Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 06, June-2023

Influence of TVET training on Implementation of Solar Streetlights project in Kisii County; Kenya

Yucabeth Nyaboke Nyamwaya
University of Eldoret
Master of Education (Technology Education – Electrical and Electronics)

Stephen Ondieki
University of Nairobi
Master of Project Planning and Management

SUPERVISORS
Dr. Simon Wanami
University of Eldoret

Dr. Isaac Nang'endo
University of Eldoret

Abstract - Solar powered streetlights project is increasingly becoming an important source of energy in Kenya due to its renewable nature. The study endeavoured to find out how TVET training affect implementation of solar streetlights project in Kisii County, Kenya. The study investigated the extent to which capacity building, induction and technology-based TVET training influence the implementation of solar streetlights project in Kisii County, Kenya. The study adopted a descriptive research design to describe the existing phenomena. It employed purposive, stratified, and simple random sampling techniques which led to a manageable study sample. Primary data was collected by use of questionnaires, and interview schedules. Secondary data for the study was sourced from print media, journals, books, internet sources and online repositories. The collected data was analysed using both descriptive and correlation analyses. Correlation analysis was conducted to show the direction and strength of the variables in order to determine the relationship existing within the variables. The results of the study were be presented using tables, graphs, and charts. The study revealed that TVET training had a significant influence on implementation of solar streetlights project in Kisii county, Kenya ($r=0.398$, $P<0.000$).

Key Terms: Investigation, implementation, Project, Solar, Streetlights, TVET training

1.0 INTRODUCTION

The use of solar powered streetlights remains one of the most credible technology mechanisms of harvesting sun rays and converting it into light and heat energy. In addition, Gumbo (2013) indicated that the technology behind producing solar energy purely lies on the technical skills acquired by the technicians, funds allocated to such projects and the right involvement of all quarters of stakeholders.

Globally, approximately 80% of all energy consumed in the world is utilized by the first twenty large economies commonly referred as G20 in 2010 (Schmidt and Haifly, 2012). Overall, about 16% of world energy consumption comes from renewables; with 10% from traditional biogas, used majorly for heating and about 3.4% from hydroelectricity. New renewable energy sources including small hydro, modern biogas, solar, wind, geothermal, and bio-fuels contribute about 2.8%. However, Gitone (2014) laments that solar technology has not been fully utilized to its optimal level due to insufficient solar technology TVET training programs in the learning institutions.

In Africa, implementation of solar powered street lighting project remains a challenge since most of the street lights are powered by electricity (Hafner, Tagliapietra & De, 2018). A study carried out in Ghana established that despite the being a country that experiences high intensity of sunshine in West Africa, solar harvesting remains a challenge because of inadequate resource allocation for TVET training facilitation that enables efficient procurement and installations of solar panels (Asumadu-Sarkodie &. & Owusu, 2016). A similar study in Uganda showed that in Kampala, the capital of the country, it is only 8% of the city's roads and streets that are illuminated by solar energy (Meyer, Eberhard & Gratwick, 2018). The situation is mainly due to lack of relevant TVET trainings such as solar installation, maintenance and solar security this has continued to affect the implementation patterns of solar streetlights projects. Ondieki (2016) notes that TVET training based on solar technology implementation in TVET institutions is taken with low magnitude in many African countries. The trend thwarts skill acquisition process, hence reducing efficiency in solar harvesting in Africa.

Contextually, Gumbo (2013) reveals that solar harvesting technology-based TVET training is an important aspect that TVET institutions should teach. The life of solar PV systems may be short if they are not properly designed or installed. Many improper solar PV systems have been installed in many places in the world and they have stopped working within a very short time due to poor designs and installations. Many parts of Kenya are also experiencing the same situations especially the rural areas where the on-grid electricity line is far from their homes. The solar renewable energy field especially in Kenya suffers a deficiency of skilled personnel qualified to design, install and effectively maintain modern energy systems. This problem can be solved by TVET training many engineers and technicians to have the right knowledge and skills on solar PV systems technology (Keriri, 2013). Moreover, the Kenyan system of education is more theoretical than practical. The emergence of the CBET, on TVET programmes, requires each trainee to acquire the necessary knowledge, skills and attitudes in every course (Gumbo, 2013). Therefore, the study is geared towards ascertaining whether the trainees get the required knowledge and skills to be competent technicians when they graduate from college to enhance implementation of solar streetlight projects.

2.0 LITERATURE REVIEW

Implementation of solar powered streetlight project is important for both developed and developing countries. Implementation of any project requires adequate TVET training based on the installation, maintenance and ensuring the security of the already installed project. TVET training on adopting best technology and use of best gained skills in order to ensure that the project is delivered (Nyamu, 2015). In addition, it is widely accepted that the active Solar Energy Systems (photovoltaics, solar thermal, solar power) provide significant environmental benefits in comparison to the conventional energy sources, contributing to the implementation of the human activities.

Solar technology-based TVET training gives rise to solar energy which may be used for lighting or heating. In the implementation of solar technology projects, the solar street light does not need to set up the transmission line or route cable, and no special management and control are required. It can be installed in the entire public place such as the square, the parking lot, the campus, the street or the highway etc. The street lighting is closely related to people's daily life. Following quick development in process of the global urbanization, the green, efficient, and long-life LED light gradually enters into our lives (Gitone, 2012). The design and installation of solar technology for street lights requires well qualified technicians.

A study by Ng'eno (2014) established that, 84.7% of the household heads have seen solar power in use; Most of them 74% have seen solar lamps. Awareness of the existence of solar technology in lighting is high in the community although, 79.7% of the household heads indicated they have never received any formal or informal TVET training on solar systems,

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 06, June-2023

91.4% of the 20.3% who indicated they have been trained up to the certificate level on solar systems by the Service providers. The study concluded that knowledge and awareness of the availability of solar technology has positive effect on implementation on solar. This implies that the level of knowledge based on solar installation in the country is poor thus prompting for enhanced TVET training by the technical institutions to provide TVET training relevant to solar technology. Relevant studies by Wambugu (2016) have shown that, the most important issue to take care of is to assign completed projects to staff members, preferably those with monitoring and evaluation skills. It is essential to instil skills and a sense of ownership among team members, especially of those projects which are completed. Strengthening the institutions which offer solar based technological courses is anticipated to yield fruits during and after implementation of solar powered streetlight project in Kisii County, Kenya.

3.0 METHODOLOGY

This study adopts the descriptive research design methodology. This research design offered the researcher the opportunity to establish the relationship between independent variables and dependent variable. According to Mugenda and Mugenda (2012) this design is economical and allows collection of quantitative data from a sizeable population.

The researchers adopted simple random sampling method to arrive at a sample size of 50 respondent who took part in the study. The respondents included that TVET training based on solar installation and maintenance has an influence the implementation of solar streetlight in Kisii county. Data was collected using the questionnaire tool.

Data was collected by use of a self-administered structure questionnaire. The questionnaire was developed based on review of studies related to TVET training and implementation of solar streetlight project. The questionnaire contained closed ended questions and Likert scales. Closed ended questions asked the respondents to make choices among a set of alternatives given by the researcher (Kothari, 2006; cited in Abaya & Ondieki, 2021). Whereas the Likert were used to rate the contractors' and workers' opinions, perception, feelings and attitudes (Mugenda & Mugenda 2012).

4.0 RESULTS AND DISCUSSION

A total of 56 questionnaires were administered to the target respondents, 50 were returned by the respondents. A response rate of 50% is adequate for analysis and reporting, a rate of 60% is generally good while a response rate of above 70% is excellent (Ekal, 2016). Therefore 89.3 per cent return rate in this study was excellent for conclusive arguments. The findings are presented in Table 1

Table 1: Questionnaire Return Rate

Questionnaires	Frequency	Percentage
Retained	6	10.7
Received	50	89.3
Total	56	100.00

The return rate of the questionnaires is 89.3 per cent. This was attained by having a clarity of questions in a logical manner that could be filled using a few minutes. This high return rate was helpful to the study as it confirmed reliable representation of the targeted population.

4.3 Demographic Information of the Respondents

This section covered the respondent's gender and age bracket of the respondent. The information was useful in ensuring respondents would be relevant to the study.

4.3.1 Distribution of Respondents by Gender

The findings from the analysis of the respondent's gender are presented in Table 2

Table 2: Distribution of Respondents by Gender

Demographic Information		Frequency	Percentage
Gender	Male	35	70.0
	Female	15	30.0
	Total	50	100

From the analysis, out of participants, (70 %) were male and (30%) were female thus meeting the two third gender rule.

4.3.2 Distribution of Respondents by Age

Respondents were asked to indicate their age to ascertain their maturity level in participating in the study. The results are illustrated in Table 3

Table 3: Distribution of Respondents by Age

Demographic Information		Frequency	Percentage
Age	Below 25 years	10	20.0
	25-30 years	8	16.0
	30-35 years	11	22.0
	35-40 years	8	16.0
	40-45 years	6	12.0
	45-50 years	2	4.0
	50 and above	5	10.0
	Total	50	100

The respondents were also to provide their age. Out of participants, (20 percent) were aged below 25 years, (16 percent) between 25 and 30 years, (22 percent) from 30 to 35 years, (16 percent) range 35 and 40 years, (12 percent) range 40 and 45 years, (4 percent) range 45 and 50 years and (10 percent) above 50 years. Every other participant was regarded mature enough to provide information at free will. From the results all the respondents were mature enough to give informed opinions.

4.4 Statistical findings

4.4.1 Descriptive analysis

The first study objective was to determine how TVET training influence Implementation of solar streetlights project in Kisii County, Kenya. The responses were given in a Likert of 1 - 5 scale where; 1= strongly agree, 2= agree, 3= neutral 4= disagree and 5= strongly disagree. The results are depicted in Table 4

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 06, June-2023

Table 4: TVET training and Implementation of solar streetlight project in Kisii, Kenya

Indicator	Agree	Neutral	Disagree	Mean	SD
TVET training is very important in streetlight project implementation	49(98%)	0(0%)	1(2%)	2.30	1.50
There is sufficient induction on solar streetlight project during project implementation	30(60%)	5(10%)	15(30%)	2.40	1.40
Project team's TVET training on solar streetlight determine how far the project will go	33(66%)	6(12%)	11(22%)	2.10	1.31
Technical knowledge of solar installation affects the outcome of project implementation	27(54%)	4(8%)	19(38%)	2.58	1.55
Capacity building on solar streetlights affects the project outcome	35(70%)	4(8%)	11(22%)	2.14	1.40
Composite Mean, Standard deviation				2.06	1.25

The data analysis and presentation of the results in Table 4 can be discussed and interpreted in the following ways;

The first indicator of independent variable sought to find out if TVET training is very important in streetlight project implementation. From a total of 50 respondents (98 percent) agreed, (0 percent) neutral, whereas (2 percent) disagreed. This indicator also had a mean of 1.32 and S.D of 0.59 against the study composite mean of 2.06 and S.D of 1.25. By way of the indicator values being above the composite values, it can be inferred that this statement influenced positively implementation of solar streetlight project in Kisii County, Kenya.

The second indicator of independent variable was to determine whether there is sufficient induction on solar streetlight during project implementation. From a total of 50 respondents (60 percent) agreed, (10 percent) neutral, whereas (30 percent) disagreed. This indicator also had a mean of 2.40 and S.D of 1.40 against the study composite mean of 2.06 and S.D of 1.25. As the indicator has a higher S.D than the composite values, it can be concluded that this statement influenced positively implementation of solar streetlight project in Kisii County, Kenya.

The third indicator of independent variable sought to evaluate whether the project team's TVET training on solar streetlight determine how far the project will go. From a total of 50 respondents (66 percent) agreed, (12 percent) neutral, whereas (22 percent) disagreed. This indicator also had a mean of 2.10 and S.D of 1.31 against the study composite mean of 2.06 and S.D of 1.25. Since the indicator numbers are above the composite values, it can be settled that this statement influenced positively implementation of solar streetlight project in Kisii County, Kenya.

The fourth indicator of independent variable was to assess if technical knowledge of solar installation affects the outcome of project implementation. From a total of 50 respondents (54 percent) agreed, (8 percent) neutral, whereas (38 percent) disagreed. This indicator had a mean of 2.58 and S.D of 1.55 against the study composite mean of 2.06 and S.D of 1.25. Because the indicator figures are above the composite values, it can be settled that this statement influenced positively implementation of solar streetlight project in Kisii County, Kenya.

The fifth indicator of independent variable was to assess if capacity building on solar streetlight affects the project outcome. From a total of 50 respondents (70 percent) agreed, (8 percent) neutral, whereas (22 percent) disagreed. This indicator also had a mean of 2.14 and S.D of 1.40 against the study composite mean of 2.06 and S.D of 1.25. Because the indicator S.D figure is above the composite values, it can be settled that this statement influenced positively implementation of solar streetlight project in Kisii County, Kenya.

4.4.2 Inferential analysis

4.4.2.1 Correlation Analysis of technology and Implementation of solar streetlight project in Kisii County, Kenya

Pearson's correlation analysis was used to determine the strength as well as direction of the correlation between independent variable (TVET training) and dependent variable (Implementation of solar streetlight project in Kisii County, Kenya). The following are correlation analysis results, as shown in Table 5

Table 5: Correlation Analysis of stakeholder engagement and Implementation of solar streetlight project in Kisii County, Kenya

Variable		TVET training	Implementation of solar streetlight project in Kisii County, Kenya
TVET training	Pearson' Correlation	1.000	0.398
	Sig(2-tailed)		0.000
	N	50	50
Implementation of solar streetlight project in Kisii County, Kenya	Pearson' Correlation	0.398	1.000
	Sig(2-tailed)	0.000	
	N	50	50

Correlation is significant at 0.05 level (2 - tailed)

Correlation analysis results showed a significant as well as a positive relationship between TVET training and Implementation of solar streetlight project in Kenya (r =0.398, p□0.000). Moreover, this simply means, the more TVET training is done the better the Implementation of solar streetlight project in Kisii County, Kenya.

4.5.2 Model Summary of TVET training and Implementation of solar streetlight project in Kisii County, Kenya

Model Summary Regression Analysis was run using SPSS Version 22 to examine the associations between independent variable (TVET training) and dependent variable (Implementation of solar streetlight project in Kisii County, Kenya) and results were presented in Table 6

Table 6: Model Summary of TVET training and Implementation of solar streetlight project in Kisii County, Kenya

Model	R	R - Square	Adjusted R - Square	Standard Error of Estimate
1	0.398	0.158	0.141	0.83675

a. Predictor: (Constant) TVET training

Analysis from Table 6 show that TVET training has a significant effect on Implementation of solar streetlight project in Kisii County, Kenya as R2=0.158 shows an increase in TVET training would lead to 15.8 percent influence in Implementation of solar streetlight project in Kisii County, Kenya.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 06, June-2023

4.5.3 Regression ANOVA Analysis of TVET training and Implementation of solar streetlight project in Kisii County, Kenya

ANOVA regression analysis was used to examine the degree of association between dependent variable (Implementation of solar streetlight project in Kenya) and independent variable (TVET training). Results were presented in Table 7

Table 7: ANOVA Analysis between TVET training and Implementation of solar streetlight project in Kisii County, Kenya

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	6.309	1.000	6.309	9.01052	0.004
	Residuals	33.607	48	0.700		
	Total	39.916	49			

a. Dependent Variable: Implementation of solar streetlight project in Kenya

b. Predictors:(Constant); TVET training

ANOVA analysis from table 7 shows that p=0.004 is below 0.05 the alpha level, hence significant. As a result, we conclude that TVET training is important in implementation of solar streetlight project in Kisii County, Kenya.

4.5.4 Regression Coefficients of TVET training and Implementation of solar streetlight project in Kisii County, Kenya

Regression Coefficients analysis was deployed to evaluate the degree of association between TVET training and implementation of solar streetlight project in Kisii County, Kenya and results were presented in Table 8

Table 8: Regression Coefficients Analysis between TVET training and Implementation of solar streetlight project in Kisii County, Kenya

Model	Unstandardized coefficient		standardized coefficient	T	Sig.
	B	Std. Err	Beta		
1(Constant)	1.271	0.322		3.950	0.000
TVET training	0.436	0.145	0.398	3.002	0.004

Dependent1variable: Implementation of solar streetlight project in Kenya

Predictors: (Constant) TVET training

Regression coefficients analysis results between TVET training and implementation of solar streetlight project in Kisii County, Kenya shows that p=0.004 is below 0.05 the alpha level hence significant. As a result, we concluded that TVET training has a significant impact on the implementation of solar streetlight project in Kisii County, Kenya.

5.0 CONCLUSION

Based on the study findings the study concludes that there was positive association between TVET training and implementation of solar streetlight project in Kisii County, Kenya. Therefore, the researcher resolved that improving the TVET training approaches, involving experts in TVET training the dispensing the right solar installation skills ensured successful implementation of solar technology.

7.0 Bibliographies

REFERENCES

[1] Abaya, P. M., & Ondieki, S. (2021). Influence of training on Occupational Safety and Health Compliance for the Construction Projects in Embakasi South Nairobi City County. International Journal of Engineering Research & Technology, 10(2).
[2] Asumadu-Sarkodie, S. & Owusu, P. (2016). A review of Ghana's energy sector national energy statistics and policy framework. Cogent Eng, 3: 1155274.
[3] Ekal, L. R. (2016). Influence of Principal's Management of Resources on Students Performamance Kenya Certificate Secondary Examination In Public Schools In Samburu County, KENYA. Nairobi: University of Nairobi.
[4] Gitone, I. (2014). Determinants of Implementation of Renewable Energy in Kenya; unpublished thesis of the University of Nairobi: Kenya
[5] Gumbo, T. (2013). Towards a Green Energy Revolution in Africa: Reflections on Waste to Energy Projects (Policy brief no. 101). Pretoria: Africa Institute of South Africa.
[6] Hafner, M., Tagliapietra, S. & De, S. L. (2018). Energy in Africa: Challenges and opportunities. Cham, Switzerland : Springer.
[7] Keriri, I. K. (2013). Factors Influencing Implementation of Solar Technology in Laikipia North Constituency, Kenya: Unpublished thesis of The University of Nairobi
[8] Kothari, C.R, (2006) Research Methodology- Methods and Techniques (2nd Edition), New Delhi, India, New Age International Publishers. Meyer, R., Eberhard, A. & Gratwick, K. (2018). Energy for Sustainable Development Uganda's power sector reform : There and back again ? Energy Sustain. Dev., 43: 75–89, 2018.
[9] Mugenda O.M., and Mugenda, A. G. (2012). Research Methods. Quantitative & Qualitative Approaches. Nairobi: Press African Center for Technology Studies (ACTS).
[10] Ondieki, S. (2016). Influence of Working Environment on Project Team's Performance: Case of Sanganyi Tea Factory in Nyamira County-Kenya: Unpublished thesis of The University of Nairobi
[11] Schmidt, J., &Haifly, A. (2012). Energy facts Delivering on Renewable Energy Around the World: How Do Key Countries Stack Up, (202).

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 06, June-2023

Yucabeth Nyaboke Nyam
228-00208, Ngong Hills, Kenya

Qualifications
Bachelor of Education (Technology Edu
Electrical and Electronics).
Master of Education Technology (Electri
Electronics).
H.Dip. In Electrical Engineering (Power)
Dip. In Electrical Engineering (Power)

Books/Journals: 1

Stephen Ondieki
4251-00100, Nairobi, Kenya

Qualifications:
Bsc. Project Planning & Mgt.
Master of Project Planning & Mgt.
DHRM
CICT
CAD
CPR
FM&E

Books/ Journals: 6

Dr. Simon Wanami
1125-30100 Eldoret, Kenya

Academic Qualifications:
B.Ed., M.Ed. (UNB, Canada),
PhD (Moi)

Dr. Isaac Wanjala Nang'endo
1125-30100 Eldoret, Kenya

A) Academic Qualifications:
B.Sc, M.Sc (Odessa Polytechnic Institute), PhD (Peter the Great, St. Petersburg State Polytechnic University). Russia
B) Specialization:
Radio Engineering, Radio physics (Remote Sensing)