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Awareness level and the adoption of solar power home systems among the residents of Kipkelion West Sub County, Kericho County, Kenya

Author: [1]Susan Chepkemoi Rotich, [2]Mary Mutisya and [3]Elijah Macharia Ndung'u
[1,2&3]The Catholic University of Eastern Africa. **Website:** www.cuea.edu
Correspondence: Susan Chepkemoi Rotich. **Email:** susanrotich12@gmail.com

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Abstract: *Solar energy is a source of energy that has recently seen an increase in use and adoption by Kenyan consumers as a source of clean and climate-friendly energy. The purpose of this study was to understand the awareness level on the adoption of solar power home systems among the residents of Kipkelion West Sub County, Kericho County, Kenya. The study was guided by diffusion innovation theory and utilized explanatory sequential research design. Multistage, purposive, stratified and simple random sampling techniques were employed to select a sample of 407 from a target population of 24688 households. A semi-structured questionnaire and interview schedule was used to collect data, and quantitative data was analyzed using statistical techniques with the help of SPSS software, version 24. Qualitative data was analyzed using verbatim and summarized according to themes. The analyzed quantitative data was presented in the form of tables, bar charts and graphs. Findings from the study revealed that, increase in adoption rates is directly associated with heightened awareness, which is achieved through the implementation of campaigns, seminars, and workshops. Additionally, the availability of solid local support played a crucial role in facilitating the decision-making process. According to a local resident, the adoption of solar energy appeared to be the most viable remedy for their home due to the recurring power outages and escalating electricity expenses. The study findings may be used by Energy Solution companies and by Kenya Power Company as they seek to understand how to bridge the existing energy gap. The study can also be of importance to the Ministry of Forestry and Environment who may be looking at the ways of finding alternative sources of energy from bio-fuel to protect the environment.*

Keywords: *Awareness level, Solar energy, home systems, clean energy, climate friendly energy*

1.1 Study background

Energy access to the human being is a precondition requirement for development and welfare as well as successful economic development and job opportunity (UNEP, 2017). Mundaca and Samahita, (2020), looked at the socio-economic factors that caused the slow adoption of solar energy technology in Sweden. Solar home system is among the cleanest, accessed with low prices and abundant sources of energy with a minimum ecological and environmental hazard. In the global context, the share of

renewable energy in the production of power capacity grew to over 33% in 2018. From which hydropower accounted for about 60% of the production of renewable electricity. It is followed by wind power, solar PV, and bio power, which accounts for 21%, 9%, and 8% respectively (Ratur, 2019). International Energy Agency (IEA) defines access to energy as the ability of a household to obtain affordable, reliable, and clean energy for cooking and electrification (IEA, 2020). Many of the world's population, especially in developing countries, generate energy from solid fuel, which threatens the health of their citizens and that of the environment (Perera, 2018). According to Guta (2018), the world's population access to clean energy and technology increased by approximately 62 percent in 2019 from 56 percent in 2012. However, around 3.5 billion of the world's population uses technologies or systems that cause pollution to the environment. Universal access to affordable, reliable, sustainable and modern energy is clearly articulated in the United Nations Sustainable Development Goal (SDG), (Axon, & James, 2018). All countries are expected to adopt the objectives of this goal with the aim of mitigating climate change, ending world poverty and promoting a shared world prosperity (Han, Choi, Park, Lee, & Kim, 2014). Energy access is affected by many factors including the affordability and willingness to adopt the available energy solutions by human populations or communities and it is therefore, no wonder that an estimated 840 million people worldwide have no access to electricity with millions more having to live with unreliable or limited access. Close to three billion people use polluting fuels like wood and biomass to cook and heat their homes with the obvious consequences in air pollution and negative health impacts.

Around 3 million people in developing countries rely on natural gas, crude oil, solid fuels, animal waste, and charcoal for their daily use (WHO, 2016). Darin-Mattsson, Fors and Kåreholt, (2017) affirms that clean energy must be given serious attention for sustainable development goals to be attained. Access to electricity has become a significant challenge to around 2.5 billion people who live in the urban and rural areas whose income is below $1 a day. Due to the high cost of energy involved in acquiring electricity in developing nations, there is a need for the government to provide an alternative solution to curb this challenge (Lin & Kaewkhunok, 2021). Cheam, Lau, and Wei (2021) indicated that countries like Malaysia aims to achieve 20 percent increase in access to renewable energy by 2025. However, despite the government promoting renewable energy adoption, three-quarters of the electricity supply in the country is generated from fossil fuels; the development of solar power has been slow, and it is in its infancy posing a challenge of achieving this goal.

In Africa continent, about 48% of the population does not have electricity access by 2017, of which the largest share is Sub-Saharan Africa inhabitants, where 57% (about 602 million people) still live in dark (Ratur, 2019). The continent also has a huge and abundant source of renewable energy. The capacity of the continent's annual solar radiation ranging from 5 to 7 kWh/M^2 (Brüderle, 2010). In Nigeria, Thompson, Ajiboye, Oluwamide, and Oyenike (2021), established that adoption of solar energy in the country was more expensive than fossil fuels when installation costs were considered. Lack of infrastructure of solar production and distribution, financial gaps for solar energy producers, and lack of solar energy innovations were the main challenges hindering access to solar energy in the country. Abdullahi, Suresh, Renukappa, and Oloke (2017), indicated that other developing counties in Africa could adopt solar energy as one of the sources of power because of the abundant sunshine in the countries. Despite the endowed natural resource, the governments have not realized the full implementation of solar energy because of a lack of technological know-how, political instability, and

inadequate research on solar energy initiatives. These barriers have contributed negatively to the power sector's failure in these countries.

Most rural populations in Malawi use paraffin (kerosene) for lighting and firewood for cooking (Coley & Galloway, 2020). According to Tenthani, (2012), solar energy plays a big role in combating climate change as well as helping in easing the burden on the Electricity Supply Commission of Malawi (ESCOM) Company, the only provider of hydropower in the country. In Uganda's 26% population had access to grid electricity. World Bank report (2019) indicated that the connectivity rate in the country increased to 55 percent in the urban population and about 10% in the rural areas. The increased access to electricity was attributed to the need to conserve the environment and improve livelihoods (Avellino, Mwarania, Wahab, & Aime, 2018). In Tanzania, the access rate to Grid-energy was 32.7% in 2017. The country's electricity supply company (UNESCO) has been mandated to increase the generation and distribution of power in rural areas to enhance economic growth, improve the living standards of marginalized people and reduce migration to urban centers. The company also aims to reduce overreliance on firewood and charcoal to protect the environment (Simpson, Rabenold, Sowman, & Shearing, 2021). However, the slow pace in adopting off-grid energy solutions in both countries has been attributed to insufficient infrastructure and technological challenges. In Kenya, the path to clean and affordable energy is contained in the national strategy that aims to increase access to energy to all citizens by 2020 (World Bank, 2020). According to George, Boxiong, Arowo, Ndolo, and Shimmon (2019), Kenya has the highest access to the grid and off-grid electricity in East Africa, with a total access of 75%. The increased uptake of off-grid power in Kenya has been attributed to several factors, such as the availability of affordable solar panels, costly fossil fuels, and instability of wind and hydro-power generation. Off-grid power generation has been recognized as the next frontier for renewable energy in the country (Rodl & Patner, 2016).

According to Day (2010), by 2015, the gap for access to reliable energy was at 23%. Therefore, there is a need for the government of Kenya to look for an environmentally friendly and cost-effective alternative sources of energy that will be sustainable in urban and rural areas. These studies have not exhaustively evaluated Socio-economic factors that may influence the adoption of solar home system, thus leaving a research gap in this area. Only 11% of residents in Kericho County use electricity as their main source of lighting. A further 51% use lanterns, and 35% use tin lamps. Less than 1% use fuel wood. Ainamoi Sub-County has the highest level of electricity use at 25%. That is 24 percentage points above Kipkelion West Sub-County, which has the lowest level of electricity use which is more expensive compared to solar home systems (Ngugi, Kipruto & Samoei, 2013). Therefore, the current study sought to analyze the socio-economic factors influencing adoption of solar energy by households in Kipkelion West Sub County, Kericho County, Kenya.

1.2 Statement of the Problem

Solar home system is among the cleanest, accessed with low prices and abundant sources of energy with a minimum ecological and environmental hazard (Kusch-Brandt, 2019). Lighting is still one of the most expensive expenses for households that do not have access to electricity (Oum, 2019). Households are estimated to spend 25-30% of their family income on kerosene for lighting and cooking, amounting to approximately US$ 36 billion per year (Pode, 2013). The low adoption rate of solar home systems in Kenya can be attributed to several factors, including high upfront costs, limited financing alternatives, insufficient consumer education, perceived technical complexities, distribution network and post-sales

assistance challenges, the availability of grid-connected electricity, and governmental incentives favoring conventional energy sources. The impediments that hinder the widespread adoption of solar technologies have the effect of diminishing the potential benefits that households could potentially derive from them. The objective of this study was to examine the correlation between the adoption of solar household systems and the degree of public awareness. The literature pertaining to the uptake of solar home systems in Kenya is deficient in providing a thorough examination of this phenomena and especially in the study area. Furthermore, there is a lack of sufficient attention given to the difficulties encountered by households residing in Kipkelion West Sub County. The present study aims to fill a notable gap in the existing knowledge regarding how awareness level affects the adoption of solar home systems in Kipkelion West Sub County. This area is known for its scarcity of resources, low levels of formal education, and limited access to financial services, which sets it apart from other regions. The present study aims to contribute to the current body of knowledge on the utilization of renewable energy sources, specifically solar technology, and provide significant insights for policymakers, energy providers, and other relevant stakeholders. The study's results are expected to offer valuable recommendations to enhance the adoption of solar technology in underdeveloped regions.

1.3 Study Objective

The study was guided by this objective: To determine the influence of the awareness level of residents on the adoption of solar energy home system in Kipkelion West Sub County, Kericho County, Kenya

1.4 Justification of the Study

Adoption of solar home system is important in enhancing sustainable development of technology, and poverty alleviation. Understanding the importance and adoption of solar home system will address three of the pillars which include, manufacturing, affordable housing, and food security and thus more focus and investments need to be dedicated to adoption of solar home system.

1.5 Significance of the Study

Conducting a study on the influence of awareness on adoption decisions in Kipkelion West, Kericho, yielded significant insights into the efficacy of information dissemination and educational initiatives. The findings of this study may guide the development of awareness-raising strategies tailored to the specific needs of residents, thereby increasing adoption rates and promoting sustainable energy practices. It is vital to recognize the obstacles encountered by households in the adoption of solar home systems, as this is crucial in overcoming barriers and facilitating extensive adoption. The findings of this study may inform the development of targeted support programs, financial incentives, and educational initiatives to overcome these challenges and facilitate the adoption of solar home systems in Kericho.

1.6 Scope and Delimitation of the Study

The study covered only Kipkelion west Sub-County rural households and targeted a sample of 407 households drawn from a population of 24,688 households in Kipkelion west Sub-County. Data was collected from household heads as respondents. The study delimited itself to only to Kipkelion West Sub County. Unavailability of solar panel could be a problem facing the whole country but the study was only limited to only Kipkelion West Sub County.

1.7 Conceptual framework

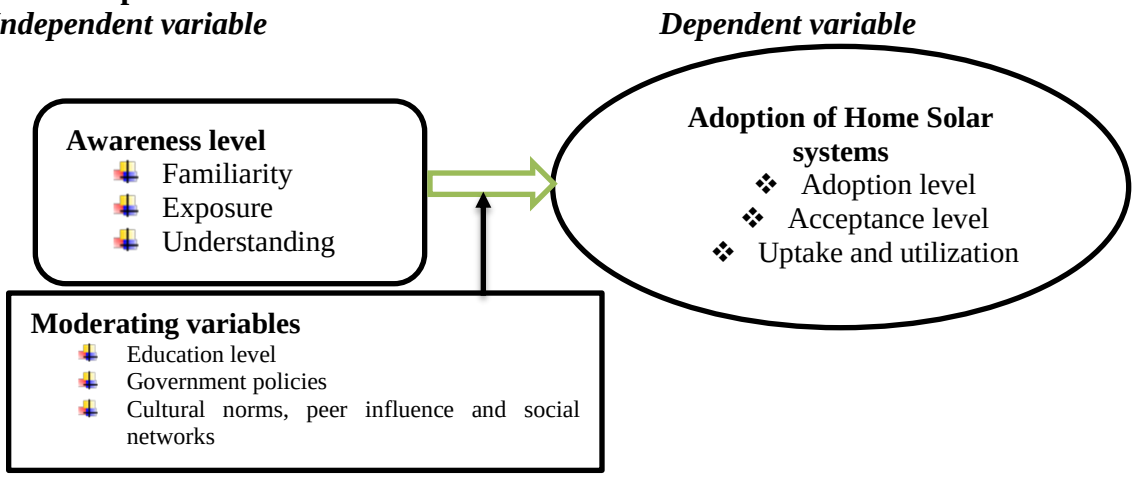

Figure 1: Conceptual framework
Source: Own conceptualization, 2023

1.8 Literature review

This section presents the theoretical framework and empirical review on the influence of the awareness level of residents on the adoption of solar energy home system in Kipkelion West Sub County, Kericho County, Kenya.

1.8.1 Theoretical review

This study was guided by diffusion of innovations theory which Rogers (1995) suggested. The adoption and diffusion of novel concepts within a social system are examined by this theory. It takes into account a number of theoretical ideas, presumptions, and claims that can clarify how socioeconomic circumstances affect adoption decisions. The innovation itself, communication routes, social networks, adopter categories, and the adoption process are some of the theoretical elements that make up the Diffusion of Innovations Theory. In this scenario, solar home systems would be the new concept, technology, or technique that is being used. The mechanisms by which news about the innovation is spread, such as the mass media, interpersonal contact, or social media, are referred to as communication channels. The dissemination process depends heavily on social networks because people are impacted by the connections and ties they have with others. From innovators to laggards, adopter categories group people based on their inventiveness and readiness to adopt. There are multiple steps to the adoption process, including knowledge, persuasion, decision, implementation, and confirmation.

According to the Diffusion of Innovations Theory, certain aspects of the innovation itself, the channels through which information is received, and the social context in which the adoption choice is made all have an impact on how quickly an innovation is adopted. The importance of relative advantage (the perceived superiority of the innovation over existing alternatives), compatibility (the fit between the innovation and the adopter's values and needs), complexity (the perceived difficulty of adopting and using the innovation), trial ability (the ability to experiment with the innovation before making a full

commitment), and observability (the visibility of the innovation and its outcomes), are just a few of the propositions that are put forth. The Diffusion of Innovations theory's applicability in comprehending the uptake of solar household systems is supported by empirical data. The adoption of solar energy technology is highly influenced by socio-economic factors as income level, education, and social influence, according to studies by Karatas and Dincer (2019) and Adu-Manu et al. (2020). Relative benefit and compatibility, two theory components, have been demonstrated to be crucial in influencing people's attitudes and intentions about the adoption of solar home systems.

There are various advantages to the Diffusion of Innovations idea. It offers a thorough framework for comprehending the diffusion process and the variables affecting the uptake of innovations. The theory offers a comprehensive understanding of adoption behavior by taking into account how social networks, communication channels, and individual-level factors interact. It has been widely used in many different sectors and has a strong empirical base for its claims. The theory does, however, have limitations. It may not adequately convey the complexities of adoption decisions in particular situations because it largely concentrates on the dissemination process. The theory's focus on social influence and the importance of interpersonal communication may obscure the impact of other socioeconomic elements that are essential for the adoption of solar home systems, including legislative backing, financial incentives, and infrastructural accessibility. Furthermore, the theory does not specifically address the potential obstacles and difficulties that people can encounter when embracing an invention, such as up-front expenses or technological challenges.

There exists a gap in the research when it comes to the application of the Diffusion of Innovations Theory's examination of the impact of institutional and policy factors on the uptake of solar household systems. According to Musa et al. (2019) and Kanyarusoke & Flötten (2018), the theory concentrates on social aspects, communication channels, and innovative features but may ignore the influence of outside factors like governmental support, market conditions, and infrastructure development. Further investigation is required to determine how adoption behavior in the context of solar household systems is impacted by these external influences.

1.8.2 Empirical review

Awareness of Solar Systems in Homes

The level of awareness highly determines the possibility of household adoption of solar home system (Naomi, 2014). Hence, an adequate level of awareness and correct information should be provided to bring a better understanding of both benefits and disadvantages of renewable technology (Rashid, 2012). Lack of adequate information of households on the negative health outcomes associated with the inefficient combustion of solid fuels impedes the growth of market demand for clean energy (Beyene, 2018). The adoption of innovations describes a point in time when the adopter of an innovation decides to use the innovation in question. Rogers (2003) theories that the process of adoption commences with an individual driven by precedent conditions such as a felt need to adopt an innovative product or service. The individual will pass along an innovation decision process at a pace that is influenced by their own level of innovativeness and by the perceived characteristics of the innovation. The decision making process is aided by communication channels; either mass-media communications or by local channels such as word-of-mouth.

Pandey and Kesari (2017) did a study of the factors affecting willingness of rural households to adoption of solar lighting system in Jharkhand, India. A survey of 462 households was done in different districts of Jharkhand. Nine hypotheses were formulated on the basis of literature study. A binary logistic regression model was structured to test the data by SPSS software package. The result of the study shows that more than 70 percent household were willing to adopt the solar lighting system but they are facing the hindrances of lack of awareness. The results further indicated that awareness was significant at 95% confidence level with a p value of 0.001 which strongly support that awareness about the product led to the increase in willingness of households. Information regarding the specification, use method, details about the service and maintenance, benefit of the product. The above study was done in India which is a developed country while the current study was done in Kenya which is a developing nation.

A study done by Azeru (2020) on factors influencing household adoption of solar home system in Baso Liben District, Amhara Regional State of Ethiopia. The data used for the econometric model was collected from randomly selected 228 adopters and 143 non-adopter households. The logistic regression model was applied to examine the factors affecting household adoption of solar home system. Media accesses found to have a positive influence on solar home system adoption at a statistically significant level ($P<0.01$. The odd ratio indicated that households who accessed with media are more likely to adopt solar by a factor of 6.242 ($P<0.01$) than those who haven't any media access. The Wald statistics (7.155) also indicated the strong significant association between media access and solar home system adoption. This reveals that, most of the rural households use radio as a source of new information about new technologies and ideas promptly. The result is consistent with Abera (2019), who indicated that access to modern communication technologies such as radio has a positive influence on the adoption of modern and clean energy technologies. The descriptive research design was applied to examine the factors affecting household adoption of solar home system the current study employed multistage sampling to select 407 households in Kipkelion West Sub County.

The study by Keriri (2013), on factors affecting adoption of solar home system in Kenya, revealed that there was a positive relationship between solar home system adoption and either formal or informal Training delivered to make sure people are aware of solar home system. The study used the multiple linear regression and descriptive statistic in its methodology. Access to training was found to have a positive influence on solar home system adoption at a statistically significant level ($P<0.01$). The odd ratio indicated that the adoption of respondents who have been accessed with training is higher by the factor of 17.949 ($P<0.01$) than those who haven't been accessed. The Wald statistics (49.899) also showed a highly significant association. This implies that as households got training about the use of the solar home system, the probability of their adoption increase. This means training removes their previous doubt about the technology and ensures their ability to decide whether to accept or reject it in a reasonable manner. The study by Kereri (2013) used multiple linear regression and descriptive statistics while the current study used descriptive statistics in data analysis.

Another study by Mukami, (2016) on the level of solar energy technology adoption within Kiambu County in Kenya. The study adopted a stratified random sampling method targeted 12 Constituencies whereby a sample size of 500 households was used. The study also adopted a descriptive survey design. Both qualitative and quantitative approaches were used to analyze the data collected. From the study findings, the researcher concluded that the people of Kiambu County have not adopted much to Solar

Energy Technology, a factor that can be attributed to the fact that there has not been any formal or informal training on solar energy technology use which resulted to the level of knowledge and awareness of solar energy and its use being relatively low. The level of knowledge and awareness from the individuals who had installed solar system in their household, had seen a solar lamp in use, had seen solar power in use, were aware of solar technology providers and had received informal training which influenced the adoption of the technology. The study also concludes that lack of information on financing opportunities influenced the adoption of solar technology as it was perceived to be expensive by most respondents. The current study employed Explanatory Sequential research design and used a sample size of 407 respondents.

Several key factors can be attributed to the low uptake of solar home systems in Kenya. The acquisition and installation expenses of solar systems present significant challenges for many households, particularly those with restricted financial means (IEA, 2020). This constitutes the primary concern. According to Musa et al. (2019), the financial resources required for the installation of solar solutions often surpass the financial means of low-income households, thereby posing a challenge to their adoption of such solutions. Lack of adequate financing alternatives constitutes a significant impediment to the extensive integration of solar home systems in Kenya, as noted by Musa et al. (2019). According to IRENA's report in 2020, a significant number of households face a challenge in accessing affordable credit or loans that offer favorable terms to facilitate the acquisition of solar systems. The lack of dedicated financial mechanisms tailored for renewable energy solutions poses a hindrance to their affordability and impedes the adoption of solar technologies, as noted by the George et al., (2019).

The low adoption rate of solar home systems can be attributed, in part, to inadequate consumer awareness and information regarding their benefits and availability, as noted by Musa et al. (2019). According to IRENA's report in 2020, a significant number of households remain uninformed about the potential long-term cost savings, enhanced energy accessibility, and environmental benefits that can be derived from utilizing solar energy. The absence of information dissemination and educational campaigns pertaining to solar technologies exacerbates the lack of awareness among prospective consumers, as noted by Musa et al. (2019). The adoption of solar home systems is hindered by various challenges encountered in distribution networks and after-sales support. According to a report by the International Renewable Energy Agency (IRENA) in 2020, the confidence of consumers in investing in solar technologies is being undermined due to the scarcity of certified vendors, trained technicians, and authentic product warranties. The accessibility and reliability of solar products are hindered by inadequate distribution infrastructure and after-sales services, as noted by George et al., (2019). The adoption of solar power is hindered by the presence of grid-connected electricity and government subsidies for conventional energy sources, as noted by Musa et al. (2019). In certain regions where grid electricity is easily accessible, certain households may opt to depend on the pre-existing infrastructure instead of investing in autonomous solar systems (IEA, 2020). According to GOK (2019), the provision of government subsidies and incentives for conventional energy sources may diminish the motivation of households to transition to solar power. Comprehensive measures are required to tackle these challenges and facilitate the adoption of solar home systems in Kenya, IRENA (2020) and GOK (2019).

1.9 Research design and methods

The research design employed in this study involved the use of an Explanatory Sequential Design and mixed-methods framework to examine how awareness level affect the adoption of solar home systems in Kipkelion West Sub-County, located in Kericho County, Kenya. The study was done in Kipkelion West Sub County, Kericho County, Kenya. The sub-county is divided into four wards; Kunyak ward, Kipkelion ward, Chilichila ward, and Kamasian Ward. According to the KNBS (2019), the sub-county has a population of 56,058, with an average household size of 4 individuals. Kipkelion West Sub-County has been purposely selected for the study because it is one of the densely populated sub-county with poor electrical power connectivity (appendix 5). The population growth rate in the county is 2% higher than the country's average growth rate (KNBS, 2019). The target population for the study comprised of the 24,688 Households (KNBS, 2019) in Kipkelion west sub-county. In addition, 12 key informants were purposively selected for the study. This study was concerned with the adoption of solar especially in households.

Sampling Procedure and Sample Size

All the households in Kipkelion west Sub County were included and members who are visitors to Kipkelion west Sub County. This study employed multistage sampling procedure whereby purposive, stratified and simple random sampling techniques were used. In the first stage, stratified random sampling procedure was used to obtain the sample of households in Kipkelion West Sub County. The study area has four administrative wards (Chilchilla, Kipkelion, Kunyak and Kamasian), which formed the four strata for this study. In each ward, a proportionate size sampling procedure was used to select respondents for the study. The number of respondents shall be selected as follows: in Chilchilla ward 104 respondents, Kipkelion ward 112 respondents, in Kunyak ward 95 respondents while Kamasian ward gave 96 respondents. Thereafter, a list of households from each ward was obtained from the County commissioner's office. A multi-stage stratified random sampling technique was used to select sites for the study. In the first stage, for the selection of study regions, keeping in view that these wards have many households. In the second stage, two divisions were randomly selected from each ward. One division is administratively subdivided into parts that are called locations. In the third stage, two sub-locations were selected from each location by using stratified sampling. In the fourth stage, two villages were randomly selected from each sub-locations. In the fifth and last stage, 407 households in total were randomly selected. The names of the households in the lists was first serially numbered and then randomly ordered and picked using a simple random sampling technique. This technique gave each household an equal opportunity of being selected and therefore, this increased the chances of obtaining an appropriate and representative sample size. The study used Yamen's (1974) formula in calculating the appropriate sample size. This is given by the formulae;

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{24{,}688}{1 + 24\ 688(0.05)^2}$$

$n = 407$

Hence with target population of a sample of 407 is appropriate. The study allows proportional allocation

$$n_{i=}\left(\frac{Ni}{N}\right)Xn$$

based on the equation,

$$n_{i=}\left(\frac{Ni}{N}\right)Xn$$

Where

$n_{\ i=proportion\ in\ the\ category\ i\ (where\ i=1,2,3\ and\ 4)}$

$N_{i=Total\ number\ of\ respondents\ in\ the\ category\ i\ (where\ i=1,2,3\ and\ 4)}$

Where n is the sample size.

$N_{i=Total\ number\ of\ respondents\ in\ the\ category\ i\ (where\ i=1,2,3\ and\ 4)}$

$N\ =\ Target\ populationN\ =\ Target\ population$

Therefore, from the above calculations, a total of 407 households formed the required sample size and was used for data analysis in this study. Household heads were interviewed; however, if the households head was not available, a spouse or a knowledgeable person of the household was interviewed.

Table 1: Sampling Frame have the formulas in black colour

Ward	**Household** $(N_i$ $(N_i$ $)$	**Illustration** $n_{i=}\left(\frac{Ni}{N}\right)Xn$	$n_{i=}\left(\frac{Ni}{N}\right)Xn$	**Sample Size** $n_i n_i$ $(\quad)$
Kipkelion	6,293	$n_{1=}\left(\frac{6293}{24688}\right)X407$		104
Chilchila	6,778	$n_{2=}\left(\frac{6778}{24688}\right)X407$		112
Kamasian	5,766	$n_{3=}\left(\frac{5766}{24688}\right)X407$		95
Kunyak	5,851	$n_{4=}\left(\frac{5851}{24688}\right)X407$		96

Total	**24,688**	$n=\left(\frac{24688}{24688}\right)x407$	**407**

Source: Field data, 2023

In addition to the sampled respondents, the study randomly chose three residents per ward, resulting in twelve in total for interviews using interview schedule. This study used both primary and secondary data sources. Primary data was collected directly from the household heads through personal interviews. Secondary data was collected through a literature review. A review of various reports such as from Ministry of energy annual reports, published theses and economic journals, economic surveys, statistical abstracts, conference reviews, books, magazines, national and county development and strategic plans, National Bureau of Statistics publications, desktop literature, and the internet sources. In this study, primary data was collected directly from the respondents using a questionnaire and interview schedules. A questionnaire was developed and used to collect data from households in Kipkelion west Sub-County. Data were collected from samples of households. The structured questionnaire was administered to the respondents through face to face interviews by the researcher. The items in the questionnaire was derived from the four specific objectives of the study. Letter seeking authorization for data collection from the university was obtained from the CUEA Board of Graduate Studies, which issued a letter introducing the researcher as a postgraduate student at the school. The initial letter was utilized to seek research permit from the National Commission for Science, Technology, and Innovation (NACOSTI). Data analysis includes editing, coding, classification, tabulation, and graphical presentation (Hall, 2010). In order to maintain consistency and accuracy, the research data were edited to make it clear and unambiguous. Reducing large amounts of data to manageable sizes, producing summaries, searching for patterns, and using statistical techniques are typical data analysis tasks. Upon receipt of the filled interview scripts initial screening of data began by sorting, coding and cleaning. Incomplete data sources were discarded. The questionnaires were numbered and coded using a coding frame ready for entry and analysis. For the determination and description of elements of independent variables on the dependent variable, descriptive statistics was used and results were presented in form of means, standard deviations, and frequencies. Editing, organizing and analysis of data collected was done with the aid of Ecxel and SPSS. The qualitative data was analyzed using content analysis. Interviews were conducted using a guide, aligned with the Explanatory Sequential Design. The data was then transcribed and thematically coded. Distribution tables were used to present the analyzed data.

Ethical Consideration

In social science research, it is important to recognize the rights and responsibilities of participants during data generation. In this study, the researcher shall inform the participants about the intention of the research, its potential benefits to the wider society and on their right to choose whether to participate or not. The respondents were informed that their responses shall only be used for academic purposes and were required not to write their names for anonymity purposes. During the consent process, the researcher shall clearly explain all issues related to confidentiality. Furthermore, respondents were given the assurance of anonymity, strict confidentiality of the information they provide, and the right to withdraw from the data collection process at any time without being charged.

1.10 Data presentation and discussion

Data collection response rates

This study issued questionnaires to collect data from 407 respondents and interviewed 8 households to conform to Explanatory Sequential research design. Data was gathered across these wards, ensuring representation from every corner. The feedback from 104 participants in Kipkelion, 112 in Chilchila, 95 in Kamasian, and 96 in Kunyak provided a comprehensive view, leading to a cumulative total of 407 participants. Insights from this data will further detail the factors affecting solar home system adoption in Kipkelion West Sub-County.

Gender demographic

The analysis of the gender distribution among respondents from the four wards, namely Chilichila, Kamasian, Kipkelion, and Kunyak, yields the findings illustrated in Table 2.

Table 2: Gender demographic

Ward	Female	% Female	Male	% Male	Total
Chilichila	24	25.30%	71	74.70%	95
Kamasian	26	27.10%	70	72.90%	96
Kipkelion	22	19.60%	90	80.40%	112
Kunyak	25	24.00%	79	76.00%	104
Total	97	23.80%	310	76.20%	407

Source: ***Field data*****, 2023**

Findings from Chilichila ward indicated that, a total of 95 participants were surveyed. Among these respondents, 24 individuals (25.3%) identified as female, whereas a substantial majority of 71 participants (74.7%) identified as male. In the Kamasian study, a sample of 96 participants was examined. Among these participants, 26 individuals (27.1%) identified as female, while the remaining 70 individuals (72.9%) identified as male. In the Kipkelion region, the survey recorded the highest level of participation, with a total of 112 respondents. The data revealed that out of these respondents, only 22 individuals, accounting for 19.6% of the total, identified as females. In contrast, the majority of respondents, comprising 90 individuals or 80.4% of the total, identified as men. Finally, in the Kunyak study, there were a total of 104 participants, out of which 25 were identified as females, accounting for approximately 24% of the sample. On the other hand, the male participants were 79, constituting approximately 76% of the whole sample from the ward. Upon considering the comprehensive perspective, it is observed that among the 407 respondents encompassing all wards, the female population constituted 97 individuals, or approximately 23.8% of the total. The male participants exhibited a significant majority, comprising around 76.2% of the total sample size, which amounted to 310 individuals. These findings imply that men are more active than women in engaging in development activities, due to the fact that majority of the respondents were male.

Level of Education

Based on data collected from the field in 2023, the educational landscape of those interviewed exhibits diverse degrees of achievement among those interviewed as illustrated in Table 3.

Table 3: Level of Education

Ward	College	None	Primary	Secondary	Total
Chilichila	10 (10.5%)	13 (13.7%)	44 (46.3%)	28 (29.5%)	95

Kamasian	8 (8.3%)	16 (16.7%)	46 (47.9%)	26 (27.1%)	96
Kipkelion	8 (7.1%)	18 (16.1%)	59 (52.7%)	27 (24.1%)	112
Kunyak	8 (7.7%)	21 (20.2%)	54 (51.9%)	21 (20.2%)	104
Total	34	68	203	102	407

Source: *Field data*, 2023

Chilichila Ward, comprising 95 participants, exhibited educational attainment rates of 10.5% at the college level, 13.7% without formal schooling, 46.3% at the primary level, and 29.5% at the secondary level. In the nearby vicinity, a study conducted by Kamasian Ward involved a total of 96 participants. The findings revealed that 8.3% of the participants had attained a college-level education, while 16.7% had no formal schooling. Additionally, 47.9% of the participants had completed primary education, and 27.1% had achieved a secondary level of education. In a similar vein, the distribution of participants in Kipkelion Ward was observed, revealing that 7.1% were enrolled in college, 16.1% had not received any formal education, a significant majority of 52.7% had completed primary education, and 24.1% had attained secondary education. The data presented by Kunyak Ward, which includes a sample size of 104 participants, indicates that 7.7% of the participants had attained a college-level education. Notably, a substantial proportion of 20.2% had no formal education, while the majority of 51.9% had completed elementary education. Additionally, an equal percentage of 20.2% had achieved a secondary level of education. Upon examining the collective data of all the wards, it becomes evident that primary education holds a prominent position, accounting for around 49.9% of the total 407 participants. The percentage of individuals who have completed secondary education is 25.1%, whereas 16.7% of the population has not received any formal education. Additionally, 8.4% of individuals have pursued higher education at the college level. The presented data provides a comprehensive overview of the educational structure of respondents in Kipkelion West Sub-County, which serves as a basis for the study's main goals. These results indicate that majority of the respondents across all the wards in Kipkelion West Sub-County have low level of education, since close to 50% (203) of all the respondents schooled up to primary level.

Level of awareness of solar home systems

The purpose of the study was to determine the extent to which awareness influences the adoption of solar technology in Kipkelion West Sub County, Kericho County, with a particular emphasis on solar residential systems. The findings are presented in Table 4.

Table 4: Awareness of solar home systems

Statements on awareness about solar home systems	1- SA	2 – A	3 – U	4 – D	5 – SD
I am competent and experienced with solar home systems.	35 (8.6%)	60 (14.7%)	87 (21.4%)	120 (29.5%)	105 (25.8%)
I am aware of the advantages and goals of adopting a solar home system.	75 (18.4%)	120 (29.5%)	62 (15.2%)	85 (20.9%)	65 (16%)
I am aware that solar household systems are available and in use.	100 (24.6%)	120 (29.5%)	90 (22.1%)	55 (13.5%)	42 (10.3%)
I have faith in my abilities to utilize and run a solar-powered home system.	82 (20.1%)	133 (32.7%)	61 (15%)	71 (17.4%)	60 (14.7%)
I'm likely to be considering installing a solar home system in my own home.	96 (23.6%)	137 (33.7%)	58 (14.3%)	64 (15.7%)	52 (12.8%)

Source: Field data, 2023

Understanding the role of awareness in influencing the adoption of solar technology in the area is the main goal of the study on the Level of Awareness of Solar Home Systems in Kipkelion West Sub-

County, Kericho County. The study reveals the breadth of knowledge and the possible receptivity to solar household systems by primarily drawing its sample from Kipkelion West Sub-County. The information acquired sheds light on a number of important topics. The fact that 29.5% of respondents confess they are ignorant of solar home systems reveals a significant knowledge gap. On the other hand, just 8.6% of respondents express considerable confidence in their industry expertise.
It's encouraging to see that almost half, or 48%, demonstrate knowledge of the benefits associated with implementing solar home systems. Looking more closely, the data shows that 54.1% of participants are knowledgeable of the availability and current use of solar household solutions, which represents a considerable increase in awareness. An overall percentage of 52.8% of the respondents are confident in their ability to run and maintain a solar system when it comes to practical application. This shows that there is a real sense of empowerment among the community to adopt this technology with the correct amount of information and training. Notably, the data also reveals a strong propensity towards the adoption of solar systems, with 57.3% of respondents saying they were thinking about doing so. The results of this study are consistent with those presented by Mwaura (2018), drawing comparisons with other scholarly publications. Their study supports the importance of awareness as a major factor in the uptake of solar technology, particularly in areas like East Africa. However, when we compare our findings to a study by Gupta (2017). A significant difference becomes apparent. His findings emphasize the importance of practical experience, which contrasts less with the findings of our study.

The outcomes from the key informant interviews were as follows: *Respondents R2, R4, and R8 expressed a consensus that their level of understanding regarding solar home systems plays a substantial role in shaping their inclination to embrace this particular technology. Participant R2 shown a comprehensive comprehension of the benefits associated with solar energy systems. Participant R4 exhibited awareness of the accessibility of such systems within their geographical region. Additionally, Participant R8 emphasized the significance of educational endeavors initiated by governmental bodies or organizations in promoting and nurturing individuals' interest in solar energy. The aforementioned responses are indicative of the findings obtained from the study, which demonstrate that the level of awareness and understanding pertaining to solar technology play significant roles in influencing its adoption. When considering levels of awareness, a wide range of diversity was identified. Certain participants had a high level of familiarity with solar home systems while others repossessed only a superficial understanding. A significant portion of participants lacked awareness regarding the existence of the system in their vicinity. Nevertheless, research confiorms that being exposed to educational initiatives led by the government or charitable organizations had a positive impact on individuals' comprehension.*

From the researcher’s point of view, the findings' key message, in sum, highlights the Kipkelion West Sub-County's thriving awareness landscape about solar household systems. While the majority applaud these systems' virtues and acknowledge their pervasiveness, there is a strong call for improved training and skill development. A rise in adoption may be sparked by well-planned campaigns and actions to create capacity, which are anchored by the community's clear propensity to consider system installations.

1.11 Conclusion

Based on the analysis of the first research question pertaining to the awareness level and the adoption of solar home systems in Kipkelion West Sub-County, it can be inferred that residents' degree of awareness on the adoption of solar home systems plays a pivotal role as a determining factor. The level of

inhabitants' knowledge and awareness regarding solar energy significantly influences their inclination and determination to embrace it. Regions that saw well-coordinated awareness campaigns and instructional initiatives demonstrated notably greater rates of adoption. Therefore, in order to promote greater acceptance and utilization, it is imperative to cultivate a climate that encourages well-informed comprehension.

1.12 Recommendations

The following recommendations are suggested:

a) The nearby educational institutions, in collaboration with the County Government should integrate renewable energy subjects and advantages into their curricula in order to provide the younger generation with vital knowledge, hence promoting greater acceptance and utilization in subsequent years.

b) The County Government in collaboration with solar providers should target regions that demonstrate limited levels of adoption. In addition, organizing workshops and seminars that focus on the community can effectively educate residents on the enduring economic and environmental benefits linked to solar household systems, while also debunking prevailing misconceptions.

c) There is need for establishment of partnerships between local governmental bodies and prominent solar technology firms, which can facilitate the introduction of state-of-the-art solar technologies that prioritize the needs and preferences of users in the region of Kipkelion. Additionally, the establishment of local service hubs dedicated to maintenance and the provision of spare parts would contribute to strengthening residents' confidence in these systems.

d) The study also recommends that the local non-governmental organizations together with the County Government should emphasize the establishment of solar farms or communal solar programs. In regions where conventional fuels such as wood or charcoal are prevalent, it becomes crucial to implement incentives that encourage households to transition towards solar solutions. This transition should emphasize the economic and environmental advantages of solar energy in comparison to traditional fuels.

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