-0.115	-0.304
	(0.229)	(0.293)	(0.384)
Keep book	-0.161	-0.335	0.374
	(0.216)	(0.278)	(0.402)
Number of workers	0.115	0.108	0.033
	(0.153)	(0.154)	(0.283)
Observations	328	201	127
R-squared	0.673	0.682	0.723
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, results for electricity expenditure as dependent variable are presented in Tables 25 and 26. In both Tanzania and Ghana, being a female enterprise owner is negatively correlated with expenditure on electricity, but the relationship is only statistically significant in Tanzania. Other control variables display the expected positive sign in both countries, but are not statistically significant – for example, having a bank account, being a member of an association (statistically significant for women in Ghana), and being a formally registered business. In other cases, signs are contradictory. For example, having a high starting capital as a positive effect on electricity expenditure in Ghana, which is

statistically significant for the sub-sample of female businesses. However, starting capital displays a negative impact in Tanzania, which is statistically significant for the male sub-sample, and turns into a positive impact for the female-only sample. Sectoral fixed effects account for a significant variation in electricity expenditure in both countries.

Table 26: OLS results, LN total expenditure on electricity – Ghana

	(3)	(3.1)	(3.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.037***	0.023	0.044**
	(0.011)	(0.015)	(0.017)
No education/primary education	0.043	0.114	0.335
	(0.183)	(0.195)	(0.370)
Migrant	0.071	-0.062	0.079
	(0.167)	(0.184)	(0.304)
Married	0.237	0.464*	0.237
	(0.197)	(0.260)	(0.285)
Bank account	0.203	-0.061	1.316**
	(0.192)	(0.218)	(0.506)
Household characteristics			
Number of children	0.003	-0.042	0.030
	(0.049)	(0.076)	(0.064)
Number of older people	0.019	0.137**	-0.022
	(0.048)	(0.059)	(0.039)
Business characteristics			
Female owner	**-0.194**		
	(0.279)		
Industrial zone	**-0.325**	**-0.190**	**-0.207**
	(0.214)	**(0.251)**	**(0.441)**
Member of association	0.270	0.168	0.758**
	(0.175)	(0.220)	(0.330)
Registered business	0.183	0.326	-0.056
	(0.223)	(0.272)	(0.332)
Starting capital ('000th)	0.001	0.001	0.004**
	(0.002)	(0.001)	(0.002)
Requested loan	0.137	0.189	0.177
	(0.170)	(0.185)	(0.316)
Permanent structure	-0.016	-0.131	0.410
	(0.216)	(0.270)	(0.344)
Keep book	0.308	0.206	0.529
	(0.225)	(0.266)	(0.319)
Number of workers	0.012	0.040	-0.056
	(0.037)	(0.055)	(0.051)
Observations	270	183	87
R-squared	0.932	0.950	0.933
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 27: OLS results, LN total expenditure on electricity – Tanzania

	(5)	(5.1)	(5.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	-0.049***	-0.065***	-0.052**
	(0.012)	(0.015)	(0.020)
No education/primary education	-0.273	-0.294	-1.099*
	(0.284)	(0.347)	(0.641)
Migrant	-0.310	-0.257	-0.266
	(0.290)	(0.350)	(0.768)
Married	0.405	1.054**	0.082
	(0.299)	(0.438)	(0.482)
Bank account	0.155	0.527	-0.816
	(0.284)	(0.345)	(0.648)
Household characteristics			
Number of children	0.031	-0.005	0.235***
	(0.044)	(0.042)	(0.082)
Number of older people	-0.136	-0.099	-0.213
	(0.091)	(0.115)	(0.159)
Business characteristics			
Female owner	-0.660*		
	(0.339)		
Member of association	0.409	0.355	0.830
	(0.300)	(0.444)	(0.552)
Registered business	0.341	0.216	0.383
	(0.273)	(0.321)	(0.625)
Starting capital ('000th)	-0.001	-0.788**	0.209
	(0.002)	(0.332)	(0.698)
Permanent structure	-0.387	-0.242	-0.481
	(0.293)	(0.313)	(0.523)
Keep book	-0.239	0.106	-0.102
	(0.276)	(0.196)	(0.341)
Number of workers	0.126	0.355	0.830
	(0.158)	(0.444)	(0.552)
Observations	216	146	70
R-squared	0.749	0.753	0.801
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, while not presented here, OLS regressions with 'hours of electricity consumption per day' as dependent variable showed female-owned enterprises in Ghana using electricity for significantly more hours than male-owned enterprises, but no significant differences between male- and female-owned enterprises in Tanzania. In both countries, starting capital was positively and significantly correlated with hours of electricity.

In summary, the comparison of modelling results shows some consistent messages. These include the positive relationship between electricity use and business economic performance. Female enterprise owners do not consistently perform worse than their male counterparts, when all other variables are kept equal. With regards to the impact of interventions, location in a light industrial zone in Ghana is linked to lower business performance, but location in Bwisya, in Tanzania, is linked to better business performance

for women than in other regions, and higher impacts of electricity on business performance. Some of the indicators for which female-owned enterprises typically performed worse than male-owned enterprises are also correlated with better business performance, such as formality, starting capital, or accounting practices.

Results for energy expenditure indicate that electricity use reduces energy bills in Tanzania, but increases them in Ghana, probably due to the more intense use of electrical appliances in the latter. Also, being a female enterprise owner is, in all cases, correlated with lower energy and electricity consumption, but is only statistically significant for electricity consumption in Tanzania.

6. CONCLUSIONS AND IMPLICATIONS FOR POLICY AND PRACTICE

Evidence from our three case studies validates our conceptual framework, indicating that, in the absence of gender approaches, men entrepreneurs become the main beneficiaries of interventions to promote productive uses of energy (PUE) when they focus on electricity as the energy carrier. Another key finding is that entrepreneurs using electricity obtain better business outcomes than the rest, and this improvement is accrued equally for men and women. Hence, policies to provide equal access to electricity for men and women entrepreneurs have the potential to deliver poverty reduction in a gender equitable way.

More detailed information per case study shows that the light industrial zones in Ghana improved electricity supply mainly for male-owned enterprises in the auto mechanics sector. Only 13 per cent of enterprises in these zones are owned by women, and women employees are a minority. In Tanzania, most enterprises in our sample are owned by men and employ other men. Besides, male-owned enterprises are usually more profitable than female-owned enterprises and more frequently use electricity. Given the lower electricity consumption levels of female-owned enterprises, even those connected to a supply would obtain lower benefits. The less important role of women as electricity consumers could make them less interesting for private sector suppliers. For example, one of the directors of the mini-grid supplier in Bwisya (Tanzania) indicated that their two priority sectors to act as anchor loads in the island are fishing and milling – both male dominated. Evidence from Myanmar, while anecdotal, showed that men benefit more and more rapidly from PUE. In all five villages, men had access to and control over the diesel generators, while women used traditional energy sources such as firewood and charcoal. When electricity arrived, a key informant in Oak Pho explained that 'for income work, women [still] use firewood more and men use mini-grid more. Firewood is used for cooking food for pigs and animals. It is also used for making charcoal. Solar mini-grid is used for building houses and rice pounding machine.'

Our findings also highlight differences and similarities in how men and women consume energy at work. For example, electricity is the most frequently used type of energy for both men and women, even if a significantly higher share of male-owned enterprises use it. On the other hand, women dominate the use of cooking fuels, whether gas, charcoal

or firewood (and among these, charcoal is the most prevalent cooking fuel). Gas was unavailable in the Tanzanian islands visited but was used by almost a quarter of female entrepreneurs in Ghana. Diesel is also more frequently used by male-owned enterprises than by female-owned enterprises. When total energy expenditure is taken into account, we found no significant differences between male- and female-owned enterprises in Ghana or Tanzania, as lower expenditure on electricity is cancelled out by higher expenditure on cooking fuels.

The Ghanaian case study showed that improving supply of electricity to male-owned enterprises does not necessarily mean that women are disadvantaged. For example, Ghana's progressive tariff scheme – through which higher-consuming commercial clients pay more per kWh than those consuming less – creates a cross-subsidy from more electricity-intensive, male-owned enterprises to lower-consuming, female-owned enterprises. Furthermore, there was no evidence that male-dominated enterprises in the light industrial zone were performing better than female-owned enterprises outside of it. On the contrary, increased competition in industrial clusters and distance from the town centre appeared to have had a detrimental effect. In fact, the predominantly male-owned enterprises located in the zone reported lower profits than their counterparts outside these zones. This brings to the fore the importance of careful planning of PUE. As previously demonstrated in the literature, energy alone cannot create economic growth; other enabling factors need to be in place when planning these interventions. PUE interventions also need to go beyond electricity to reach women. For example, interventions related to cooking fuels, such as Ghana's LPG promotion programme, would benefit female rather than male entrepreneurs.

The case studies reveal the reasons for these differential impacts, providing evidence to the gendered-specific constraints that women face when trying to unlock the benefits of PUE. In spite of the different ways in which women's productivity could benefit from existing energy policies, all countries showed a gender gap in profits, salaries and electricity consumption. Several reasons account for these gender gaps. First, women typically specialise in sectors with low average electricity (as opposed to energy) consumption. These include hairdressing, tailoring, restaurants and bakeries. They are often less profitable and less power-intensive than male-dominated activities. However, when men and women operate in the same sector, their performance is not different. In rural economies, men dominated the most profitable activities along the value chains of fishing and agriculture. For example, in Tanzania, men were involved in selling agricultural crops and cultivation of cash crops, while women were confined to subsistence crop cultivation for household consumption. In Myanmar, men worked in the higher-value roles within the fishing industries, while women were involved in the lower-paid roles of processing. Sectoral segregation is largely due to gender norms that determine the 'appropriate' income-generation activities for women. Women's limited access to capital and other resources also makes them more likely to specialise in those sectors. In all three countries, men's paid roles tend to involve heavy machinery and activities requiring physical strength (such as carpentry), while women's paid roles use less appliances and electricity overall (such as cooking or hairdressing).

Linked to sectoral segregation, women are also disadvantaged when it comes to accessing the skills, financial and physical resources needed to start a business. In rural economies, women's educational attainment is lower than that of men, but this was not the case in

urban Ghana. Access to capital was repeatedly mentioned as a key constraint for both men and women, but women had smaller capital to start with. Women also showed lower ownership of high-wattage electric appliances, and lower ownership of land and buildings that could be used as collateral for loan applications. Lack of equipment was particularly mentioned by women in Ghana as a constraint for them to cross over into male-dominated sectors. There was also some evidence showing that care responsibilities limit women's performance at work. For example, women work shorter hours than men, and run their businesses from home or nearby so that they can attend to household responsibilities. Urban Ghana displayed a more gender equal society than rural Tanzania and Myanmar, in that men had taken over some typically female responsibilities such as ironing and childcare. However, cooking and washing remained distinctively in women's domain.

The relatively more gender-equitable Ghanaian society showed encouraging progress in some respects. Education was helping both men and women to challenge gender stereotypes about household responsibilities and the types of businesses that men and women can or should do – for example, with more women taking up roles in desirable formal sector employment in banks, the civil service or as school teachers. And more women are entering STEM professions. Even if women reported lower starting capital than their male counterparts, they showed significant economic empowerment, in that they were more likely to hold a bank account than men, and more able to save and reinvest their business profits without diversion to the household. In this respect, the cultural norms of the region made men responsible for providing for the household (the 'breadwinner), and men more often complained of being unable to save for their business because of having to meet family expenses. Furthermore, facilitated by globalisation and exposure to new role models, more men and women are beginning to challenge traditional gender roles. Women in traditionally male sectors are showing pride in what they do, and demonstrating that they can do just as good a job as men. Many men appreciated women venturing into what are regarded as traditionally male jobs and showed delight when their preconceptions were proved wrong.

6.1. Recommendations

We conclude this report with policy recommendations that take into account the diversity of our target regions and draw from their prevailing gaps and achievements towards gender equality in PUE. We organise the recommendations into two groups: (1) PUE interventions that support the activities that men and women currently do, without discriminating against either sex; and (2) PUE interventions that transcend the segregation that has traditionally existed within and between sectors, moving towards greater equity in the use of energy at work.

(1) To support men and women's PUE in their current roles, we recommend the following actions:

1. **Improve access to finance and equipment**. Male and female enterprise owners both cited finance as their most pressing constraint to growth. However, different strategies for finance provision are required for men and women to match their particular needs. For example, finance was more likely to be captured by household needs when given to men in Ghana. In Tanzania, key

informants recommended that women receive transfers in kind rather than in cash to avoid these being captured by household needs.

2. **Provide energy management training.** Many businesses, both in Ghana and Tanzania, displayed a total lack of understanding about how electricity bills are calculated, and distrusted whether meter readings were legitimate. In Ghana, there was much resistance to prepaid meters among some entrepreneurs, even though these should allow businesses to better control their bills. Further understanding of energy bills and how to achieve savings could support both male- and female-owned businesses to improve energy efficiency and derive greater benefits from PUE.

3. **Improve reliability of supply.** The poor reliability of grid electricity supply was highlighted by both men and women entrepreneurs as a key constraint to their businesses. Poor reliability causes delays in production, lost customers, lower sales, and damaged equipment. As a result, those who can afford it were turning to individual generators or solar home systems to bypass the grid. This starts a vicious cycle in which larger consumers abandon the grid, hence reducing the revenues of the power utility and its ability to invest to improve reliability.

4. **Support traditionally female trades with high-quality, affordable energy, and not just electricity.** Interventions to improve the cost and quality of cooking fuels, and to support small commercial consumers of electricity or improve energy supply for subsistence agriculture, are more likely to target women. Cooking fuels interventions include the promotion of LPG, with lower impacts for women's health, or improved cook stoves, which use charcoal more efficiently. Interventions to support smaller-scale electricity consumers include progressive tariffs (as in Ghana). However, such systems require good quality of service to avoid the wealthier consumers leaving the grid in favour of self-generation. Interventions promoting women in agriculture include irrigation with pressure pumps. Support to small or subsistence-based women's activities may not appeal to private investors, though, so the public sector may need to fill this gap in provision.

5. **Support traditionally male trades with improved high-quality, affordable energy as well as new technologies, but taking into account other business constraints.** Heavy consumers of electricity (mostly male-owned businesses) have benefited from improved supply in Ghana's light industrial zones, but these arrangements present other challenges that suppress profits (e.g. inability to invest in equipment, strong competition from neighbouring businesses, and distance to the town centre). Men in our sample used their own physical strength as their only energy source more often than women, because they could not afford to buy equipment and were involved in trades with heavy requirements of mechanical energy. If human strength could be replaced with mechanisation, women could more easily enter the trade. This should be a priority area for further support for PUE among men and women. Another priority would be to support both men and women to develop skills that are more advanced so that they could take up more specialised occupations where competition is less intense.

(2) To support men and women to transcend their traditional roles and move towards gender equity in PUE, we recommend the following actions:

6. **Increase provision and uptake of education and training.** In Ghana, gender equality in education is beginning to change attitudes about what types of work men and women can and should do in the workplace and at home. Higher education is allowing women to enter formal occupations that can bring stability and higher income. A new role for women in the workplace can also reduce the pressures that men feel due to cultural norms that prescribe them as 'breadwinners'. The sharing of household and financial responsibilities can support both men and women to feel professionally accomplished, save and reinvest in their businesses, and enjoy time for leisure. In our case study of Bwisya island (Tanzania), for example, cultural norms among the Kara prevented men from allowing their wives to engage in business. However, after a gender mainstreaming intervention, women started to engage in business and men started to support their wives. Men were willing to undertake family care work on behalf of their wives during training courses that lasted between two and four months, which challenged traditional norms about the household division of labour.

7. **Support business owners to develop skills and gain exposure to new role models who are overcoming occupational segregation.** Even if women are increasingly entering the formal market due to improved access to education, they are still relegated to secondary positions with little or no decision-making power. Those in the informal sector operate at smaller scale than men and using less machinery. Our interviews clearly conveyed that stereotypes can be broken when men and women are exposed to others in their community who have successfully transcended gender roles and have shown what is possible. Confidence-building for women venturing into male trades had often come with the encouragement of male role models. Policies to increase exposure to women in decision-making positions or women in highly capitalised sectors could be very effective to erode the persisting occupational segregation. Examples include: affirmative action to include quotas for women in training programmes and apprenticeships; mentoring programmes where women in powerful positions or running businesses in male trades counsel younger women; or mutual support networks/associations for women in male-dominated sectors or occupying positions of responsibility.

8. **Support women to scale up their businesses.** The small-scale character of women´s businesses acts as a drag on growth and keeps them as relatively low electricity consumers. Women can be supported to join forces in associations to target customers together, access supplies at a lower cost, or increase their bargaining power with government and private investors.

9. **Increase access to transformational appliances.** Many women are not attracted to typically male sectors such as milling or carpentry due to their reliance on physical strength. Support for businesses in these sectors to upgrade, using new technologies that replace physical energy with electric power, could make it easier for women to cross over into those sectors, as apprentices, workers and entrepreneurs. Other sectors might offer opportunities to include women in higher-value activities – for example, investing in freezers in the fishing industry

would provide women with more bargaining power to buy and sell fish. A more detailed assessment is required of the role of specific appliances in aiding women to move into more profitable sectors or to higher value-added activities within a sector.

The appropriate policy choice depends on the particular circumstances of the target communities and areas. For example, the first set of recommendations – targeting support to help male and female entrepreneurs in their current roles – is expected to achieve faster success, and particularly so in more traditional societies. The second set requires transformations at the community level but will lead to longer-lasting improvements. In the case of Bwisya, Tanzania, transformational interventions were already showing some initial successes. Women had started new electricity-consuming businesses after being exposed to training and awareness activities, as well as gaining access to loans. Some men, on the other hand, were starting to change attitudes towards women's involvement in enterprises. In Ghana, there was also clear evidence that gender roles could change with time, education and exposure to different ways of doing things. In any case, much remains to be done in all settings to overcome deep-rooted preconceptions about what types of work are suitable for men and women.

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ANNEX 1 : FOCUS GROUP DISCUSSION ON ACCESS TO AND CONTROL OVER RESOURCES

Table 28: Access to and control over resources by men and women – averages (over 10) for Techiman and Berekum, Ghana

	ACCESS		CONTROL	
	Men	Women	Men	Women
Water	8	2	0	10
Firewood	0	10	2	8
Microwave	6	4	2	8
Woman's income	3	7	2	8
Gas (LPG)	5	5	3	7
Fridge	6	4	4	7
Television	6	4	4	7
Other elec. appliances	4	6	4	6
Utensils for cooking	2	9	4	6
Charcoal	0	10	5	5
Electricity	7	3	5	5
Fan	9	1	5	5
Mobile phones	7	3	7	4
Motorbike	9	2	7	4
Radio	8	2	7	4
Cash	7	3	7	3
Computers	9	2	7	3
Iron	7	3	7	3
Livestock	7	3	7	3
Furniture	8	3	8	3
House	8	2	8	2
Lands	9	2	9	2
Car	9	1	9	1
Man's income	7	3	9	1
Petrol/diesel	9	1	9	1
Total average	**6.3**	**3.7**	**5.5**	**4.5**

Table 29: Access to and control over resources by men and women – averages (over 10) for Bwisya and Sambi, Tanzania

	ACCESS		CONTROL	
	Men	Women	Men	Women
Land/farm	4	7	8	2
Land/plot	7	3	8	2
House	5	5	7	3
Trees for timber	8	2	9	2
Fruit trees	5	5	6	4
Cattle	7	3	8	2
Goats	7	4	8	2
Poultry	3	7	4	7
Pigs	8	2	8	2
Radio/TV	5	5	8	2
Lamp/lantern	5	5	7	4
Mobile phone	5	5	5	5
Furniture	5	5	8	3
Kitchen utensils	2	9	1	9
Savings	6	5	6	4
Salary	6	5	5	5
Income from agriculture	4	6	5	5
Income from business	8	3	7	3
Fishing nets	10	0	9	1
Food crops	5	5	4	6
Village community Bank	5	5	5	5
Canoe	10	0	8	3
Motorcycle	6	4	8	2
Bicycle	5	5	8	2
Labourers	5	5	5	5
Total average	**6**	**4**	**7**	**3**

Table 30: Access to and control over resources by men and women in Kenti, Myanmar

Energy uses and resources	**Access**		**Control**	
	Male	**Female**	**Male**	**Female**
Motorcycle	5	3	6	2
TV/ video	2	6	2	6
Farm	3	4	7	1
Pet	1	7	8	-
Meter box	4	4	8	-
Music box	5	3	5	3
Sewing machine	-	8	4	4
Home-used (solar)	4	4	4	4
Phone	4	4	6	2
Solar lantern	1	7	-	8
Savings account	3	5	2	6
Motor boat	6	2	8	-

ANNEX 2 : OLS REGRESSIONS RESULTS

2.1 Ghana

Table 31: OLS results – opening hours

	(7)	(7.1)	(7.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.085***	0.100***	0.081***
	(0.015)	(0.020)	(0.026)
No education/primary education	-0.131	-0.129	-0.336
	(0.297)	(0.299)	(0.606)
Migrant	0.640**	0.440*	0.773
	(0.251)	(0.256)	(0.517)
Married	0.369	0.011	0.796
	(0.335)	(0.371)	(0.601)
Bank account	1.427***	1.062***	1.583**
	(0.294)	(0.329)	(0.715)
Household characteristics			
Number of children	-0.245**	-0.224**	-0.376
	(0.095)	(0.090)	(0.234)
Number of older people	-0.009	0.019	-0.052
	(0.045)	(0.077)	(0.064)
Business characteristics			
Female owner	**-0.254**		
	(0.450)		
Electricity	**1.025*** **	**0.272**	**1.692*** **
	(0.292)	**(0.348)**	**(0.528)**
Industrial zone	**-1.034*** **	**-0.704** **	**-0.668**
	(0.336)	**(0.326)**	**(1.239)**
Member of association	-0.273	-0.314	-0.333
	(0.295)	(0.295)	(0.570)
Registered business	0.784**	0.713*	0.692
	(0.339)	(0.404)	(0.624)
Starting capital ('000th)	0.003**	0.002*	0.007**
	(0.001)	(0.001)	(0.003)
Requested loan	0.624**	0.367	1.121**
	(0.285)	(0.321)	(0.535)
Permanent structure	1.039***	0.360	1.868***
	(0.334)	(0.389)	(0.641)
Keep book	0.139	-0.168	0.650
	(0.356)	(0.404)	(0.710)
Number of workers	-0.127**	-0.013	-0.168**
	(0.050)	(0.081)	(0.080)
Observations	395	250	145
R-squared	0.954	0.969	0.944
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 292: OLS results – LN sales (high season)

	(8)	(8.1)	(8.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.062***	0.062***	0.062***
	(0.009)	(0.013)	(0.012)
No education/primary education	0.126	0.070	0.168
	(0.141)	(0.169)	(0.244)
Migrant	0.386***	0.451***	0.221
	(0.125)	(0.158)	(0.242)
Married	0.223	-0.051	0.623***
	(0.165)	(0.250)	(0.221)
Bank account	1.083***	1.002***	1.358***
	(0.152)	(0.178)	(0.323)
Household characteristics			
Number of children	-0.097**	-0.167***	0.022
	(0.043)	(0.054)	(0.052)
Number of older people	-0.004	-0.004	0.011
	(0.024)	(0.043)	(0.032)
Business characteristics			
Female owner	**0.246**		
	(0.214)		
Electricity	**0.692*** **	**0.523*** **	**0.589** **
	(0.145)	**(0.196)**	**(0.281)**
Industrial zone	**-0.504*** **	**-0.479** **	**-0.390**
	(0.189)	**(0.221)**	**(0.423)**
Member of association	0.048	0.121	-0.028
	(0.140)	(0.176)	(0.225)
Registered business	0.319*	0.369*	0.059
	(0.174)	(0.200)	(0.317)
Starting capital ('000th)	0.003**	0.003*	0.004**
	(0.001)	(0.002)	(0.002)
Requested loan	0.356**	0.325*	0.295
	(0.146)	(0.191)	(0.248)
Permanent structure	0.620***	0.772***	0.609**
	(0.161)	(0.211)	(0.307)
Keep book	-0.020	0.145	-0.253
	(0.177)	(0.222)	(0.299)
Number of workers	0.001	0.077*	0.000
	(0.029)	(0.042)	(0.039)
Observations	396	250	146
R-squared	0.969	0.971	0.972
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 303: OLS results – LN sales (low season)

	(9)	(9.1)	(9.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.049***	0.042***	0.057***
	(0.009)	(0.013)	(0.012)
No education/primary education	-0.042	-0.019	0.159
	(0.196)	(0.282)	(0.253)
Migrant	0.291	0.332	0.036
	(0.183)	(0.259)	(0.247)
Married	0.511**	0.677**	0.605**
	(0.203)	(0.320)	(0.234)
Bank account	1.267***	1.371***	1.001***
	(0.229)	(0.317)	(0.322)
Household characteristics			
Number of children	-0.159**	-0.300***	0.052
	(0.071)	(0.087)	(0.056)
Number of older people	0.017	0.071	0.001
	(0.032)	(0.071)	(0.032)
Business characteristics			
Female owner	**0.140**		
	(0.226)		
Electricity	**0.691*** **	**0.871****	**0.296**
	(0.200)	**(0.339)**	**(0.290)**
Industrial zone	**-0.016**	**0.106**	**-0.645**
	(0.315)	**(0.400)**	**(0.474)**
Member of association	0.061	0.215	-0.170
	(0.217)	(0.339)	(0.240)
Registered business	0.135	0.196	-0.171
	(0.252)	(0.335)	(0.342)
Starting capital ('000th)	0.003**	0.002	0.004*
	(0.001)	(0.001)	(0.002)
Requested loan	0.375**	0.350	0.244
	(0.177)	(0.270)	(0.241)
Permanent structure	0.497**	0.722**	0.401
	(0.215)	(0.341)	(0.322)
Keep book	0.018	0.242	-0.205
	(0.216)	(0.261)	(0.348)
Number of workers	0.028	0.063	0.058
	(0.034)	(0.065)	(0.045)
Observations	396	250	146
R-squared	0.908	0.885	0.958
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 314: OLS results – customers (high season)

	(10)	(10.1)	(10.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.038***	0.035***	0.039***
	(0.006)	(0.009)	(0.009)
No education/primary education	0.260*	0.208	0.246
	(0.153)	(0.183)	(0.216)
Migrant	0.409***	0.408***	0.146
	(0.127)	(0.151)	(0.211)
Married	0.256*	0.066	0.569***
	(0.137)	(0.185)	(0.188)
Bank account	0.742***	0.594***	0.799***
	(0.140)	(0.170)	(0.244)
Household characteristics			
Number of children	-0.027	-0.015	-0.006
	(0.035)	(0.050)	(0.051)
Number of older people	-0.053**	-0.005	-0.050*
	(0.021)	(0.040)	(0.030)
Business characteristics			
Female owner	**-0.520****		
	(0.204)		
Electricity	**0.336****	**-0.126**	**0.206**
	(0.144)	**(0.203)**	**(0.231)**
Industrial zone	**-0.472*****	**-0.364***	**-0.771***
	(0.176)	**(0.197)**	**(0.410)**
Member of association	-0.266*	-0.218	-0.184
	(0.142)	(0.170)	(0.205)
Registered business	0.289*	0.284	0.239
	(0.173)	(0.185)	(0.286)
Starting capital ('000th)	0.000	-0.001	0.002
	(0.001)	(0.001)	(0.002)
Requested loan	0.270*	0.213	0.287
	(0.140)	(0.173)	(0.212)
Permanent structure	0.059	0.097	0.405
	(0.163)	(0.206)	(0.264)
Keep book	0.169	0.275	-0.058
	(0.179)	(0.193)	(0.303)
Number of workers	0.017	0.069	0.032
	(0.028)	(0.044)	(0.036)
Observations	368	222	146
R-squared	0.904	0.915	0.932
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 325: OLS results – customers (low season)

	(11)	(11.1)	(11.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.035***	0.029***	0.041***
	(0.006)	(0.009)	(0.008)
No education/primary education	0.173	0.120	0.232
	(0.155)	(0.194)	(0.223)
Migrant	0.332**	0.331**	0.056
	(0.131)	(0.159)	(0.220)
Married	0.318**	0.243	0.580***
	(0.136)	(0.187)	(0.197)
Bank account	0.690***	0.541***	0.719***
	(0.142)	(0.178)	(0.249)
Household characteristics			
Number of children	-0.099**	-0.093	-0.089*
	(0.039)	(0.058)	(0.050)
Number of older people	-0.063***	-0.043	-0.042
	(0.022)	(0.042)	(0.029)
Business characteristics			
Female owner	**-0.515****		
	(0.208)		
Electricity	**0.395*****	**0.201**	**0.128**
	(0.139)	**(0.206)**	**(0.214)**
Industrial zone	**-0.425****	**-0.369***	**-0.682***
	(0.182)	**(0.212)**	**(0.366)**
Member of association	-0.149	-0.019	-0.142
	(0.147)	(0.188)	(0.210)
Registered business	0.201	0.157	0.141
	(0.181)	(0.190)	(0.311)
Starting capital ('000th)	0.000	-0.001**	0.002
	(0.001)	(0.001)	(0.002)
Requested loan	0.249*	0.249	0.223
	(0.141)	(0.179)	(0.216)
Permanent structure	0.106	0.094	0.383
	(0.161)	(0.217)	(0.257)
Keep book	0.101	0.150	-0.033
	(0.184)	(0.201)	(0.335)
Number of workers	0.042	0.085*	0.049
	(0.028)	(0.045)	(0.038)
Observations	378	232	146
R-squared	0.843	0.828	0.901
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 336: OLS results – LN annual profit

	(14)	(14.1)	(14.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.073***	0.072***	0.081***
	(0.011)	(0.017)	(0.012)
No education/primary education	0.226	0.424*	-0.004
	(0.188)	(0.250)	(0.296)
Migrant	0.618***	0.726***	0.301
	(0.189)	(0.253)	(0.269)
Married	0.539**	0.348	0.934***
	(0.210)	(0.335)	(0.300)
Bank account	1.161***	1.062***	1.229***
	(0.196)	(0.266)	(0.354)
Household characteristics			
Number of children	-0.184***	-0.269***	-0.070
	(0.064)	(0.097)	(0.058)
Number of older people	0.008	0.008	0.028
	(0.029)	(0.066)	(0.030)
Business characteristics			
Female owner	**0.298**		
	(0.296)		
Electricity	**0.728*** **	**0.698** **	**0.608***
	(0.202)	**(0.328)**	**(0.329)**
Industrial zone	**-0.724*** **	**-0.614** **	**-1.056***
	(0.237)	**(0.283)**	**(0.536)**
Member of association	0.060	0.247	-0.242
	(0.209)	(0.303)	(0.279)
Registered business	0.270	0.233	0.055
	(0.266)	(0.349)	(0.378)
Starting capital ('000th)	0.004***	0.003*	0.007***
	(0.001)	(0.002)	(0.002)
Requested loan	0.260	0.306	0.141
	(0.201)	(0.265)	(0.306)
Permanent structure	0.531**	0.546*	0.695**
	(0.205)	(0.296)	(0.327)
Keep book	0.304	0.505	0.107
	(0.250)	(0.352)	(0.388)
Number of workers	-0.053	0.044	-0.090
	(0.039)	(0.057)	(0.055)
Observations	396	250	146
R-squared	0.963	0.961	0.972
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 347: OLS results – LN total expenditure

	(15)	(15.1)	(15.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.066***	0.049***	0.091***
	(0.008)	(0.014)	(0.011)
No education/primary education	-0.096	-0.033	-0.072
	(0.182)	(0.211)	(0.247)
Migrant	0.401***	0.382**	0.321
	(0.135)	(0.163)	(0.262)
Married	0.448***	0.390	0.533**
	(0.170)	(0.259)	(0.235)
Bank account	1.060***	0.945***	1.311***
	(0.174)	(0.213)	(0.361)
Household characteristics			
Number of children	-0.097***	-0.096*	-0.121**
	(0.036)	(0.050)	(0.057)
Number of older people	-0.007	0.048	-0.013
	(0.027)	(0.050)	(0.027)
Business characteristics			
Female owner	**0.005**		
	(0.243)		
Electricity	**0.394****	**0.457***	**0.156**
	(0.176)	**(0.249)**	**(0.329)**
Industrial zone	**-0.507****	**-0.522****	**-0.290**
	(0.205)	**(0.229)**	**(0.522)**
Member of association	-0.164	-0.002	-0.317
	(0.154)	(0.193)	(0.233)
Registered business	0.533***	0.662***	0.066
	(0.202)	(0.236)	(0.343)
Starting capital ('000th)	0.003***	0.003**	0.005*
	(0.001)	(0.001)	(0.003)
Requested loan	0.558***	0.492**	0.516*
	(0.162)	(0.219)	(0.266)
Permanent structure	0.618***	0.627***	0.759**
	(0.179)	(0.234)	(0.350)
Keep book	0.105	0.026	0.211
	(0.244)	(0.328)	(0.303)
Number of workers	0.029	0.152***	-0.053
	(0.035)	(0.049)	(0.043)
Observations	396	250	146
R-squared	0.965	0.968	0.972
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 358: OLS results – LN total hours electricity used

	(3)	(3.1)	(3.2)
	All sample	**Male**	**Female**
Individual characteristics			
Age	0.020***	0.018**	0.022***
	(0.004)	(0.007)	(0.007)
No education/primary education	0.063	0.071	0.051
	(0.085)	(0.106)	(0.129)
Migrant	0.053	0.006	0.107
	(0.077)	(0.089)	(0.145)
Married	0.115	0.003	0.231*
	(0.087)	(0.131)	(0.134)
Bank account	0.121	0.071	0.580***
	(0.096)	(0.116)	(0.194)
Household characteristics			
Number of children	-0.020	-0.015	-0.034
	(0.017)	(0.028)	(0.027)
Number of older people	0.012	0.033	-0.003
	(0.010)	(0.024)	(0.013)
Business characteristics			
Female owner	**0.325*** **		
	(0.111)		
Industrial zone	**-0.146**	**0.104**	**-1.145****
	(0.130)	**(0.135)**	**(0.518)**
Member of association	0.011	-0.112	0.130
	(0.087)	(0.127)	(0.126)
Registered business	0.184**	0.218**	0.089
	(0.086)	(0.106)	(0.126)
Starting capital ('000th)	0.001***	0.001**	0.001
	(0.000)	(0.001)	(0.001)
Requested loan	0.067	0.100	0.130
	(0.077)	(0.091)	(0.135)
Permanent structure	0.077	-0.051	0.356***
	(0.094)	(0.131)	(0.121)
Keep book	0.096	0.079	0.152
	(0.112)	(0.144)	(0.172)
Number of workers	-0.025*	-0.004	-0.041*
	(0.013)	(0.024)	(0.023)
Observations	270	183	87
R-squared	0.937	0.936	0.961
Region fixed effect	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

2.2 Tanzania

Table 369: OLS results – LN customers (high season)

	(2)	(2.1)	(2.2)	(2.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	0.024***	0.031**	0.055***	0.012
	(0.007)	(0.015)	(0.010)	(0.013)
No education/primary education	0.368*	0.116	0.190	0.788*
	(0.201)	(0.507)	(0.390)	(0.398)
Migrant	0.517***	0.692*	0.604**	1.502***
	(0.188)	(0.381)	(0.304)	(0.425)
Married	0.442**	1.177*	0.057	0.441
	(0.197)	(0.664)	(0.329)	(0.289)
Bank account	0.315	0.573	0.002	0.505
	(0.203)	(0.497)	(0.396)	(0.376)
Household characteristics				
Number of children	-0.018	-0.245**	-0.037	0.023
	(0.030)	(0.107)	(0.039)	(0.053)
Number of older people	0.001	0.092	-0.013	0.038
	(0.044)	(0.071)	(0.069)	(0.104)
Business characteristics				
Female owner	0.127	1.365**	-0.090	-0.238
	(0.210)	(0.653)	(0.345)	(0.344)
Electricity	0.502***	-0.183	0.247	0.612*
	(0.169)	(0.572)	(0.284)	(0.365)
Member of association	0.076	0.022	0.317	-0.010
	(0.196)	(0.621)	(0.321)	(0.367)
Registered business	0.151	0.499	0.363	-0.128
	(0.192)	(0.631)	(0.348)	(0.385)
Starting capital ('000th)	0.001	0.002	0.005	0.001
	(0.002)	(0.005)	(0.010)	(0.004)
Permanent structure	0.483***	0.554	0.224	0.586
	(0.185)	(0.490)	(0.278)	(0.458)
Keep book	0.268	0.177	0.569	0.465
	(0.191)	(0.479)	(0.424)	(0.315)
Number of workers	0.075	0.132	-0.244	0.455**
	(0.140)	(0.278)	(0.263)	(0.227)
Observations	328	66	140	122
R-squared	0.896	0.924	0.895	0.919
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 40: OLS results – LN customers (low season)

	(3)	(3.1)	(3.2)	(3.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	0.017**	0.019	0.037***	0.006
	(0.007)	(0.014)	(0.014)	(0.012)
No education/primary education	0.391**	0.038	0.389	0.841**
	(0.187)	(0.434)	(0.350)	(0.384)
Migrant	0.218	0.257	0.251	1.131***
	(0.181)	(0.317)	(0.304)	(0.349)
Married	0.319*	0.924	0.258	0.167
	(0.183)	(0.549)	(0.374)	(0.270)
Bank account	0.079	0.343	0.027	0.149
	(0.198)	(0.444)	(0.380)	(0.381)
Household characteristics				
Number of children	-0.035	-0.152	-0.073	0.011
	(0.034)	(0.091)	(0.048)	(0.050)
Number of older people	-0.022	0.034	-0.036	0.074
	(0.035)	(0.056)	(0.070)	(0.096)
Business characteristics				
Female owner	-0.038	0.860	-0.321	-0.361
	(0.210)	(0.530)	(0.397)	(0.337)
Electricity	0.494***	0.255	0.393	0.469
	(0.167)	(0.546)	(0.361)	(0.352)
Member of association	0.048	0.119	0.431	-0.272
	(0.205)	(0.551)	(0.344)	(0.353)
Registered business	0.056	0.185	0.102	0.088
	(0.179)	(0.502)	(0.350)	(0.357)
Starting capital ('000th)	0.002	-0.001	0.011	0.001
	(0.002)	(0.004)	(0.011)	(0.003)
Permanent structure	0.323*	0.156	0.053	0.390
	(0.174)	(0.401)	(0.301)	(0.373)
Keep book	0.475**	0.422	0.753*	0.646**
	(0.184)	(0.369)	(0.423)	(0.281)
Number of workers	0.029	0.108	-0.385	0.420**
	(0.127)	(0.311)	(0.254)	(0.190)
Observations	328	66	140	122
R-squared	0.834	0.885	0.818	0.881
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 41: OLS results – opening hours

	(6) **All sample**	(6.1) **Bwisya**	(6.2) **Murutunguru**	(6.3) **Irugwa**
Individual characteristics				
Age	0.148***	0.113**	0.150***	0.161***
	(0.018)	(0.045)	(0.026)	(0.036)
No education/primary education	0.609	1.747	-1.015	2.133**
	(0.540)	(1.486)	(0.802)	(0.991)
Migrant	1.888***	1.555	1.357*	3.464***
	(0.487)	(1.259)	(0.692)	(1.058)
Married	1.297**	3.952**	1.439*	0.528
	(0.560)	(1.549)	(0.794)	(1.130)
Bank account	-0.104	1.323	-0.095	-0.913
	(0.570)	(1.761)	(0.863)	(1.054)
Household characteristics				
Number of children	-0.230***	-0.420	-0.102	-0.207
	(0.069)	(0.278)	(0.089)	(0.150)
Number of older people	0.161	0.129	0.442**	0.009
	(0.127)	(0.224)	(0.175)	(0.331)
Business characteristics				
Female owner	0.411	1.771	0.966	-1.182
	(0.597)	(1.651)	(0.758)	(1.096)
Member of association	-0.956*	-0.505	-1.406*	-0.401
	(0.518)	(1.686)	(0.718)	(0.905)
Registered business	0.705	1.554	-0.279	0.668
	(0.526)	(1.766)	(0.804)	(0.913)
Starting capital ('000th)	0.012**	0.003	0.013	0.010
	(0.005)	(0.015)	(0.021)	(0.010)
Permanent structure	1.214**	1.947	1.995***	-0.713
	(0.498)	(1.631)	(0.687)	(0.964)
Keep book	0.429	-1.148	1.666*	0.456
	(0.514)	(1.504)	(0.884)	(0.831)
Electricity	1.989***	1.139	1.478**	2.080**
	(0.546)	(2.026)	(0.735)	(0.835)
Number of workers	-0.579*	-0.668	-0.456	-0.582
	(0.336)	(0.925)	(0.506)	(0.595)
Observations	328	66	140	122
R-squared	0.915	0.939	0.924	0.930
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 372: OLS results – LN sales (high season) ('000 TZS)

	(7)	(7.1)	(7.2)	(7.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	-0.016**	-0.035**	0.007	-0.013
	(0.006)	(0.013)	(0.011)	(0.009)
No education/primary education	0.003	0.443	0.040	0.067
	(0.164)	(0.483)	(0.271)	(0.277)
Migrant	0.165	-0.251	0.207	0.404
	(0.155)	(0.363)	(0.213)	(0.331)
Married	-0.031	0.453	-0.482	0.145
	(0.159)	(0.483)	(0.313)	(0.226)
Bank account	0.388**	0.665	0.283	0.628**
	(0.156)	(0.440)	(0.270)	(0.272)
Household characteristics				
Number of children	0.032	0.016	0.026	-0.003
	(0.023)	(0.074)	(0.032)	(0.040)
Number of older people	0.016	-0.019	-0.068	0.061
	(0.047)	(0.097)	(0.067)	(0.061)
Business characteristics				
Female owner	0.102	0.744	-0.428	0.270
	(0.161)	(0.573)	(0.300)	(0.273)
Member of association	0.112	-0.099	0.275	0.169
	(0.157)	(0.461)	(0.237)	(0.246)
Registered business	0.408***	0.910**	0.480*	-0.031
	(0.146)	(0.437)	(0.249)	(0.232)
Starting capital ('000th)	0.001	0.001	0.014*	-0.003
	(0.002)	(0.003)	(0.008)	(0.002)
Permanent structure	-0.067	-0.229	-0.482**	0.440
	(0.154)	(0.392)	(0.205)	(0.333)
Keep book	0.351**	0.780*	0.649**	0.207
	(0.147)	(0.402)	(0.260)	(0.213)
Electricity	0.072	-0.731	-0.176	0.121
	(0.141)	(0.509)	(0.273)	(0.248)
Number of workers	0.405***	0.069	0.400**	0.439***
	(0.104)	(0.269)	(0.185)	(0.158)
Observations	328	66	140	122
R-squared	0.523	0.790	0.561	0.580
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 38: OLS results – LN sales (low season) ('000 TZS)

	(8)	(8.1)	(8.2)	(8.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	-0.019***	-0.045***	-0.005	-0.015
	(0.007)	(0.017)	(0.010)	(0.012)
No education/primary education	-0.305	0.423	0.019	-0.337
	(0.210)	(0.490)	(0.329)	(0.392)
Migrant	0.030	-0.693*	-0.112	0.471
	(0.252)	(0.399)	(0.287)	(0.801)
Married	-0.258	0.231	-1.088***	0.204
	(0.203)	(0.506)	(0.328)	(0.325)
Bank account	0.023	-0.088	-0.169	0.304
	(0.216)	(0.498)	(0.345)	(0.384)
Household characteristics				
Number of children	0.061**	0.148*	0.084**	-0.031
	(0.025)	(0.083)	(0.040)	(0.053)
Number of older people	-0.187**	-0.475***	-0.217***	-0.054
	(0.081)	(0.102)	(0.080)	(0.110)
Business characteristics				
Female owner	0.170	0.410	-0.458	0.318
	(0.228)	(0.516)	(0.316)	(0.481)
Member of association	-0.190	-0.599	0.164	-0.133
	(0.203)	(0.589)	(0.322)	(0.353)
Registered business	0.220	0.487	0.445	-0.372
	(0.193)	(0.462)	(0.327)	(0.300)
Starting capital ('000th)	0.004	0.002	0.016*	-0.001
	(0.003)	(0.004)	(0.009)	(0.003)
Permanent structure	-0.146	-0.259	-0.557*	-0.009
	(0.190)	(0.520)	(0.298)	(0.447)
Keep book	0.322	0.774*	0.966***	-0.099
	(0.208)	(0.452)	(0.365)	(0.288)
Electricity	0.225	0.137	-0.213	0.417
	(0.221)	(0.538)	(0.339)	(0.390)
Number of workers	0.420***	0.270	0.618***	0.371**
	(0.123)	(0.441)	(0.226)	(0.164)
Observations	328	66	140	122
R-squared	0.476	0.771	0.629	0.344
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 394: OLS results – LN (annual profit) ('000 TZS)

	(9)	(9.1)	(9.2)	(9.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	0.015	-0.012	0.013	0.017
	(0.009)	(0.018)	(0.010)	(0.021)
No education/primary education	-0.203	0.517	-0.380	-0.490
	(0.226)	(0.688)	(0.412)	(0.509)
Migrant	0.353	0.652	-0.263	1.784**
	(0.283)	(0.484)	(0.286)	(0.870)
Married	-0.173	0.747	0.448	-0.796*
	(0.250)	(0.487)	(0.271)	(0.473)
Bank account	0.307	0.890	0.184	0.170
	(0.297)	(0.685)	(0.338)	(0.717)
Household characteristics				
Number of children	0.015	-0.039	0.028	-0.015
	(0.028)	(0.099)	(0.034)	(0.074)
Number of older people	0.067	-0.021	-0.027	0.287**
	(0.051)	(0.138)	(0.064)	(0.113)
Business characteristics				
Female owner	0.029	0.668	0.308	-0.679
	(0.283)	(0.649)	(0.330)	(0.662)
Member of association	-0.127	0.457	-0.330	-0.245
	(0.235)	(0.490)	(0.326)	(0.499)
Registered business	0.175	1.264**	0.700***	-0.438
	(0.210)	(0.614)	(0.255)	(0.410)
Starting capital ('000th)	0.010***	0.006	0.029***	0.013***
	(0.003)	(0.006)	(0.008)	(0.005)
Permanent structure	0.019	-0.890*	-0.085	-0.218
	(0.185)	(0.496)	(0.224)	(0.541)
Keep book	0.061	0.325	-0.107	0.118
	(0.262)	(0.581)	(0.311)	(0.491)
Electricity	0.204	-0.635	0.372	0.285
	(0.197)	(0.716)	(0.225)	(0.390)
Number of workers	-0.134	-0.133	-0.433*	-0.063
	(0.241)	(0.351)	(0.226)	(0.523)
Observations	327	66	140	121
R-squared	0.546	0.752	0.687	0.549
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 405: OLS results – LN total expenditure ('000 TZS)

	(10)	(10.1)	(10.2)	(10.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	-0.018***	-0.020*	-0.023**	-0.023***
	(0.005)	(0.011)	(0.011)	(0.008)
No education/primary education	-0.066	-0.381	-0.097	0.438
	(0.146)	(0.389)	(0.281)	(0.275)
Migrant	0.118	0.631*	-0.042	0.191
	(0.142)	(0.348)	(0.243)	(0.226)
Married	0.094	-0.371	0.059	0.275
	(0.149)	(0.298)	(0.308)	(0.228)
Bank account	0.178	0.825**	0.195	-0.331
	(0.151)	(0.370)	(0.279)	(0.283)
Household characteristics				
Number of children	0.029	0.091	0.047	-0.031
	(0.020)	(0.057)	(0.036)	(0.032)
Number of older people	-0.042	-0.026	-0.081	0.026
	(0.033)	(0.056)	(0.058)	(0.069)
Business characteristics				
Female owner	-0.124	-0.508*	-0.044	-0.587**
	(0.157)	(0.276)	(0.290)	(0.260)
Member of association	0.146	0.527	0.113	0.308
	(0.159)	(0.315)	(0.259)	(0.234)
Registered business	0.292**	0.733*	0.363	-0.130
	(0.147)	(0.428)	(0.280)	(0.255)
Starting capital ('000th)	0.003*	0.004	0.014*	0.000
	(0.001)	(0.003)	(0.007)	(0.002)
Permanent structure	-0.071	-0.701*	-0.197	-0.065
	(0.153)	(0.348)	(0.279)	(0.257)
Keep book	0.218	0.251	0.273	0.244
	(0.138)	(0.364)	(0.283)	(0.209)
Electricity	0.296**	-0.221	0.157	0.326
	(0.136)	(0.377)	(0.276)	(0.210)
Number of workers	0.253**	0.239	0.402**	0.293
	(0.098)	(0.229)	(0.170)	(0.229)
Observations	328	66	140	122
R-squared	0.420	0.742	0.502	0.397
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regressions other energy performance indicators

Table 41: OLS results – LN total hours of energy used

	(11)	(11.1)	(11.2)	(11.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	0.014***	0.032***	0.013**	0.002
	(0.004)	(0.007)	(0.006)	(0.009)
No education/primary education	0.107	-0.069	-0.056	0.222
	(0.108)	(0.298)	(0.168)	(0.273)
Migrant	0.014	-0.086	0.030	0.294
	(0.107)	(0.248)	(0.157)	(0.219)
Married	-0.013	-0.371	0.127	-0.070
	(0.119)	(0.274)	(0.197)	(0.179)
Bank account	0.051	0.034	-0.157	0.290
	(0.124)	(0.284)	(0.222)	(0.217)
Household characteristics				
Number of children	-0.009	-0.124**	0.039*	0.002
	(0.017)	(0.050)	(0.023)	(0.031)
Number of older people	-0.006	0.070*	-0.055	0.071
	(0.026)	(0.038)	(0.045)	(0.052)
Business characteristics				
Female owner	-0.220*	-0.801*	-0.054	-0.075
	(0.128)	(0.402)	(0.196)	(0.226)
Member of association	-0.019	0.279	-0.188	-0.168
	(0.118)	(0.345)	(0.193)	(0.200)
Registered business	0.022	-0.141	-0.070	0.329*
	(0.116)	(0.298)	(0.198)	(0.193)
Starting capital ('000th)	0.001	0.001	0.002	0.001
	(0.001)	(0.002)	(0.005)	(0.002)
Permanent structure	-0.075	0.144	-0.176	-0.073
	(0.103)	(0.259)	(0.145)	(0.240)
Keep book	0.099	0.599*	0.166	0.110
	(0.119)	(0.302)	(0.202)	(0.189)
Electricity	1.447***	1.119***	1.625***	1.310***
	(0.113)	(0.265)	(0.185)	(0.211)
Number of workers	-0.036	-0.162	-0.066	0.080
	(0.072)	(0.166)	(0.120)	(0.124)
Observations	328	66	140	122
R-squared	0.872	0.941	0.881	0.887
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 42: OLS results – LN total hours of electricity used

	(12)	(12.1)	(12.2)	(12.3)
	All sample	**Bwisya**	**Murutunguru**	**Irugwa**
Individual characteristics				
Age	0.034***	0.049***	0.049***	0.022*
	(0.005)	(0.016)	(0.010)	(0.011)
No education/primary education				
	0.053	-0.380	0.052	0.347
	(0.138)	(0.416)	(0.248)	(0.375)
Migrant	0.052	0.122	0.018	0.472*
	(0.146)	(0.338)	(0.242)	(0.258)
Married	0.067	0.114	0.079	0.081
	(0.146)	(0.432)	(0.318)	(0.216)
Bank account	0.174	0.657*	-0.065	0.144
	(0.157)	(0.361)	(0.339)	(0.300)
Household characteristics				
Number of children	-0.036	-0.163**	-0.001	-0.026
	(0.023)	(0.076)	(0.034)	(0.027)
Number of older people	0.012	0.111	-0.057	0.049
	(0.033)	(0.070)	(0.060)	(0.058)
Business characteristics				
Female owner	-0.077	-0.315	0.014	-0.112
	(0.181)	(0.713)	(0.315)	(0.287)
Member of association	-0.201	0.029	-0.516*	0.230
	(0.163)	(0.460)	(0.296)	(0.296)
Registered business	0.155	-0.365	0.060	0.273
	(0.140)	(0.364)	(0.246)	(0.228)
Starting capital ('000th)	0.002***	0.005	-0.002	0.002
	(0.001)	(0.003)	(0.008)	(0.002)
Permanent structure	0.110	0.513	0.058	0.156
	(0.139)	(0.375)	(0.228)	(0.323)
Keep book	-0.041	0.054	0.233	-0.092
	(0.141)	(0.414)	(0.286)	(0.207)
Number of workers	-0.152	-0.512**	-0.257	-0.081
	(0.092)	(0.190)	(0.276)	(0.189)
Observations	216	47	89	80
R-squared	0.885	0.931	0.880	0.918
Region fixed effect	Yes			
Sector fixed effect	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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