



UNIVERSITY of
RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY



AFRICAN CENTER OF
EXCELLENCE IN ENERGY FOR
SUSTAINABLE DEVELOPMENT

RURAL ELECTRIFICATION AND WOMEN EMPOWERMENT IN MALAWI

Thesis Number: ACEESD/EEC/21/21

Names of student: NYIRAHIRWA Sylvie

Registration number: **220011382**

A THESIS SUBMITTED TO AFRICAN CENTER OF EXCELLENCE IN ENERGY FOR SUSTAINABLE DEVELOPMENT, COLLEGE OF SCIENCE AND TECHNOLOGY, UNIVERSITY OF RWANDA. IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN ENERGY ECONOMICS

Advisor: Dr. Johnson Bosco RUKUNDO

November 2021

Kigali-Rwanda

Declaration

I, the undersigned, declare that this Thesis is my original work, and has not been presented for a degree in University of Rwanda or any other universities. All sources of materials that will be used for the thesis work will have been fully acknowledged.

Names: Sylvie NYIRAHIRWA (220011382)

Signature:



Date of Submission: 18th November 2021

This thesis report has been submitted for examination with my approval as a university advisor.

Signature:



Dr. Johnson Bosco RUKUNDO

Thesis Advisor

Acknowledgements

Firstly, I would like to express my special appreciation to my Master thesis supervisor Dr. Johnson Bosco RUKUNDO for his support and guidance during the course of this thesis. I would especially like to thank the World Bank, which has provided scholarships to pursue higher education at the African Centre of Excellence in Energy for Sustainable Development (ACE-ESD) in University of Rwanda-College of Science and Technology.

To close, I would like to thank my family for their continued support and encouragement

Abstract

Access to electricity has been revealed to fast-track opportunities for women by moving them into more profitable activities., However whether development through financial empowerment change the norms from the common gender standards and practices inside the family unit remains debatable. This investigation analyses the relationships between electricity access and women empowerment, using two waves 2010/2011 and 2019/2020 panel data from Malawi National Statistical Office (NSO). The study focuses on women empowerment indicators including: (i) Time allocation on income generating and non-economic activities, (ii) household assets ownership, income, decision making on household earnings and whether the households engage in income generating activities. Results from Fixed Effect models, shows that electricity access improves all indicators of women's empowerment. Income and assets values are higher in electricity usage for household compared to other household with no access to electricity, time allocation for different economic activities is identified through hours spent weekly in different home activities such as fetching water, firewood collection, food processing and farming activities, further, results show the total number of hours used up in those home-based accomplishments are less for electricity users households compare to electricity non-users. Finally, the households with access to electricity spend more hours in income generating activities compared to the households without electricity access. This study suggests that electric energy access can be a significant for policy makers aimed improving the equity and gender equality for social transformation.

Key words: Electricity access, rural electrification, fixed effects, developing country and women empowerment

Table of Contents

Declaration.....	ii
Acknowledgements.....	iii
Abstract.....	iv
LIST OF TABLES.....	vi
LIST OF FIGURES.....	vii
List of Abbreviations.....	viii
Certification.....	1
CHAPTER ONE: GENERAL INTRODUCTION.....	2
1.1. Introduction of the Study.....	2
1.2 Background of the Study.....	3
1.3 Problem Statement.....	4
1.4 Objectives of the Study.....	5
1.5 Research Questions.....	6
1.5. Research Hypothesis.....	6
1.6. Scope of the study.....	6
CHAPTER TWO: LITERATURE REVIEW.....	7
Research gap.....	11
2.1 Theoretical framework.....	12
CHAPTER THREE: RESEARCH METHODOLOGY.....	12
3.1 Strategy identification.....	12
3.2 Data and Variable description.....	13
CHAPTER FOUR: RESULT AND DISCUSSIONS.....	16
4.1 Descriptive statistics.....	16
4.2 Estimation Results from regression model.....	20
4.2.1 Access to electricity and non-income generating activities time allocation in Malawi.....	23
4.2.2 Electricity access and income generating activity participation.....	24
CHAPTER FIVE: CONCLUSION AND RECOMMENDATION.....	26
References.....	27

LIST OF TABLES

Table 1. Mean values features of households with and without electricity access in rural Malawi	16
Table 2. Access to electricity, earnings decision, income generating activities, household assets and income.....	21
Table 3: Electricity access and time allocation for woman in the household.....	23
Table 4: Electricity access and time spent in income generating activities.....	24

LIST OF FIGURES

Figure 1.Theory of Change from Electricity accessibility to Women empowerment.....	12
Figure 2: Cumulative probability distribution of annual asset and electricity access	29
Figure 3: Cumulative probability distribution of annual income and electricity access	30
Figure 4.Cumulative probability distribution of annual hours spent in unpaid work and electricity access	31
Figure 5.Cumulative probability distribution of annual hours spent in non-farming activities and electricity access	31
Figure 6. Cumulative probability distribution of annual hours spent in salaried or wage activities and electricity access	32

List of Abbreviations

ESMAP: Energy Management Assistance Program

FE: Fixed effect

IHPS: Integrated Household Panel Surveys

IEA: International Energy Agency

LSMS: Living Standards Measurement Survey

MAREP: Malawi Rural Electrification Programme

NSO: National Statistical Office

SDGs: Sustainable Development Goals

MGDS: Malawi Growth and Development Strategy

ESCOM: Electricity Supply Commission of Malawi

WIDSAA: Women in Development Southern Africa Awareness

SARDC: Southern Africa Research and Documentation Centre

WLSA: Women and Law in Southern Africa

Copyright

NYIRAHIRWA Sylvie, 2021

Certification

This is to certify that this thesis has passed through the antiplagiarism and found compliant and this is approved final version of the thesis.

Title: Rural Electrification and Women Empowerment in Malawi

Names: Sylvie NYIRAHIRWA

Thesis Advisor: Dr. Johnson Bosco RUKUNDO

CHAPTER ONE: GENERAL INTRODUCTION

1.1. Introduction of the Study

Energy accessibility is an integral part of many fundamentals that enables women and men to achieve other development outcomes and must be understood within the priority challenges faced in any given context. Development dividends can be gained when time freed up from energy related activities such as collecting firewood for household use, drawing water for agricultural and household activities, and cooking and processing food converts to a greater investment in human development. This includes increased benefits to family health (childcare, care of sick, food preparation), improved food security (agricultural production), engagement in alternative forms of livelihood support (income generation), increased attendance at school by girls and improvements to women's health.

Gender equality is emphasized by its inclusion as one of the seventeen Sustainable Development Goals(SDG's), where it is intended to achieve gender equality and empower all women and girls (SDG 5)The UN refers to gender equality as an equal rights, responsibility and opportunities of women and men and girls and boys. Women's and men's rights, responsibility and opportunities will not depend on whether they are born male or female. In order to achieve the global poverty reduction target, the distinct energy concerns of women need to be addressed through gender sensitive policies and programmes. Approximately 2 billion people throughout the world do not have electricity (Africa, 2019). About the same number rely on traditional fuels, such as wood, charcoal, cow dung, and agricultural residues, for cooking and heating. Grid-based electrical power does not reach many rural and poor urban areas in developing countries, nor is there adequate distribution of gas or other cooking and heating fuels(D. Barnes and M. Sen., 2004).

In many contexts, it is women who experience the most from conditions of extreme poverty. Of the 1.2 billion people living on an equivalent of one dollar a day, according to (Barnes, D. and M. Sen., 2003)70 percent are women. Because of their traditional responsibilities of unpaid care work such as collecting fuel and water, in many developing countries, women and girls would benefit the most from access to improved energy sources. The time and physical effort expended by women and girls in gathering fuel and carrying water heavily limits their ability to attend schools and gain knowledge through education and engage in income-generating activities.

Many women and girls also suffer from health problems related to gathering and using traditional fuels (Daka, K.R., Ballet, J., 2011). In addition to the time and physical burdens involved in gathering fuel, women suffer serious long-term physical damage from strenuous work without sufficient recuperation time. Women must worry about falls, threats of assault, and snake bites during fuel gathering. They are also exposed to a variety of health hazards from cooking over poorly ventilated indoor fires, including respiratory infections, cancers, and eye diseases. Smoke from poorly ventilated indoor fires accounts for close to 2 million premature deaths per year. Reduced drudgery for women and increased access to non-polluting power for lighting, cooking, and other household and productive purposes can have dramatic effects on women's levels of empowerment, education, literacy, nutrition, health, economic opportunities, and involvement in community activities. These improvements in women's lives can, in turn, have significant beneficial consequences for their families and communities. Women's empowerment has been widely promoted as a key development goal. It is not only desirable in itself, but also has been linked to faster economic growth (World Bank, 2011).

1.2 Background of the Study

Today, 770 million people have no access to electricity and hundreds of millions live with unreliable access to it (IEA, 2019). People with access to electricity increased since 1990, from around 71% to 86% in 2016 which means that 13% of the world did not have access to electricity in 2016 (IEA, 2016). However, the progress remains uneven as 75% of people who can't access live in sub-Saharan, where Malawi our country of interest belongs too. Distinguishing the note worthiness of women strengthening, the United Nation notwithstanding "Accomplish sex fairness and engage all ladies and young ladies" in its 17 Sustainable Development Goals.

The absence of electricity access is experienced particularly by individuals and includes various outcomes. The comparable applies for admittance to electricity which impacts ladies and men in fluctuating manners. Toward the beginning of the 1970s, rural electricity access was viewed as a critical need and the aftereffects of its mediations were believed to be a preferred position for the family units all in all, to construct occupations and to improve family well-being. In any case, concerns were raised about the impacts of remote area electricity access on earnings and family well-being during the 1980s, linkages that had been

set up between remote area electricity access and poverty lightening, preparing, prosperity, earnings, and business must be minded (Winther, 2014.) .

The population of Malawi is estimated at 10.7 million of whom 85 percent live in rural areas. Malawi, which has one of the most liberalised electricity sectors on the continent, offers a useful lens for examining the effect of power sector reform on social objectives, including energy access (Annecke, 2005). Liberalisation was supposed to yield a better managed power sector. While the country's electricity sector has performed better financially than its neighbours, the electrification rate has lagged. The grid electrification rate is estimated at 22% (rural 21% and urban 57%) (Matinga, M. N., and H. J. Annegarn., 2013).

The policy in Malawi has been to give electricity to those communities that are progressively gainful and all the more densely populated, however to urge all households to connect to the grid once it is accessible in the community (WLSA , SARDC WIDSAA, 2005). Malawi's Rural Electricity access Project (REP) has the objective of accomplishing a 10% rural electricity access rate, a net growth of 400,000 households, by 2015. The essential goal was to decrease imbalances in access to electricity and associated opportunities for expanded social welfare, education, health, wellbeing, and income generation (Kelkar, G., and D. Nathan., 2005).

1.3 Problem Statement

By achieving gender equality all activities toward human development can improve women and females' perspectives such as policy development, implementation of projects and programs. The power sector in Malawi is in a state of acute crisis. This has major implications for the wider economy of the country, and the reform and restructuring of the national power utility, the Electricity Supply Commission of Malawi (ESCOM), is an urgent priority. The overall problems of the power sector are reflected in the country's rural electrification program. Little headway has been made in electrifying rural areas, and new connections are virtually at a standstill.

Malawi has two lineage patterns, patrilineal and matrilineal. Under patrilineality, descent is through males, and residence is patrilocal. The wife leaves her village and resides in her husband's village. On the other hand, in matrilineality, descent follows the female lineage (WLSA , SARDC WIDSAA, 2005). In both matrilineal and patrilineal societies, the position that women assume is inferior to the male members within the systems as decisions are mostly made by the men with women on the receiving end. It has also been argued that in

terms of social security, the patrilineal system may provide such security to women and children as men feel they have an obligation to take care of their families (WLSA , SARDC WIDSAA, 2005)

The majority of Malawian women who are poor and reside in the rural areas remain disempowered due to the fact that they obtain endless small loan cycles from MFIs, and even though a few manage to graduate from the medium to large enterprise sector, they are unable to secure loans from commercial banks due to lack of collateral (Semu L., G. Kamchedzera, and N, Ngwira, 2004).

Few women in Malawi have the capacity to limited access to energy services and infrastructures, and their graduation from the micro and small level of energy services enterprise to medium and large is practically unachievable which is slows the movement towards the strengthening of women. As women rely on group pressure as an alternative to collateral, the majority of women remain in dysfunctional groups and are unable to carry out different energy service activities and developing the enterprises for income generation (WLSA , SARDC WIDSAA, 2005). Therefore, government needs to improve infrastructure in rural areas to ensure that microfinance and other business advisory services reach the rural poor, the majority of which are women (Bisika, T. Ntanta, P. Konyani, S., 2005).

1.4 Objectives of the Study

The research study investigates access to electricity and women empowerment in rural Malawi. The specific objectives of the research study include;

- To ascertain if electricity interventions would improve women welfare through income generation and labour force participation and increased working hours outside home.
- To investigate the influence of electricity penetration into rural family units on income and welfare distribution through empowering females.
- To determine household females' income and assets value obtained from activities carried out as result of electricity accessibility.

1.5 Research Questions

The research study eventually intends to respond to questions concerning electricity access and usage, and what aspects affect women's empowerment. The specific questions of the study are:

- What extent women's employment, health, education, and media consumption are affected by grid electrification?
- What are the potential causal effects of these outcome variables on women's empowerment?
- To what degree and how do women have access to electricity at home in ways that enrich women's empowerment?
- To what degree and how do productive uses of electricity upgrade women's empowerment?

1.5. Research Hypothesis

Based on the objective and research questions listed above, two hypotheses' tests are developed and tested. Assume 5% level of significance, and test the following null and alternative hypothesis:

H₀: Rural electrification does not contribute to Women Empowerment in Malawi

H₁: Rural electrification contributes to Women Empowerment in Malawi

1.6. Scope of the study

The study will focus on the electrification in rural households in Malawi and examine the relationship of electricity access with the determining factors of the women empowerment. This relationship between these variables of interest will be analysed for all rural household in the surveyed data from Malawi Integrated Household panel Surveys (IHPS) and the analysis will be carried out using STATA software tool.

Access to electricity does not only affect household burdens but in addition gives the opportunity to enhance income generating activities just as to improve gender relations and increase in welfare of both women and men(Cecelski, 2005).

Most studies analysing outcomes of household electrification focus on households' units though gender orientation measurements are once in a while thought of. It is broadly expected that women benefit from rural electrification as women spend more time at home, thus household electrification improves their working and living conditions. Nonetheless, it is frequently left aside that power relations among men and women highly influence the benefits of rural electrification (Cecelski 2004). The absence of research focusing on the impact of electrification on women's lives is particularly concerning the communicated duties to help gender equality and orientation correspondence by the international benefactor network and the size of investment put into electrification projects (Köhlin et al. 2011). Current research often focuses on the direct advantages of electricity, for example, saves costs of kerosene, lamp oil, diesel, candles and batteries; anyway, indirect outcomes like health wellbeing impacts, income generating activities, educational benefits and specific gender impacts are insufficiently looked into.

CHAPTER TWO: LITERATURE REVIEW

Empirical studies illustrate that electricity access disproportionately benefits ladies and young ladies. In families with electricity, females invest less used up time on family unit responsibilities and are bound to partake in earnings generating deeds, and young ladies have higher educational accomplishment (Samad, Hussain, and Fan Zhang. , 2017). What is less perceived is whether upgrades in well-being results likewise enable ladies and change gender norms standards and practices inside families. Better educational results for young ladies could catalytically affect practically all elements of improvement, including women strengthening over the long period (Duflo, 2012).

The review of empirical studies show that a great number of researchers have obtained a positive relationship between electricity access and women empowerment but in the past review of literature has focused on electricity provision, making services of electricity available to poor people, and increasing demand and supply of electricity.

Mostly women are responsible for households' duties especially in rural areas where women spend considerable time such as collecting firewood, fetching water, food processing and other domestic activities, access to electricity will facilitate for more efficient product to use in these tasks. (Dinkelman T. , 2011) in South Africa .another study by (Salehi-Isfahani, D., and S. Taghvatalab., 2014.) demonstrates that access to reliable electricity allow rural women

to work outside home by 23% due to more efficient home production in the form of lighting and modern cooking appliances, improving these basics conditions will allow women to participate in local economy whereas informed individuals, Healthy, safe, are more apt to be productive.

The study done (Annecke, 2005)(Dinkelman T. , 2011) by in South Africa about the contribution of women through adoption of electricity access opportunity showed that women employment increase by 9.5% on IV results. This was done during a census. This translates that contribution of women in labour force is 15000 more than men.

In Nicaragua, electric energy caused a day by day efficient in gathering fuel of around 60 minutes (ladies: 45 minutes, men 65 minutes) where men invested twice as much energy in this movement than ladies before electric energy access, (Grogan, L., and A. Sadanand. , 2013)

The reviewed statistical studies they regularly utilize displaying for assessing electricity's effect utilizing huge informational collections that get either from energy overviews led in the latest past. The essential reason for these examinations is to measure the effect of having electricity access (Standal, K., and T. Winther. , 2016). They entirely emphasis on rural, remote and urban areas with the grid connection, considering such access in binary terms: whether people have a subscription or not (Skutsch, 2005.). They intended to test postulates with predefined dependent variables on which the level of electricity's impact is dignified (Matinga, M. N., and H. J. Annegarn., 2013). Thematically, many of these studies considered at particular indicators of electricity's impact based on gender on welfare indicators (Grogan, L., and A. Sadanand. , 2013). For example, they observe to what degree household access to electricity reduces the time allocation for women (and men) enhances children's enrolment in school or spend on drudgery. Others emphasis on measurable resources either electricity's impact on women's employment (Winther, 2014.); (Van de Walle, 2015.) and /or changes in fuel use. Electricity's impact on fertility rates and gender norms, henceforth overarching issues, has also been considered (La Ferrara, E., A. Chong, and S. Duryea. , 2012.). some of these studies are 'causal' in that they analytically control for other aspects that may clarify the observed changes between households without and with electricity ((Jensen, R., and E. Oster. , 2009.); (Dinkelman T. , 2011); (Khandker, S. R., H. A. Samad, R. Ali, and D. F. Barnes. , 2014.). Others simply show a correlation between selected variables and electricity access (Heltberg, 2004).

In the Philippines (ESMAP 2002) there was the significant reduction in total drudgery (firewood included) by one hour per day. In certain states in India, where women without electricity spent twice as much time collecting fuel as men spent on this activity, both genders decreased their time allocated by 3.3 hours per month (Khandker, S. R., H. A. Samad, R. Ali, and D. F. Barnes. , 2014.).

The electric light introduction may talk into a reorganising of tasks. An instance in India observed that women with access to electricity started preparing the evening meal half an hour earlier than without electricity (Millinger, M., Marlind, T., Ahlgren, E. O., 2012), and such time reallocation was also proposed as a justification for decreased drudgery in one of the econometric studies (D. Barnes and M. Sen., 2004.).

In Afghanistan women said that their daughters would support them in the nightfall (carpet weaving and other chores) and go to school during daytime as a result of the coming of the electric light, (Standal, 2010). Likewise, an econometric study from India proposed that a reallocation of girls' home duties from daytime to the evenings resulted to girls' increased enrolment in school, by this means reducing parents' opportunity cost of sending their daughters to school (Van de Walle, 2015.). In contrast, girls in Madagascar the electricity access didn't change the degree to what they help their mothers, but with their study time reallocation from daytime to the evenings, when they would get help from their parents(Daka, K.R., Ballet, J.,, 2011).Lastly, as new technologies turn out to be available the 'gender' of traditional practices may change and in turn lead to more interest of time-saving technologies, Some men engaging in cooking and ironing as result of the introduction of electric appliances from the two studies from South Africa (Annecke, 2005).

The Earlier reviews on energy interventions and gender have called for a need to move away from gender-blind approaches towards addressing women and their interests in electrification policy and practice (Clancy, J., M. N. Matinga, S. Oparaocha, and T. Winther, 2017).

The contribution of electrification towards women empowerment has been done by different researcher based on gender norms as well as practices. Some assumption to these norms prohibits women from benefiting electrification opportunities compared to man opportunities (Winther, 2014.).The study done in Africa by researchers using qualitative studies and mainly focused on the informal sector revealed that women use electricity tend to increase their income either by establishing and running shops (Matinga, M. N., and H. J. Annegarn., 2013) . To the same study, by producing income from home the study carried out that using electricity to process and sell food can raise income gained by households (Standal, K., and

T. Winther. , 2016). As for first example of the case, women in Bangladesh reportedly increased their income by 0.44% MALAWIAN KWACHA per year by using electrified tools for income generating activities such as rice hulling and Shea nut grinding (Samad, Hussain, and Fan Zhang. , 2017)On other side, In study done in two Indian cases showed that electrification did not affect women's income as indicated by outcome found by (Standal, K., and T. Winther., 2016).

Some studies showed that women can be benefited from electrification opportunity, there is a controversy showed that in some circumstances they are pointed out to this occasion, and this was obtained in study carried out by (Standal, 2010). In His findings the result demonstrated that women had limited power to decide on the spending of their incomes. As a result, their material endowments did not increase. In the same line, the outcome from Afghan case shows that women increased economic opportunities do not necessarily lead to their increased control of these resources. As consequences, the influence over decision-making becomes a crucial element for assessing empowerment. On the side of financial support, the results from some scholars supported the contribution of loan supplied to women investments. The study taken has showed that the introduction of a financing mechanism subsidised poor and 'female-headed' households (Dinkelman T. , 2011). This was based on single ladies' families expanded the connection rate among female-headed family units from 63 percent to 90 percent. In other examination taken in South Africa, uncovered a similar outcome. Implying that a sweeping sponsorship for connections prompted a significant level of connections even among helpless families and an 'essential' level of utilization gave around 50 kWh of free power every month per family (Matinga, M. N., and H. J. Annegarn., 2013)

Women empowerment does not only provide financial support towards electricity access but also the way of getting opportunities to the other services. The review of literature made on lighting service showed that it is men slightly than women who have a tendency to choose on and be accountable for payments to the grid and they demonstrated also that a reduction of domestic activities promote women to watch television and use mobile phones and finally they gain enough time to relax and to interact with others (Clancy, J., M. N. Matinga, S. Oparaocha, and T. Winther, 2017). Women and men tend to improve their communication (Standal, K., and T. Winther., 2016). Electricity also will facilitate women's mobility outdoors because it will stimulate security around homesteads (Standal, K., and T. Winther. , 2016)

Furthermore, the research had done in other dimensions show that Electricity access increase women 'skills and knowledge in different ways. For example, in during evening they will find enough time to educate their kids and innovate the way of dressing eating etc.(Daka, K.R., Ballet, J.,, 2011).Additionally, the study carried out to uncover starting bits of knowledge about the advantages experienced with clients by utilizing Solar Sister's perfect energy items was found to make benefits for singular ladies and their family units as well as the networks. These were accomplished by upgrading pay and self-governance; business abilities and administration; correspondence and correspondence; family unit wellbeing and soundness; kid training; versatility and status; and network security (Solar Sisters, 2019) Finally, other study has shown that access to electricity also benefits the women who tried to create such business. These include hairdressing, ironing services, phone charging and other private businesses based on electronic devices. These help those to move from extreme poverty as demonstrated inside regions associated by a small-scale grid organization in Ghana (Africa, 2019).

Research gap

Current literature made by different researchers had only evaluated accessibility to grid electricity services and micro enterprise development, drivers and obstructions to rural electrification, influences of access to electrical energy to rural enterprises. However, their research did not cover entire continent towards women empowerment in family unity through electricity access especially in Sub-Saharan Africa countries like Malawi, Kenya, Rwanda, and others. Little has been done to identify the impact of electrification to the women empowerment in rural family units. Therefore, this study on Malawi attempts to channel such knowledge gap in literature and it will consider women's empowerment as a procedure towards gender equality, hence this will be a concept that requires analytic consideration regarding to females and males.

2.1 Theoretical framework

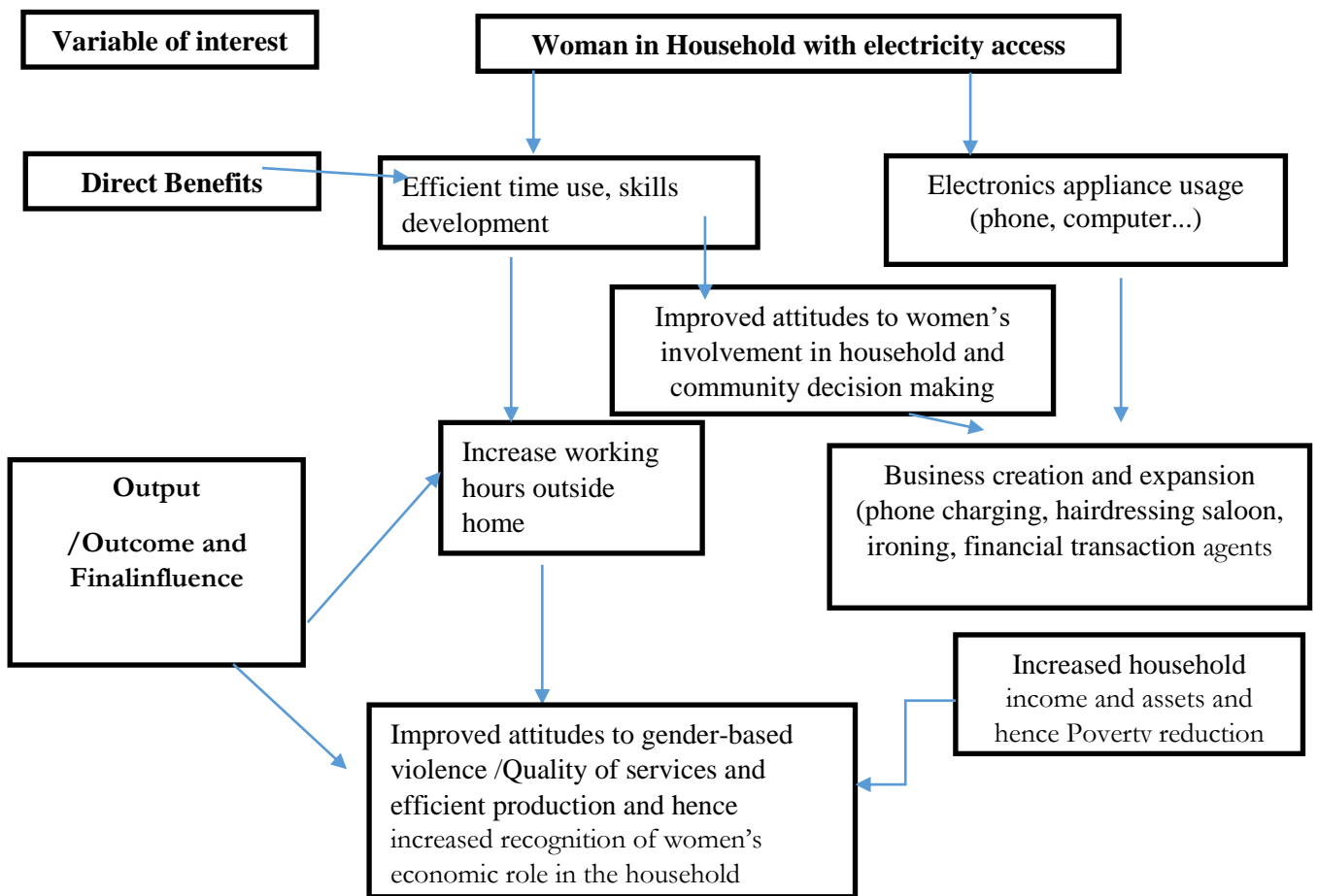


Figure 1. Theory of Change from Electricity accessibility to Women empowerment

The figure 1 above describes the conceptual framework indicating the variables of interest in this study for the target group with the associated impact as well as the direct benefits associated to the electricity access in the rural areas

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Strategy identification

To achieve our objective and derive the linkage between electricity access and Women Empowerment for achieve the study objective we estimate the following equation since there

are repeated observations both at the household and community level, we will use a fixed-effects (FE) method to estimation Evaluating the effect of electrification on women empowerment includes estimating the following conditional outcome equation

$$Y_{\pi t} = \alpha^y_{\pi} + \beta^y X_{\pi t} + \gamma^y V_{\pi t} + \delta E_{\pi t} + \varepsilon^y_{\pi t} \dots \dots \dots (1)$$

The above equation for fixed effects (community and survey year), Where $Y_{\pi t}$ is outcome variables of interest indicating women empowerment (Household assets, Household income, Formal education for female, Number of hours spent in home unpaid care work, Number of hours spent in non-agriculture activities,) of a given household from the community or village. The term π is a community fixed effects while t denotes for survey year fixed effect. The community effect absorbs all time invariant observable and unobservable village attributes that could affect electricity access in the community these may include social norm, distance from household to grid. On the other hand, the year fixed effect is being used to account for time varying characteristics which can influence Electricity access.

Another variable of interest $E_{\pi t}$ (Whether a household have electricity or not). The model also contains the time varying household and community characteristics represented by $X_{\pi t}$ and $V_{\pi t}$ respectively. The household characteristics include (Age of the household Head, Household size, Gender of the household head, Household location Urban/rural and the number of Dependence) and $\varepsilon^y_{\pi t}$ is unobserved factors affecting the women empowerment indicator $Y_{\pi t}$.

3.2 Data and Variable description

This study consists of examining the link between electricity access and women empowerment we will be using Two waves (2010/11, 2019/20) information. The integrated household panel survey (IHPS) is implemented by Malawi National Statistics office with support of World Bank Living Standard Measurement Study (LSMS-ISA). For the household level examination, aggregate community level panel dataset is built from 2010 up to 2019 Malawi statistics information from third and fifth Integrated Household panel Surveys (IHPS), which were mutually completed by analysts from the Malawi National Household Census, for this study we will use the sample of 12,288 households. The Integrated

Household Survey is one of the primary instruments implemented by the Government of Malawi through the National Statistical Office (NSO) roughly every 3-5 years to monitor and evaluate the changing conditions of Malawian households. The IHS data have, among other insights, provided benchmark poverty and vulnerability indicators to foster evidence-based policy formulation and monitor the progress of meeting the Millennium Development Goals (MDGs), the goals listed as part of the Malawi Growth and Development Strategy (MGDS) and now the Sustainable Development Goals (SDGs).

Policy relevance

The policy in Malawi has been to give electricity to those communes that are progressively gainful and all the more densely populated, however, to urge all households to connect to the grid once it is accessible in the communes. Malawi Rural Electrification Programme (MAREP) and the Electricity Supply Corporation of Malawi (ESCOM; formerly "the Electricity Supply Commission of Malawi") was placed in charge of the MAREP has the objective of accomplishing a 10% rural electrification rate, a net increment of 400,000 households, by 2015. The essential goal is to decrease imbalances in access to electricity and associated opportunities for expanded social welfare, education, health, wellbeing, and income generation (Kaijuka, 2007). The Sustainable Development Goals (SDGs) try to change the course of the 21st century, tending to key difficulties, for example, poverty eradication and hunger, taking out disparities and violence against ladies and young ladies, and fighting atmospheric and climate change. Gender equality and ladies' empowerment are essentials for accomplishing these and other global objectives. Along these lines accomplishing gender equality and ladies' empowerment is a stand-alone objective—SDG 5—and incorporated over the other goals, with numerous objectives explicitly perceiving gender equality and ladies' empowerment as both the target furthermore, some portion of the solution. Existing writing have demonstrated the significance of electrification on employment and other labour market outcomes, yet what is missing is the impact of this effect, particularly in developing countries. Discoveries from this proposed examination will uncover whether the effect of electrification on income contrasts among communities.

This will help policy makers, stakeholders, and partners to recognize integral strategies and complementary policies, programs to be presented with the aim of electrification for improving the lives of individuals in the community. Furthermore, as developing countries

are endeavouring to formalize their economies to improve the standard of life of its residents. This is significant for open approach public policy making, structure, definition, and usage of strategies in developing countries as they are expanding their power electricity infrastructure.

CHAPTER FOUR: RESULT AND DISCUSSIONS

4.1 Descriptive statistics

Table 1: Mean values features of households with and without electricity access in rural Malawi

Variables	Wave1(2010/2011)			Wave2(2019/2020)		
	with access	without access	T-test	with access	without access	T-test
Household assets	900612.000	63514.940	-17.192	3843611.000	609779.500	-5.430
Total household income	56673.950	2670.313	-32.162	145492.300	10283.980	-27.951
Hours in salaried or waged activities	36.435	6.008	-45.017	23.347	4.608	-37.981
Hours in unpaid work	8.416	28.369	17.7191	7.9531	32.0373	1.0806
Hours in no agriculture activities	13.709	4.400	-17.469	13.945	4.885	-21.921
Female deciding on HH earnings	0.028	0.017	-7.862	1.011	1.007	-5.145
Household own non agriculture business	0.164	0.056	-12.989	0.207	0.119	-9.421
Household own street business	0.159	0.050	-13.663	0.203	0.100	-11.911

Household characteristics Variables

Age of the household head	42.850	48.419	4.158	42.323	47.125	4.633
Household size	5.055	4.749	-4.217	4.454	4.408	-0.799
Gender of household head	0.297	0.210	0.932	0.312	0.234	0.963
Household location Urban or rural	0.209	0.883	0.364	0.322	0.893	0.843
Formal education for female	0.798	0.666	-8.380	0.638	0.227	-34.899
Number of households	2,938			3,437		

Tables 1 present Mean values attributes of electricity users and non-users in rural Malawi for all waves (2010/11 and 2019/20) and average values of the key variables respectively used in this study. As shown in table it provides more details descriptive statistics of household characteristics (Age of the household Head, Household size, Gender of the household head, Household location Urban/rural) and outcomes variables (Household assets, Household income, Formal education for female, female deciding on the household earnings, whether the household own non-agricultural business, whether household own street business). In wave 1 the average of the age of household was 48 for non-users of electricity and 43 for users while in wave 2 the average for users was 42 and for the non-users was 47; this illustrates that an increase in age of the head of the household will lead to a decrease of access to electricity. Approximately 29 percent of the Households with electricity are headed by the female while 21 percent of the households without electricity are headed by female in wave one while 31 percent of the Households with electricity are headed by the female while 23 percent of the households without electricity are headed by female in wave two, this indicated that when the households get access to electricity this increase the likelihood of being headed by the female and hence female strengthening through electricity access. 20 percent of the Households living in rural regions have electricity while 88 percent of the households living in the rural regions are without electricity in wave one while 32 percent of the Households living in rural regions have electricity while 89 percent of the households living in the rural regions are without electricity in wave two, this indicates that the electricity access will be induced by the region in which the household located. 79 percent of the females with formal education live in electrified households and 66 percent of the women with formal education live in non-electrified households in wave one while 64 percent of the females with formal education live in electrified households and 22 percent of the women with formal education live in non-electrified households in wave two and this illustrates that the electricity access for the households lead to increasing likelihood of getting formal education for the females hence empowerment. Women who live electrified households are more likely to have both higher total household income and total household assets value, total average annual income in wave 1 for electricity users' households is higher income of (56,674 Malawian Kwacha) and lower for electricity non users (2,670 Malawian Kwacha) while in wave 2 for electricity users' households is higher income of (145,492 Malawian Kwacha) and lower for electricity non users (10,283 Malawian Kwacha) and for electricity users the average household asset value is (900,612 Malawian

Kwacha) and for non-users it is (63,514 Malawian Kwacha) in wave one while in wave two for electricity users average value of household asset is (3,843,611 Malawian Kwacha) and (609,779 Malawian Kwacha) for non-users. Women are more likely to have no formal education if they have no access to electricity as shown in the table it has increased by 0.16 point percentage for electricity users and by 0.17 point percentage for electricity non users. The number of hours working in different home activities such as fetching water, firewood collection, food processing and other domestic activities women in electricity users spend less hours than the ones in non- electricity users because they spend more time in some other income earning activities. The females in electrified households spend 36 hours while female from non electrified households spend 6 hours in salaried or waged activities in wave one while The females in electrified households spend 23 hours while female from non electrified households spend 5 hours in salaried or waged activities in wave two and this indicates that as the households get electrified this leads to increased time spent by females in salaried or waged activities hence increased income and then empowerment. From the figure 2, (annex) we report the cumulative probability distribution of the total estimated annual asset and electricity access in Malawi. It shows that the households with electricity access have higher total annual assets compared to the households without electricity access. From the figure 3(in the annex) we report that the cumulative probability distribution of total income and electricity access in Malawi.

It shows that the households with electricity access have higher total income compared to the households without electricity access. Figure 4(in the annex) represent the Cumulative probability distribution of annual hours spent in unpaid Care work and electricity access in Malawi. It indicates that the electricity non-users spent more hours in unpaid care work compared to the electricity users where at more than 100 hours spent in unpaid care work both cumulative probability for electricity users and electricity non-users coincide and this means that the probabilities look the same for both. all of these variables we use in this study about time allocation show how a lady in the family unit with access to electricity can be strengthened by spending less hours in unpaid care work and find time to work in other generating income activities which will lead to her economic development, to her household member as well as to her community. Figure 5(annex) represent the Cumulative probability distribution of annual hours spent in non-farming activities and household's electricity access in Malawi. It indicates that the households with electricity access spent more hours in non-farming activities compared to the households without electricity access. Figure 6(annex)

represent the cumulative probability distribution of annual hours spent in salaried or wage activities and household's electricity access in Malawi. It indicates that the households with electricity access spent more hours in salaried or wage activities compared to the households without electricity access. all of these variables we use in this study about time allocation show how a lady in the households with electricity access can be empowered by spending more hours in income generating activities which will lead to her economic development through contributing to the household total income, to her household member as well as to her community.

4.2 Estimation Results from regression model

The results from table 2 to table 4 as well as all figures describe the Equation (1) results; the results are summarized into 3 parts. First is Access to electricity, earnings decision, business activities, household assets and income in (4.1) which presents the likelihood of the females to decide on the household earnings(1), households having non agriculture business(2), total household asset(3), households having the street business(4), household total income(5) ,second is Access to electricity and time allocation in non-income generating activities in Malawi (4.2) which presents the number of hours spent in unpaid care work (1) association with electricity access using fixed effect as has been described in equation(1) and the third electricity access with time allocation in income generating activities in (4.3) which presents the total hours spent in non-farming activities(1) and salaried or wage activities(2).

Table 2.: Access to electricity, earnings decision, business activities, household assets and income

VARIABLES	(1) Female decision on earnings	(2) Nonagribusiness	(3) asset	(4) Street business	(5) income
Electricity access	0.184*** (0.025)	0.073*** (0.015)	2.194*** (0.107)	0.034** (0.014)	1.269*** (0.107)
Age household head	-0.002*** (0.000)	-0.001*** (0.000)	0.002* (0.001)	-0.001*** (0.000)	-0.002 (0.003)
Household size	0.026*** (0.003)	0.009*** (0.002)	0.128*** (0.010)	0.008*** (0.002)	-0.002 (0.020)
Gender of household head	0.976 (0.943)	0.218 (0.568)	1.343 (2.818)	0.172 (0.519)	-0.003 (0.085)
Formal education for female	-0.347*** (0.013)	-0.020** (0.008)	-0.525*** (0.043)	-0.021*** (0.007)	-0.017 (0.093)
Location (Rural)	0.006 (0.020)	-0.104*** (0.012)	-1.317*** (0.083)	-0.107*** (0.011)	-0.106 (0.098)
Constant	-1.281 (1.887)	-0.124 (1.136)	10.629* (5.643)	-0.036 (1.039)	9.836*** (0.223)
Observations	6,375	6,374	6,374	6,374	6,374
R-squared	0.106	0.041	0.231	0.038	0.197
Survey year FE	YES	YES	YES	YES	YES

Source: Author's computation based on IHS data for (2010/2011) and (2019/2020)

Robust standard errors in parentheses** 1 percentage, ** p<0.05, * p<0.1

The results of the regression are presented in table 2, which shows that when the household use the electricity the total estimated value of all the assets owned by the household is increased by 2.2 points percentage which is significant at 1 percentage and 1.3 points percentage increase in household's income which is significant at 1 percentage, when the households have electricity access this leads to the increase of 18.4 points percentage in likelihood for the female to decide on the households earnings which is significant at 1 percentage and an increase of 7.3 points percentage in likelihood of the households to own the non-agriculture businesses which is significant at 1 percentage and when the households are electrified the likelihood of having the street businesses is increased by 3.4 points percentage and this is significant at $p < 0.05$, With one addition year on household head age is associated with significantly an increase of 0.002 point percentage in the total household asset which is significant at 10 percentage and is associated with the decrease of 0.2 points percentage in the likelihood for the females to decide on the households earnings which is significant at 1 percentage while one additional year on the age of the household head decrease in the likelihood of having both non agriculture and street business by 0.1 point percentage which is significant at 1 percentage, when the female in households have the formal education this is associated with the decline of 34.7 points percentage in likelihood of the female decision on the household earnings this means that having formal education for female does not necessarily lead her to control of household earnings which is significant at 1 percentage while surprisingly female with formal education lead to decline of 2 points percentage in the likelihood of the households to have the non-agricultural businesses which is significant at $p < 0.05$ surprisingly the female household head with formal education is associated with the decline in the household asset by 0.5 point percentage and having formal education for the household head is associated with decrease of 2.1 point percentage in the likelihood of owning street business and this is significant at 1 percentage also one member increase on the total number of household members is associated with the significantly rise of 0.13 points percentage on the household's total asset which is significant at 1 percentage with a significantly increase of 0.8 points percentage on the likelihood of the household to have the street businesses which is significant at 1 percentage and increase of 0.9 points percentage on the likelihood of the household to have the non-agricultural businesses which is significant at 1 percentage while this is associated with an increase of 2.6 points percentage on the likelihood of the females in households to decide on the household's earnings which

is significant at 1 percentage. surprisingly, The household living in the rural regions is associated with the decrease of 10.4 points percentage in likelihood of the households to have the non-agriculture businesses which is significant at 1 percentage while this is associated with 1.32 points percentage decrease on the total estimated value of the household's assets which is significant at 1 percentage and this is associated with decline of 10.7 points percentages on the likelihood of the households to own the street businesses which is significant at 1 percentage.

4.2.1 Access to electricity and non-income generating activities time allocation in Malawi

With the survey year fixed effect, there leftovers a strong restrictive link between period used up in some activities and furthestmost useful with income generating accomplishments and family unit electricity access status.

Table 3: Electricity access and time allocation for woman in the household non-income generating activities

Variables	(1) Unpaid care work
Electricity access	-0.470*** (0.086)
Age of household head	0.006*** (0.001)
Household size	0.188*** (0.009)
Gender of household head	2.119 (2.743)
Formal education female	0.052 (0.039)
Location (Rural)	1.269*** (0.064)
Constant	-5.466 (5.491)
Observations	6,374
R-squared	0.162
Survey year FE	YES

Source: Author's computation based on IHS data for (2010/2011) and (2019/2020)

Robust standard errors in parentheses*** 1 percentage, ** p<0.05, * p<0.1

Table 3 shows that, household consuming electric energy is accompanied with 0.47-point percentage decrease in hours spent by rural women on unpaid care work which is significant at 1 percentage level. The findings of the study are that electricity access is related with a

generous decrease in time spent on unpaid care work and this agrees with those found by the other authors Heltberg (2003) and Heltberg (2004). As well, Dinkleman (2011) finds that electricity access in KwaZulu-Natal triggered a decline in the time spent in unpaid care work like collection of wood. From table 3 above represents that one more year additional on the age of household is associated with 0.006-point percentage incline in the hours spent on unpaid care work which is significant at 1 percentage from table 3 reports that on more additional member on the total numeral of family unit members within household is associated with significantly incline of 0.18point percentage in the hours spent on unpaid care work which is significant at 1 percentage. Interestingly, from table 3 shows that when household lives in the rural location is associated with significantly increase of 1.3-point percentage incline in the hours spent on unpaid care work which is significant at 1 percentage, ceteris paribus hold.

4.2.2 Electricity access and income generating activity participation

Table 4: Electricity access and time spent in income generating activities

Variables	(1) Nonfarming	(2) Wage
Electricity access	0.256*** (0.055)	0.904*** (0.055)
Age of household head	-0.004*** (0.001)	-0.005*** (0.001)
Household size	0.044*** (0.007)	0.002 (0.007)
Gender of household head	1.270 (2.068)	0.424 (2.038)
Formal education of female	0.034 (0.028)	0.137*** (0.028)
Location(Rural)	-0.576*** (0.044)	-0.660*** (0.044)
Constant	-1.042 (4.139)	0.860 (4.080)
Observations	6,375	6,375
R-squared	0.072	0.169
Survey year FE	YES	YES

Source: Author's computation based on IHS data for (2010/2011) and (2019/2020) Robust standard errors in parentheses, *** 1 percentage, ** p<0.05, * p<0.1

From table 4 represents correlation between access of electricity and time spent in the income generating activities the results of our study have highlighted the change in the time hours spent in income generating activities like non-farm and salaried or wage activities among households with vs. households without electricity from the above table the households with electricity access is associate with increase of 0.26 points percentages in the time spent on the non-farming activities which is significant at 1 percentage while this is associated with an increase of 0.9 points percentage on time spent in salaried or wages activities which is significant at 1 percentage. This could be explained by improved and developed infrastructure which is followed by job creation through business creation which utilizes the electricity in addition to other electricity delivered services provided to general population where non-electricity users belong. The woman within household with electricity access is more like to spend the most of her time in income generating activity which mostly use electricity hence empowered through contributing to the total household income since the leads to the decreased numeral total hours over by that woman in different activities especially in non-income generating activities.

From table 4 represents that one more year additional on the age of household head is associated with a significantly decline of 0.004 point percentage on the time spent in non-farming activities which is significant at 1 percentage while this additional age of the household head is associated with the decrease of 0.005 points percentage on the time spent in salaried or waged activities which is significant at 1 percentage, whereas one additional member on the household members within household is associated with a significantly increase of 0.044 point percentage on the time spent in non-farming activities which is significant at 1 percentage, worthwhile when the female household with a formal basic education is associated with a significantly incline of 0.14 points percentage on time spent on salaried or waged activities which is significant at 1 percentage, while when the household lives in the rural location is surprisingly associated with a significantly decline of 0.58point percentage on time spent in non-farming activities which is significant at 1 percentage and this is also associated with a significant decrease 0. 66-point percentage in time spent in the salaried or waged activities which is significant at 1 percentage hence the above outcomes give proof that accessing power positively affects all indicators for women's empowerment, *ceteris paribus* hold.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

This study examines at the causal connection between admittance to electricity and women' strengthening utilizing an enormous gender disaggregated panel data collection from Malawi. It shows that women in the households with access to electricity will not focus only in domestics activities such as cooking, raising kids, etc. she will be able to go and work outside home in other generating income activities such as hairdressing, phone charging, ironing services, etc. she will also benefits having electricity in her home and find time to do extra hours and educating her children, by using phone and television she will get information easily and find time for leisure and relaxation which will allow good communication between household members ,it will also save time for young ladies and ladies to seek after scholastic open doors as evidently the advancement of lady in Africa is altogether hindered by the overburden of home accomplishments The additional time could then be spent grinding away through independent work or job creation which will lead to her economic development, to her household member as well as to her community. Women empowerment is essential in our community because when is empowered the society will be empowered. The outcomes recommend that electricity access can be an essential policy lever for empowering females. Nevertheless, electrification alone is unlikely to guarantee markable improvement in important extents of females' empowerment, in certain, their decision-making ability and labour participation. Sustained efforts in improving women are earning opportunities, education, and labour participation for women empowerment; these empowering aspects can be improved in other ways above and beyond electrification. This study also suggests considering woman within household by providing electricity because there will be a big change after as seen in our results.

References

- D. Barnes and M. Sen,. (2004.). The impact of energy on women's lives in rural India. Washington D.C.: *The World Bank Energy Sector Management Assistance Programme (ESMAP), World Bank*, 1-15.
- WLSA Malawi, SARDC WIDSAA . (2005). *Beyond Inequalities 2005, Women in Malawi WLSA Malawi SARDC WIDSAA, Limbe and Harare* . Limbe and Harare : WLSA Malawi.
- Africa, P. (2019). *what power africa means for Ghana*. Accra: Power africa.
- Annecke, W. (2005). *Whose turn is it to cook tonight? Changing gender relations in a South African township*. . Collaborative Research Group on Gender and Energy (CRGGE)/the ENERGIA International Network on Gender and Sustainable Energy .
- Barnes, D. and M. Sen. (2003). *The Impact of Energy on Women's Lives in Rural India. Washington, D.C.: ESMAP World Bank Energy Sector Management Assistance Programme. Formal Report 276/04*. NewDelhi: ESMAP World Bank Energy Sector Management Assistance Programme.
- Bisika, T. Ntanta, P. Konyani, S. (2005). *Violence Against Girls and Education*. Zomba: A Research Commissioned By Action aid. Centre for Social Research, (CSR) .
- Cecelski, E. (2005). Energy, Development and Gender: Global Correlations and Causality. *LeMalawian Kwachaen: ENERGIA.*, 1-26.
- Clancy, J., M. N. Matinga, S. Oparaocha, and T. Winther. (2017). “Social Influences on Gender Equity in Access to and Benefits from Energy.” . *World Bank*. Accessed 4 May 2017.
- Daka, K.R., Ballet, J., . (2011.). Children's education and home electrification: A case study in northwestern Madagascar. *Energy Policy*, 39,, 2866–2874.
- Dinkelman, T. (2011). “The Effects of Rural Electrification on Employment: New Evidence from South Africa.”. *American Economic Review* 101 (7): . doi:10.1257/aer.101.7.3078, 3078–3108.
- Dinkelman, T. (2011.). The Effects of Rural Electrification on Employment: New Evidence from South Africa. *American Economic Review* 101(7) , 3078–3108.
- Duflo, E. (2012). Women Empowerment and Economic Development. *Economic Literature*, 50(4) : , 1051-1079.
- Grogan, L., and A. Sadanand. . (2013). . “Rural Electrification and Employment in Poor Countries: Evidence from Nicaragua.” . *World Development* 43 (C):, 252–265.
- Heltberg, R. (2004). . “Fuel Switching: Evidence from Eight Developing Countries.”. *Energy Economics* 26 (5): 7 doi:10.1016/j.eneco.2004.04.018, 869–88.
- Jensen, R., and E. Oster. . (2009.). “The Power of TV: Cable Television and Women's Status in India.”. *The Quarterly Journal of Economics* 124 (3): doi:10.1162/qjec.2009.124.3.1057., 1057–1094.
- Kelkar, G., and D. Nathan. (2005.). “*Gender Relations and the Energy Transition in Rural Asia*.” *Report to DFID, KaR R 8346: Gender as a key variable in energy*. New Delhi:. new delhi: UNIFEM, South Asia Regional Office.
- Khandker, S. R., H. A. Samad, R. Ali, and D. F. Barnes. . (2014.). “Who Benefits Most from Rural Electrification? Evidence in India. *Energy Journal* 35 (2): . doi:10.5547/ISSN0195-6574-EJ, 75–96.
- La Ferrara, E., A. Chong, and S. Duryea. . (2012.). “Soap Operas and Fertility: Evidence from Brazil.” . *American Economic Journal: Applied Economics* 4 (4):., 1–31.

- Matinga, M. N., and H. J. Annegarn. (2013). "Paradoxical Impacts of Electrification on Life in a Rural South African Village." *Energy Policy* 58: . doi:10.1016/j.enpol.2013.03.016., 295–302.
- Millinger, M., Marlind, T., Ahlgren, E. O. (2012). Evaluation of Indian rural solar electrification: A case study in Chhattisgarh. *Energy for Sustainable Development* 16(4), 1-13.
- Panjwani, A. (2013). Energy as a Key Variable in Promoting Gender Equality and Empowering Women: A Gender and Energy Perspective on MDG #3. http://r4d.dfid.gov.uk/PDF/Outputs/Energy/R8346_mdg_goal3.pdf (2013-05-06). Discussion Paper.
- Patton, M. Q. (2001). *Qualitative Research and Evaluation Methods*. 3rd ed. London: . Sage Publications.
- Salehi-Isfahani, D., and S. Taghvatalab. (2014.). "Rural Electrification and Female Empowerment in Iran: Decline in Fertility." *IIEA Annual Conference, Boston College, October 2014*. Boston: Boston College.
- Samad, Hussain, and Fan Zhang. . (2017). Heterogenous Effects of Rural Electrification: Evidence from Bangladesh. *World Bank Policy Research Working Paper 8102...* Washington D.C.
- Semu L., G. Kamchedzera, and N, Ngwira,. (2004). *Strategic Gender Assessment*. . UN/World Bank .
- Skutsch, M. M. (2005.). "Gender Analysis for Energy Projects and Programmes." *Energy for Sustainable Development* 9 (1) 37–52. doi:10.1016/S0973-0826(08)60481-0., 37–52.
- Solar Sisters. (2019). *Light the Way: Outcomes is Solar Sister's annual review of our goals and impact, and our future strategic plans*. Washington D.C: solar sisters.
- Standal, K. (2010.). Giving light and hope in rural Afghanistan: Enlightening women's lives with solar energy. *Lampert Academic Publishing*.
- Standal, K., and T. Winther. . (2016). "Empowerment through Energy? Impact of Electricity on Care Work Practices and Gender Relations." *Forum for Development Studies* 43 (1): . doi:10.1080/08039410.2015.1134642., 27–45.
- Standal, K., and T. Winther. . (2016.). "Empowerment through Energy? Impact of Electricity on Care Work Practices and Gender Relations." *Forum for Development Studies* 43 (1): doi:10.1080/08039410.2015.1134642, 27–45.
- Van de Walle, D. M. (2015.). "Long-Term Gains from Electrification in Rural India." *The World Bank Economic Review* . doi:10.1093/wber/lhv057, 1–36.
- Winther, T. (2014.). "The Introduction of Electricity in the Sundarban Islands: Conserving or Transforming Gender Relations?" In *Women, Gender and Everyday Social Transformation in India*, edited by K. B. Nielsen and A Waldrop, 47–61. London: Anthem Press., 47–61.

Appendices

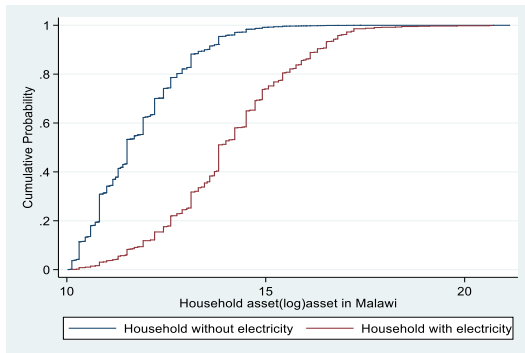


Figure 2: Cumulative probability distribution of annual asset and electricity access

Notes: the cumulative distribution is drawn across all regions in Malawi using IHS 2010-2019

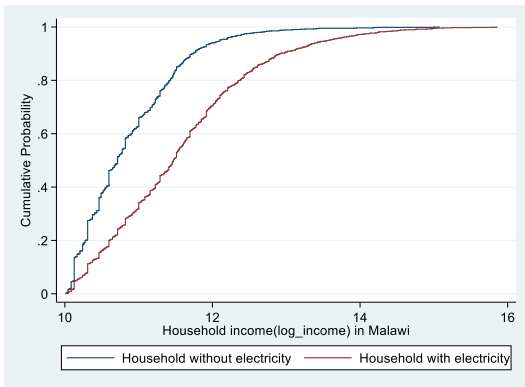


Figure 3: Cumulative probability distribution of annual income and electricity access

Notes: the cumulative distribution is drawn across all regions in Malawi using IHS 2010-2019

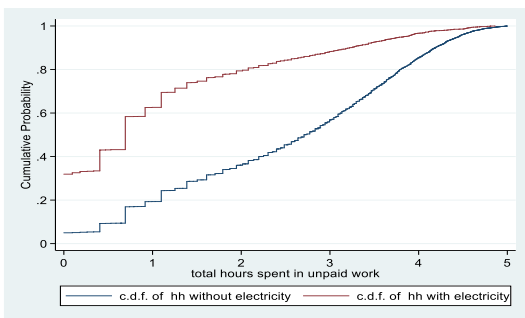


Figure 4. Cumulative probability distribution of annual hours spent in unpaid work and electricity access

Notes: the cumulative distribution is drawn across all regions in Malawi using IHS 2010-2019

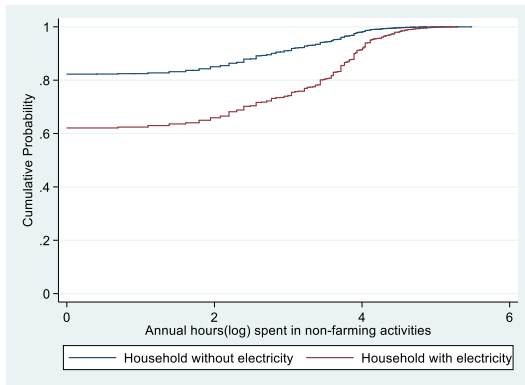


Figure 5. Cumulative probability distribution of annual hours spent in non-farming activities and electricity access

Notes: the cumulative distribution is drawn across all regions in Malawi using IHS 2010-2019

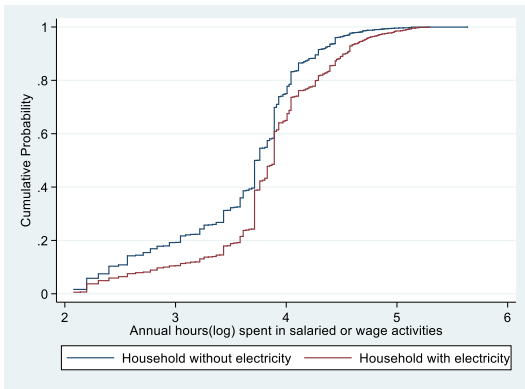


Figure 6. Cumulative probability distribution of annual hours spent in salaried or wage activities and electricity access

Notes: the cumulative distribution is drawn across all regions in Malawi using IHS 2010-2019