

# Community Participation, Policy Framework and the Performance of Solar Energy in Kenya: A Case Study of Kalobeyei Ward in Turkana West Sub-County

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**Abstract:-** Understanding the dynamics solar energy transitions and the collaborative advantage of involving the communities in planning for sustainable energy in the local level can facilitate the steering of current and future global developments for clean energy solutions. This study investigated the relationship between community participation and policy framework on the performance of solar energy projects in Kenya. The key objective of this study were to investigate the relationship between community empowerment and policy framework on performance of solar energy in Kenya with focus on Kalobeyei Ward in Turkana West Sub-County. The research study used descriptive research and regression for the investigation. The target population of the study was 3200 households. Stratified Radom sampling was employed during the study with a sample of 320 household heads. A pilot study was conducted to test the accuracy of the research instruments to ensure reliability and validity of research data. Data was processed and analyzed quantitatively and qualitatively. Independent and dependent variables relationship was determined by use of multiple regression models using Statistical Package for Social Sciences (SPSS) version 20. Research findings were presented using graphs, pie charts and frequency tables. The inferential statistics used regression and correlation analysis. The findings indicated that there was a positive and significant relationship between community participation and policy framework on the performance of solar energy in Kalobeyei Ward. The study concluded that most of the respondents strongly agreed that in their area civic education was done to transfer and disseminate knowledge, skills, and values to general public and to promote solar energy project efficacy. The study also found out that there are Turkana County government has a directorate mandated to support public participation. The study established that community satisfaction surveys are important platforms to enhance the project performance and access achievement of the intended program to the beneficiary. The two variables studied only explain 57.8 percentage of the performance of solar energy as indicated by  $R^2$ . His means that 42.2% of solar energy is contributed by other factors not studied in this study. The study found out that public participation and policy framework contribute significantly to the performance of solar energy. The study concluded that the county governance structures should ensure that decisions made during public participation and are included in their plans and the county fiscal strategy paper. The study also concludes that the local government should also share the solar energy project indicators and project progress reports for the public to validate the success of failure of the projects. The study recommends that the there is need to ensure inclusivity and community empowerment during community

participation to ensure sustainability of the of solar energy projects. The government should also foster the use of Information and Communication technology (ICT) to expand democratic space for community participation in project design, implementation as well monitoring and evaluation of solar energy projects. Finally the study recommends that the community should be trained on aspects of community action planning and mapping to identify their needs and develop plans in a participatory process to address local challenges and contribute to renewable energy initiatives.

**Key Words:** Community, Empowerment, Feedback, Policy Framework.

## I. INTRODUCTION

Community participation is the process of engagement in governance in which people contribute and share control over priority setting, policy-making, resource allocations and access to public goods and services (World Bank, 2011). Community participation is seen as imperative improving performance, efficiency and effectiveness of decision making as it widens the knowledge base, stimulates creativity and creates social support for project initiatives.

Developing countries are increasingly adopting various types of community participation governance mechanisms – institutional arrangements that aim to facilitate the participation of ordinary citizens in the public policy process (Andersson & Laerhoven, 2007). They involve citizens in planning, decision-making about the allocation of public funds and the design of public policies, as well as in monitoring and evaluation (Speer 2012). In renewable energy governance, the community participation concept insists on being energy consciousness and literacy as well as sustainable development in energy practices. It also stresses that people can act as social and political actors, and that energy citizens can actively engage as individuals, for example through energy efficiency measures in households, or in larger collectives, for example through engagement in energy policy in climate activist groups.

*Global Perspectives on Community Participation in Solar Energy*

Community participation takes many forms. It can be indirect – in a representative democracy, elected officials and

government bureaucracies are expected to act in the interest of the citizens. Or participation can be direct, reflecting the view that citizens are own the government and should be involved in decision-making (Yang and Callahan 2005). Direct participation can be achieved through a number of approaches or mechanisms, such as e-petitions, public hearings, public ballots, public surveys, negotiated rule-making, and citizens' review panels (Pool, 2015).

The World Bank and the Institute of Economic Affairs looked at community participation as the process by which an organization consults with interested or affected individuals, organizations, and government entities before making a decision. They further view community participation as a two-way communication and collaborative problem solving with the goal of achieving better and more acceptable decisions (WB, 2015). It is widely believed that community participation contributes to better projects, better development and collaborative governance. Research has shown that community participation is, indeed, advantageous for the speed and quality of implementation of planning decisions. Most of the time however, when participation is wrong, democracy in a country also suffers greatly, leading to problems of disempowerment and lack of trust (Jancovich, 2015).

Tawiah, (2014) identified several barriers which are undermining the promotion of solar energy utilization in the Ghana. They included lack of governmental support, outdated energy policies, insufficient information and awareness creation. The study recommended that a more pragmatic approach and more relevant solar widespread strategy need to be adopted to assist the current power crisis the country is facing.

Additionally, to reduce likely social tensions when supporting energy projects, it is seen necessary to balance the needs of locals and to encourage them to engage in activities that involve their regular interaction. This process of "mutual adaptation" is essential to enrich social, economic and civic life and to ensure the security and stability of society as a whole (UN-Habitat, 2018).

#### *Community Participation in the Kenyan Perspective*

Conceptually, community participation is an appealing model that promotes the ideals of shared governance of institutions. Community participation: community empowerment, transparency and conflict mechanism in decision-making processes are paramount for public service delivery and efficiency (WB, 2015). Kenya's constitution and the legal framework on devolution place strong emphasis on community participation, transparency, and accountability as means of improving efficiency, equity, and inclusiveness of government and service delivery as well as a platform to reduce regional imbalances

Participation of citizens during the development of clear indicators of progress and performance and the attendant

means of verification is considered critical during project planning processes (Opiyo, 2017). This is necessary because instituting appropriate and adequate engagement forums for inclusivity, equality and effective citizen participation in management and development matters promotes performance. Okello *et al*, (2008), notes that most challenges involved in engaging citizens in meaningful participation and effective development is predicated on the need for knowledge and skills on how to execute their responsibilities and how projects will benefit them.

The quality community participation is achieved through an informed citizenry, enhanced government systems for sharing information, consulting citizens and receiving feedback (World Bank, 2015). CIC (2014) adds that use of various feedback mechanisms for the public is as useful as the development of legislation on public participation itself.

In the energy sector, devolution and community participation offers an opportunity to tackle past imbalances created by the centralized approach to planning (Lambe, 2015). This is particularly on the centralization of large-scale energy systems, often with little emphasis on the household sector, even though it accounts for most of the country's energy demand. Furthermore, limited access to modern energy services means that most household energy needs are met through traditional biomass fuels, which are associated with serious indoor air pollution, environmental degradation and negative social impacts.

#### *Performance of Solar Energy in Kenya*

The Kenya Vision 2030, launched on June 2008 by the government of Kenya, recognized the government's ambition to transform Kenya in "into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment" (Government of Kenya, 2007). For this transformation to happen, it has been estimated the need for an increase in total energy installed capacity of about 18,000 MW by 2030 (World Bank Group, 2015).

This demand is caused by the fact that conventional energy resources are insufficient to respond to the demand of electricity, therefore the deployment of renewable energy sources such as geothermal, solar, wind, biomass and small hydro-power, is a priority for the Government, which has initiated several projects and plans with the objective of enhancing the expansion of these resources (World Bank, 2015).

Renewable energy development is a priority for Turkana County. The County Government has been pursuing partnerships with development actors to enhance energy access in the county. The main goal is to maximize the utilization of available resources including hydroelectric power, solar energy, wind energy, geothermal energy, and sustainably sourced wood fuels. The county planned to do this

by developing coherent policy framework, civic education and dissemination of information, robust resources data, enhanced technical skills, and storage of solar energy. So far, solar energy has been harnessed through installation of solar panels in schools, hospitals and government institutions through the county Department/directorate of Energy, and the distribution of solar ovens and solar lanterns to households (Turkana County Government 2015).

#### *Statement of the Problem*

Until recently, a lot of research in energy has tended to avoid the social dimensions like community participation in energy systems, with social science and interdisciplinary approaches being under-represented (Sovacool, 2014). Miller *et al.* (2015) identified an omission of social dimensions in energy policy discussions more broadly, and in the design of key governing institutions. In some countries like Kenya, devolution provides an opportunity for the government to better understand and respond to the needs of the people, but this can only happen through effective participation of community members. Civic education, public participation and availability of information are key requirements of the Constitution as avenues for citizens to actively participate in devolved governance (Kenya Institute of Economic Affairs, 2015). However, while community participation and policies are important for solar energy performance, research shows community participation does not necessarily lead to the intended outcomes. Particularly, in Turkana County it was found that county executive made the final decisions on projects to be implemented which meant that the public views don't necessarily influence projects and programs in the county (Oduor *et al.*, 2015). This has often led to negative impacts to households such as expensive and unreliable electricity; hazards involved in collecting firewood; health impacts for biomass users, and lack of engagement in energy planning and decision-making processes (Oliver, 2016). As a result, this weak performance of public participation in Kenyan counties has led to deteriorating public goodwill characterized by shaky citizen-government relations in the counties (Transparency International, 2015). The effects eventually will also spillover to development partners, which can lead to losses in investments in the energy sector (IEA, 2015; World Bank, 2015). This study therefore sought to address this gap by investigating community empowerment, feedback mechanisms and performance of solar energy in Kalobeyei ward in Turkana County.

#### *General Objective*

The objective of this study was to ascertain the relationship between community empowerment, feedback mechanisms and performance of solar energy in Kalobeyei ward in Turkana West Sub-County.

#### *Theoretical Literature Review*

##### *The Theory of Empowerment*

The theory of empowerment includes both processes and outcomes (Swift and Levine, 1987). The theory also contents that actions, activities, or structures may be empowering and that the outcome of such a process results in a level of being empowered (Zimmerman, 1995). Kluska *et al.* (2004) noted that psychological empowerment includes feelings of competence, autonomy, meaningfulness, and an ability to impact the organization. Members of an organization that are empowered are more committed to the organization, more accountable for their work, and better able to fulfil job and institutional demands in an effective and productive manner (Degner, 2005).

Rappaport thinks that empowerment is a construct that links individual strengths and competencies, natural helping systems, and proactive behaviors to social policy and social change (Rappaport, 1981, 1984). He has noted that it is easy to define empowerment by its absence but difficult to define it in action as it takes on different forms in different people and contexts.

Czuba (1999) expand this theory further to suggest that there are three facets of empowerment that are fundamental to any understanding of the concept. Empowerment occurs within sociological, psychological, economic, and other dimensions. Empowerment also occurs at various levels, such as individual, group, and community. It is a social process, since it occurs in relationship to others, and it is a process along the continuum. Other aspects of empowerment may vary according to the specific context and people involved, but these three remain constant. How empowerment is understood also varies among perspectives and context.

Erickson, Hamilton, Jones and Ditomassi (2003), posits that empowerment is thought to occur when a government sincerely engages citizens and progressively responds to this engagement with mutual interest and intention to promote performance and development. It develops with time as the community gets control of their lives and the governance decisions which affect them. The key principles associated with member empowerment are equity, ownership, partnership and accountability, meaning the willingness to invest in decision making and sharing a sense of responsibility for individual and collective outcomes (Batson, 2004).

##### *Game Theory*

Based on Ostrom (1993) game theory is based on the choice to cooperate as a decision which depends on assessments that the long term payoff for mutual cooperation is higher for everyone individually and collectively. The theory suggests that, if all the other members of the community cooperate then it is also in each individual's interest to cooperate. The question that arises is how can we manage sustained cooperation or enlist others to cooperate. There are two basic concepts of equilibrium, amongst the vast literature on the subject, that are particularly relevant to the conceptualization of cooperation based upon rational choice used here—Pareto optimality and Nash Equilibrium (Hardin, 1998). A strategy

of action is optimal or Pareto-efficient if no player can improve his welfare without reducing the welfare of the other player, or if there is no strategy of action whereby both players could simultaneously improve their situation (Ostrom, 1990).

Similarly it is worthwhile my driving on the right side of road as long as everybody else drives on the right side of the road (Lewis, 2002). Or, for that matter, it pays for me to drive on the left side of the road as long as everybody else drives on the left side of the road. The safety (which is the payoff) of each driver (player) depends upon his maintaining the same behavior based upon the expectation that all of the other drivers will maintain theirs. Each driver stands to lose (crash) if one deviates from the strategy of action. Social norms and institutional factors are seen as very important part of the description and analysis of game situations and interaction behavior and provide a reliable basis for explaining and predicting many behavioral patterns (Burns & Roszkowska, 2005).

#### *Social Exchange Theory*

Social exchange theory evolved from the work of sociologists such as Homans (1958), Blau (1964), and Emerson (1972). In social exchange theory, the relationship in which a person or group acts in a certain way toward others in order to receive a reward is called an exchange relationship (Blau, 1964).

Homans, the originator of the social exchange theory, expressed that this theory was developed to understand the social behavior of humans in economic undertakings. It contents that all human relationships are created solely by the use of a subjective cost-benefit analysis and the comparison of alternatives. Homan, (1958) highlighted that social behavior is an exchange of goods, material goods but also non-material ones, such as the symbols of approval or prestige. It reveals that members of community give much to others try to get much from them, and persons that get much from others are under pressure to give much to them. Blau (1964) expand this theory of social exchange by stating that it refers to relationships that entail unspecified future obligations. He gave an example of how economic exchange works to show that social exchange generates an expectation of some future return for contributions; however, unlike economic exchange, the exact nature of that return is unspecified.

Blau, (1964) believes that individuals will enter into and maintain a relationship only as long as they can satisfy their self-interests and at the same time ensure that the benefits that will accrue will outweigh the costs. An individual will seek to maximize his or her profits and minimize losses in interactions with others. In terms of continuing relationships, individuals will try to maintain those exchanges which have proven to be rewarding in the past, and break off those which proved to be more costly than rewarding, and to establish new relations which have a good chance of being more rewarding than costly.

#### *Empirical Literature Review*

##### *Community Empowerment and the Performance of Solar Energy*

Talib and Muhamad (2015) did a study on community empowerment and sustainable development, which emphasizes on quality and reduction of costs, has the potential to transform and change the way rural communities can achieve the quality of life in the developing countries. The study explored the relationship between community empowerment, sense of community and sustainability of community-driven (CD) projects. It used hierarchical regression analysis to test the relationship between community empowerment and sustainability of CD projects. The findings showed that Community empowerment is significantly related to the sense of community and helping communities in improving the quality of their lives. The key gap in this study though is that it only focused on general community development projects. This study will look at the impact of community empowerment on how solar energy is performing in the area of study. This is necessary because it focuses on single project therefore making it easy to quantify the impacts.

Dufe, (2015) examined the factors influencing accessibility of rural electrification in Kenya, with a specific focus on Naivasha Constituency. The study adopted a survey design and focused on the Rural Electrification Authority projects Naivasha. Data was collected from a sample size of 221, representing about 10% of the target population and analyzed using thematic and content analysis. The study found that monitoring is not conducted on a continuous basis and public participation was found to be lacking. It also found that majority of the residents were aware of the alternative power sources available, eg. solar which are relatively cheaper to install and more reliable in comparison to grid connection. A major problem with this empirical literature is that there is no systematic or comparative evidence on whether increased citizen participation in generates better outputs in access of electricity and particularly solar energy.

When accessing solar energy, gender is deemed a key issue. A study supporting this has been done by Tanja (2017) to demystify women's empowerment through electricity access. The study reviewed statistical studies related with access to the electricity and measured the impact on welfare indicators and employment. It used qualitative analysis to establish various types of electricity supply and studied how electricity access in a given context has influenced women and men in everyday life, focusing on the role of the design of the systems of supply and the process of electrification. The research revealed that the electricity access benefits the welfare of women as well as men, but that the impact on gender relations remains largely unclear. The available evidence draws evidence from numerous countries and sectors which is seemingly anecdotal. This study will address this by looking at case study for a particular ward in Turkana County.

George, Kahiu & Robert, (2019) studied the factors affecting sustainability of mini - grid energy in Kenyan rural areas, a case study of Kisii County. This study endeavored to investigate the influence of energy policy /framework advisory, implementation mechanism and capacity building/training on sustainability of mini- grid energy within rural areas in Kisii County. A descriptive research design was adopted and the study targeted 110 personnel in various departments of the energy service companies and 600 customers using stratified random sampling. The quantitative data obtained from the questionnaires was coded and keyed into statistical package of social science (SPSS) analysis software. The study found that rural inhabitants use mini-grid energy in their homes to a moderate extent. Energy policy framework and capacity building/training affect sustainability of mini - grid energy within rural areas of Kisii County. The study recommended that there was need to provide training and education to increase the levels of awareness and knowledge on the use of mini-grid systems. This study is highly localized and hence can be used to show the effects in different counties and additionally, it doesn't demystify other variables for community empowerment beyond policy and civic education which will be addressed in this study.

This has been reinforced by Gichui (2016) in a study that aimed to establish the level of solar energy technology adoption within Kiambu County in Kenya. The study tried to establish what gaps exist and why, provided for the factors influencing the solar energy technology adoption , socio economic implications of solar energy technology and the effective strategies being used from across the globe for increasing awareness. The study adopted a stratified random sampling method. The reason for the choice of this method was because the target population is divided into 12 Constituencies. The study also adopted a descriptive survey design as it allowed the researcher to describe record, analyses and report conditions which existed. Both qualitative and quantitative approaches were used to analyse the data collected. The results showed that solar energy has not been adopted as expected, a factor that can be predicated to the fact that there has not been any formal or informal training on solar energy technology use which has led to the level of knowledge and awareness of solar energy and its use being relatively low. The study additionally concludes that lack of information on financing opportunities had an impact on the adoption of solar technology since most of them wrongly perceived it to be expensive. The cultural and ethnographic realities of Turkana county and Kiambu county are quite different and therefore, the study cannot be able to give clear outcomes on community empowerment on the performance of solar energy in Turkana county.

#### *Policy framework and the performance of solar energy*

In Nigeria, Turkey and United Kingdom, Nurcan (2015) did quite an extensive study on the impact of government policies in the renewable energy investment. The aim of the paper was to emphasize the selections for renewable energy investment,

to shed new light on RE investment decisions, and how they are influenced by renewable energy policies. The paper used a conceptual framework and qualitative analysis to understand the structural factors affecting the investors' decisions as well as the linkage between renewable energy policies and investment in the case study countries of United Kingdom, Turkey and Nigeria. The results suggest that renewable energy policies increases growth in the renewable energy investments. The research used qualitative which is an inductive and theoretical or theory-generating research. This means that the purpose of the study is to develop theory and cannot quantify the relationship data and show the relationships between policy and performance of solar energy. This research will therefore use quantitative analysis to statically quantify the data and use qualitative analysis also for the key informant interviews.

Kathungu, (2016) considers budgeting as an effective tool to influence the extent of public investments in solar energy. The researcher additionally budgeting process as the means by which all planned activities will be delivered and responsiveness in the activities will create the outcome for reporting by the end of the implementation period. Her research sought to investigate the effect of budget utilization on the financial performance of county governments in Kenya. The study used descriptive statistics to analyses the collected data and regressed data on Statistical Package for Social Sciences to illustrate the variable outcomes in the adopted regression model for analysis. The results were presented in form of tables and explained clearly on the impact existence in the variables. Study came up with the conclusion that in joint budget utilization has a positive impact on the outcomes of planned activities in the county governments. This study will focus on individual performance of solar energy

A research that used randomized experiment to examine the linkage between mobilization and elite capture in participatory institutions in Kenya argued that mobilization has a significant effect on citizen participation. It also shows that mobilization did not lead to increased adoption of either the organization's preferred projects or the projects requested by citizens. Instead, the intervention changes the type of discrepancies observed in final allocations, indicating that elite control over planning institutions can adapt to increased mobilization and participation (Sheely, 2015). The methodology used cannot show quantities of various variables and their relationship. This will be addressed by adopting a descriptive study.

#### *Performance of Solar Energy*

Understanding Stakeholders' views and the influence of the socio-cultural dimension is very important in the adoption of solar energy technology in Lebanon (Research Houda 2018). This study was done in light of climate change and global commitments and great amount of programs and policies have been implemented by governments targeting the diffusion of

renewable energy technologies. It suggested that for a successful diffusion relies on the understanding, persuasion and acceptance by consumers and other stakeholders. The results revealed that contextual factors, specifically related to the social, cultural, geographic and market dimensions, played a crucial role in shaping solar energy market development, especially in relation to the uptake of solar energy technology by different consumer groups. The sampling framework in this study is not clear and therefore it's not possible to understand how the data was analyzed and whether its sufficient to come to the conclusions arrived at. This study will use stratified sampling for a sample for 320 households and divide the community into stratum/villages for better and representative research.

When delivering any projects for renewable energy, it is evident that these projects will have an impact on the local communities. A study on to support this argument has been done to look at the role of local voices on renewable energy projects with particular focus on the performative role of the regulatory process for major offshore infrastructure in England and Wales (Yvonne et al, 2018). The methodology used involved detailed reading and coding of documentation and the use of focus groups with local people identified through the online documentation, six of which were for offshore cases. The research concludes that local voices are limited by how the performative role of the government's regulatory regime differentiates between interests and suggests that new ways of giving voice to local people are required. The research used only qualitative study which cannot provide statistical analysis for the data to show relationships.

Locally in Kenya, Anna (2016) did a study on the impact assessment of gaining access to electricity via micro-grids and SHS and to find out what differences there were in impacts between them in Kitale. The study used semi-structured interviews and observations from a field study were the input method into rural sustainability indicators that were compared with pre-electricity indicators. The results showed that access to off grid solar energy had positive effects related to health, safety, economy, education, mobile phone and internet usage. The differences between the different off grid electricity solutions were that SHS had less environmental impact and was cheaper to use, however micro grids had positive impacts regarding business investments, gender equality and social activities which Solar Home Systems did not have. The study used qualitative research methods and hence did not show quantities and relationships that can be achieved through quantitative study that will be adopted for this study. Part of results is focused on gender and access to solar energy. This study will look at gender but also generally look at men and women involvement in solar energy and how the benefits are distributed across the ward.

Drawing on material collected in Homa Bay and Kitui counties in 2016, a paper developed by (Sini *et al.*, 2016) examines the gendered setup, organization and impact of solar

powered electricity access as compared with the central grid. The paper employs a framework for analyzing women's empowerment through electrification, which draws most of the thinking from anthropology, socio-technical system theory and practice theory of supply. The study reveals that men dominate within the grid, mini-grids and private suppliers, leaving an important potential for women's empowerment untapped. However solar energy is seen as very key in rural development. The methodology is not clear one cannot systematically understand how the results were generated. The procedure on how the data will be collected, analyzed and interpreted is will be clearly demonstrated in this study.

## II. RESEARCH DESIGN AND METHODOLOGY

### *Research Design*

Research design as the general plan for getting answers to the questions being studied and for handling some of the difficulties encountered during the research process (Othari, 2004). This study adopted a qualitative and quantitative research design to collect information using a structured questionnaire and interview guide. Additionally descriptive design was used because it focuses on doing analysis to show the correlation of variables and the causal effect of each variable on other variables.

### *Target Population*

The population in question for this study the constituents of Kalobeyi ward who are in the voting age gap, that is, aged 18 years and above, spread across the villages in the ward. The total population targeted is approximately 320 households from a population of 3200 households in kalobeyi ward (KNBS, 2018).

### *Sample and Sampling Technique*

A sample is a subset of the population to be studied and a true representative of the entire population to be studied (Hyndma, 2008). Later on (Kothari, 2011) added that a well-represented sample will result in a small sampling error; viable, economical, and systematic and the results can be applied to a population and demonstrate a reasonable level of confidence. According to Kothari (2004), a sample size of between 10% and 30% is a good representation of the target population, for populations below 10000. In stratified random sampling, the population is categorized into various strata. Random sampling is then applied in the selection of the respondents from each of the strata. In random sampling all the respondents have equal chances of being selected. The advantage of this method is that it gives a sample size that is representative of the whole population. The study therefore adopted a stratified random sampling technique to select 10% of the target population for households as the sample size. Therefore, the sample size for this study was the selection 320 households. To enrich the study, focus group discussions for key informants was conducted for the relevant county government ministries and other stakeholders in the energy sector in the study area.

### *Instruments*

Primary data was gathered using questionnaire and an interview guide. The questionnaires were administered to respondents by the research assistants while the interview guide was used by the researcher to interview key informants. The questionnaires were prepared to align and respond to the research objectives and questions. In the questionnaire, five responses for Likert scale were employed. The Likert scale is very useful as it has scales which can assist in conversion of qualitative response into values which are quantitative. This will include options to either strongly agree, agree, neutral, disagree or strongly disagree.

### *Data Collection Procedure*

Primary data was collected via face-to-face and telephone interviews and questionnaires. In key informant, face-to-face and telephone interviews, the researcher asked the questions as indicated in the questionnaire where appropriate. According to Smith (1975) so as to improve on reliability and validity of data as collected, it is imperative to employ several methods of data collection. The choice of the instrument to use was guided by how well it met the research needs. Questionnaires were used to determine the impact of community participation, policy framework on the performance of solar energy in kalobeyei ward in Turkana west sub-county. The questionnaires used both closed and open ended questions, developed in a standardized way, uniform to all respondents. The closed ended questions, may limit the length of the responses, however, they will enhance the consistency of responses across responses (Wallen, 2012). On the other side, open ended questions will be used because of the possibility to get personal comments from respondents, hence helping to get very authentic and rich information, (Cohen, Manion, & Morrison, 2007). Therefore, both quantitative and qualitative data will be collected.

### *Data Analysis and Presentation*

The study used quantitative techniques in analyzing the data. Descriptive analysis was utilized to establish the frequencies/percentages, mean standard deviations. Inferential statistics such as correlation analysis and regression analysis will be used adopted and SPSS version 21 will be assist in interpretation of organized data based on the objectives. The analyzed data will be presented in frequency and percentage tables for better interpretation and understanding of the research findings. Inferential statistics was done using regression and correlation analysis. The analysis of variance (ANOVA) was checked to reveal the overall model significance. Individual regression coefficients were checked to see whether the independent variables affect the performance of solar energy in Kalobeyei ward. The study will also rely on a linear regression model to test the significance and the influence of the independent variables on the dependent variable. The linear regression model that will be used in this study is shown below.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \mu$$

Where:  $Y_i$  = Performance of solar energy in Kalobeyei ward;  
 $\beta$  = Constant;  $\beta_1 \dots \beta_4$  = Coefficients of independent variables;  $X_1$  = Citizen Empowerment;  $X_2$  = policy framework;  $\mu$  = Error term

The reliability of the data will be estimated using multiple linear relationships. This will be done by the use of coefficient of determination to determine the goodness of fit of the estimated model (Oso & Onen, 2011). Subsequently, analysis of variance (ANOVA) will be done to determine the contribution of independent variable to the dependent variable (Kothari, 2011). The significance of the model that was used for this study was tested using the p-value for the F statistics, whereby if the p-value was less than 0.05, then it was concluded that the model is significant and has good predictors of the dependent variable.

## III. RESEARCH RESULTS

### *Community Empowerment and Performance of Solar Energy*

Majority of respondents strongly agreed that in their area civic education programs are conducted to transmit knowledge, skills, and values to general public and to promote project efficacy as shown by mean score of 4.2. This will enlighten citizens on their rights and equip them with knowledge and power on how to articulate issues relating to solar energy in the ward. Further respondents also agreed that they are aware of community based organizations that deals with solar energy in their area and that local community is adequately informed projects implementation processes more so on solar energy projects. Likewise, respondents agreed that development projects management team provides appropriate information to the community that pertains to performance solar energy as shown by mean score of 3.73. Through civil education programs level of community participation on performance of solar energy have been demonstrated to a great extent and existence of community based organizations that plays a very important role for the performance of solar energy in the area influence performance of solar energy

The regression analysis shows that community participation was positively and significantly related with performance of solar energy in Kalobeyei ward. ( $\beta=0.287$ ,  $p=0.000$ ). This means that an increase in a unit of community participation leads to an increase in 0.287 units of performance in solar energy. The findings imply that citizen civic education, community institutions established and access to information are important aspects for the performance of solar energy.

### *Policy Framework and the Performance of Solar Energy*

The fourth specific objective of this study was to investigate the role of policy framework on the performance of solar energy in Kenya. From the findings most of the respondents were neutral that the county has developed policy to guide development of solar energy and that the county has allocated a budget for solar energy projects. Further respondents agreed

that county the county has developed clear policy regulations, implementation mechanisms on community participation and that county has developed adequate engagement forums to ensure inclusivity, equality and effective citizen participation. The county has set up requisite institutions with adequate trained personnel to support public participation programmes and locals agreed that they are aware of government or development partners' energy projects in the area as indicated by mean score of 3.66 and 3.54 respectively. However majority of the people remain neutral on whether the public engagement programmes and whether the forums really support equity and inclusivity.

The regression analysis shows that policy framework was positively and significantly related with performance of solar energy in Kalobeyei ward ( $\beta = 0.235$ ,  $p = 0.012$ ). This means that an increase in a unit of policy framework leads to an increase in 0.235 units of performance in solar energy. The findings imply that use of policies on community participation available, institutions for community participation, budgetary commitment is important aspects for the performance of solar energy.

To the influence of policy framework and the performance of solar energy, study established that that the county has developed policy to guide development of solar energy and that the county has allocated adequate budget for solar energy projects. The study also established that county has developed clear legislation, policies, procedures and implementation mechanisms on community participation and that county has developed adequate engagement forums to ensure inclusivity, equality and effective citizen participation.

### *Solar Energy Performance*

The study revealed that there is knowledge transfer on solar energy among the community members. The study also established that solar energy projects were completed on time. There are solar energy projects in the ward. The community has experienced increase in solar energy performance at the household level. The people trained have been able to support operation and maintenance of solar energy projects in the area.

### *Inferential Analysis*

To measure the strength of correlation between the independent variables and the dependent variable, the study conducted an analysis on coefficient of correlation, determination and regression.

### *Coefficient of Correlation*

Karl Pearson's coefficient of correlation ( $r$ ) was used by the researcher to establish the correlation between the various variables being investigated. The results show a positive correlation between and community empowerment and performance of solar energy as shown by a correlation and solar energy performance figure of 0.523. The positive correlation between policy framework and solar energy performance is shown by correlation value of 0.614. This shows that there is there was a positive correlation between community empowerment, feedback mechanism and solar energy performance.

Table 1: Coefficient of Correlation

Statements		Solar energy performance	Community empowerment	Policy framework
Solar energy performance	Pearson Correlation Sig. (2-tailed)	1		
Community empowerment	Pearson Correlation	.523	1	
	Sig. (2-tailed)	.0032		
Policy framework	Pearson Correlation Sig. (2-tailed)	.5210 .0172	.3420 .0031	1

### *Coefficient of Determination*

Determination of coefficient explains the how change in dependent variable can be explained in the variation percentage in dependent variable or independent variable that is explained by all 3 independent variables. The 2 variable

studied, only explains 52.7 percentage of the performance of solar energy as adjusted  $R^2$ . Meaning 47.3% of factors not studied in this study contributes in solar energy performance. Thus there is need to conduct a study that will aim to investigate the others factors that influence solar energy performance.



Table 2: Model Fitness

R	R Square	Adjusted R Square	Std. Error of the Estimate
.726a	0.527	0.514	0.61651
a Predictors: (Constant), community empowerment, policy framework			

### ANOVA Results

In trying to test the significant of the model, the study used ANOVA. From table 4.13 the significance value is 0.00 which is less than 0.05 thus the model is statistically significant in predicting the relationship between community

empowerment, feedback mechanism, conflict management, policy framework and performance of solar energy. The F critical at 5% level of significance was 37.954. Since F calculated is greater than the F critical (value = 3.84), this shows that the overall model was significant.

Table 3: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	57.702	4	14.425	37.954	0.000
Residual	51.691	136	0.38		
Total	109.393	140			
a Dependent Variable: Performance of solar energy b Predictors: (Constant), community empowerment, policy framework					

### Regression Equation

Multiple regression analysis was conducted so as to determine the relationship between solar energy performance and the 2 independent variables.

Table 4: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.548	0.261		2.102	0.037
Community Empowerment	0.287	0.062	0.328	4.658	0.000
Policy framework	0.235	0.092	0.231	2.546	0.012

As per the SPSS generated table 4, the equation:

$(Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \mu)$  becomes:

$$Y = 0.548 + 0.287X_1 + 0.235X_2$$

As per the above regression model, it was established that when all the independent variables are assumed to be zero, an increase of a single unit in community empowerment will lead to a better performance of 0.287 in solar energy projects and a unit increase in policy framework will lead to 0.235 improvements in solar energy project performance. This shows that community empowerment contributes most to solar energy projects performance then policy framework contributed the lowest.

## IV. DISCUSSION OF THE FINDINGS

The regression analysis shows that community participation was positively and significantly related with performance of solar energy in Kalobeyei ward. ( $\beta = 0.287$ ,  $p = 0.000$ ). This means that an increase in a unit of community participation leads to an increase in 0.287 units of performance in solar energy. The findings imply that citizen civic education, community institutions established and access to information are important aspects for the performance of solar energy.

This is in line with a study Dufe, (2018) that found that participation of citizens during the development of clear indicators of progress and performance and the attendant means of verification was also considered critical during project planning processes. This is also supported by Opiyo (2018) who established that communication from counties should be through sub-counties for interpretation and

dissemination in a language understood by all citizens in order to stimulate performance.

The regression analysis shows that policy framework was positively and significantly related with performance of solar energy in Kalobeyei ward ( $\beta = 0.235$ ,  $p = 0.012$ ). This means that an increase in a unit of policy framework leads to an increase in 0.235 units of performance in solar energy. The findings imply that use of policies on community participation available, institutions for community participation, budgetary commitment is important aspects for the performance of solar energy.

A study done by Motari, (2017) supports this results by proving that establishment of good solar energy projects is depended on government policies and adequate budgetary allocations and the existing government policy. Another study by Otieno, (2017) also confirms that instituting appropriate and adequate engagement forums for inclusivity, equality and effective citizen participation in management and development matters there is need for the development of policy that promotes performance.

## V. CONCLUSIONS

The study concluded that the county governance structures should ensure that decisions made during public participation and are included in their plans and the county fiscal strategy papers. The local government should also share the solar energy project indicators and project progress reports for the public to validate the success or failure of the projects.

The study also concluded that the county government needs to enhance community empowerment programs are to transfer knowledge and skills to the public and to promote project efficacy. While there are community based organizations and NGOs that work on solar energy projects, the community felt that there is little or no knowledge transfer in the solar energy projects implemented in the ward. Mostly the projects implemented are only for solarizing public institutions and water boreholes and few projects in for individual households. Additionally the community felt that implementation although the projects are beneficial; the implementation is mainly done in settlements and towns along the main roads and the communities near the major public services.

The study also concludes that county has developed clear legislation, policies, regulations and an institution for supporting. Additionally the study concludes that community participation and that county has developed adequate engagement forums to ensure inclusivity, equality and effective citizen participation. The county also has advanced in the use of ICT to share information to the community concerning energy among other development projects. However, language barrier, literacy levels and low digital penetration is a major limit to the community's use of ICT platforms in public participation and holding the government accountable during service delivery processes.

## VI. RECOMMENDATIONS

This study recommends the county governments, development partners and other stakeholders to foster the collaborative advantage of community participation in project identification, planning, implementation as well as monitoring of solar energy projects. This will not only create ownership of project to the community where it is implemented but also helps in ensuring that communities are involved in the identification of the own problems and the development of solutions to address key energy problems in their community.

Secondly, community empowerment in the project was moderate, and while majority of the population wanted to be a part of this, most of the engagements were only focused on major towns and new settlements near the major transportation corridors. More emphasis by the development partners and especially the government should be made to enhance the geographical reach during the involvement of the community in solar energy projects to ensure equitable transfer of skills and knowledge on the community's role in planning, use, operation and maintenance of solar projects.

Third, the government should also foster the use of Information and Communication technology (ICT) to expand democratic space for community participation in project design, implementation as well as monitoring and evaluation of solar energy projects.

Finally, Government, NGOs or any other development partners that support community based projects should build the capacity of the community so that they can effectively participate in the project. The community can be trained on aspects of project planning such as coming up with project design, project costing and budgeting, resource mobilization, drawing up implementation, monitoring and evaluation plans amongst others.

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