KITCHEN PERFOMANCE TEST ON INTRODUCTION OF ELECTRIC PRESSURE COOKERS– CASE STUDY NAKURU COUNTY

Introduction

In line with the Sustainable Development Goal number 7 (SDG 7) (Sachs, 2012). Kenya has an ambitious target of achieving universal access to modern cooking solutions by 2030 (Mwenzwa *et al*., 2014). These solutions include LPG (Liquefied Petroleum Gas), electricity, biogas, bioethanol and improved solid fuel cook stoves. Charcoal, firewood, paraffin, and LPG continue to be the main sources of cooking fuel but this is reducing overtime. According to the 2019 Kenya Population and Housing Census, 55.1% of Kenyan Households use firewood for cooking followed by 23.9% using LPG. The introduction of non-taxed LPG cylinders, rural electrification and other secondary sources of energy has slowly reduced the consumption of biomass fuels from 83% in 1980 to 55.1% in 2019 in Kenya.

Records indicate that 1.8 billion people globally have access to electricity (Doll *et al*., 2010). In Kenya, access to electricity was reported to be at 75% in 2018 according to the World Bank collection of development indicators. KPLC (Kenya Power and Lighting Company), Kenya's national electricity utility, has approximately 6 million customers, yet very few households use electricity as their primary fuel both globally and nationally. Weak grids, load shedding, affordability of electricity, accessibility of liquid petroleum gas (LPG), tradition, perception and inadequacy of suitable cooking appliances all act as barriers to scaling up the use of clean cooking devices. Therefore any initiative towards overcoming these barriers is welcome.

Whilst charcoal and kerosene used to be cheap in Kenya, prices have shot up in recent years. In 2018, a logging ban was put in place to protect the nation's dwindling forest reserves, causing the price of wood fuels to double overnight. The Kenyan government has also pushed up kerosene prices by raising the tax, both to incentivise uptake of LPG for cooking and to prevent unscrupulous filling stations from adulterating petrol with cheaper kerosene. Electricity therefore remains a niche cooking fuel, with wealthier households often owning task-specific electric cooking appliances such as kettles or microwaves, but relying on LPG for the bulk of their cooking.

A new wave of energy-efficient electric cooking appliances are now available, meaning that the cost of cooking with electricity is now even more affordable. It was also alluded that Electric

Pressure Cooker (EPC) offers the ability to cook the most energy intensive foods like cereals with less than a fifth of the energy of the electric hotplate and at a fraction of the cost of any other fuel (Batchelor *et al*., 2019). It was at this point that a consortium of SCODE (Sustainable Community Development Service) and Egerton University conducted a study to evaluate the performance of Electric pressure cookers. Kitchen Performance Test was part of the evaluation protocol.

At the heart of any evaluation lies a comparison of outcomes (such as fuel consumption) between a treatment group (those who have an ICS but no traditional stoves) and a control group (those have traditional stoves but no ICS), cross sectional study. The Kitchen Performance Test (KPT) is the principal field–based procedure to measure household fuel consumption. This protocol was modified to accommodate the power measurement in kilowatts hour on use of electrical appliances (Bailis *et al.,* 2007).

The primary objective of the KPT was to quantify fuel consumption under typical household and stove usage conditions. KPT is often combined with household surveys, which help to contextualize fuel consumption practices. Because it occurs in the homes of stove users, this type of testing, when conducted carefully, is the best way to understand the stove's impact on fuel use and, when complemented with the appropriate surveys, on general household characteristics and behaviors (Lillywhite, 1984; VITA, 1985), in this context, EPC (Electric Pressure Cookers) was the stove under KPT test.

It is also important to note that KPT is a particularly difficult way to test stoves because it intrudes on people's daily activities. In addition, the measurements taken during the KPT are more uncertain because potential sources of error are harder to control in comparison to laboratory-based tests. For this reason, the protocol for the KPT is quite different from the protocols for the Water Boiling Test (WBT) and the Controlled Cooking Test (CCT). Kitchen Performance Test Version 4.0 protocol developed by Global Alliance for Clean Cook stoves was used in this study and it was both qualitative and quantitative surveys (Smith, 2010).

Quantitative surveys was used to gauge how people feel about the stove. The goal being to identify basic social, economic and cooking information of the community families. The survey provided important information and it occurred before stoves were distributed. The survey also included households that did not adopt the stove. In addition to providing information about families that are potential stove users, the survey also identified households that are were to participate in more in-depth fuel consumption tests as well as households that were willing to participate in the second stage which is quantitative survey.

MATERIALS AND METHODS

The quantitative Kitchen Performance Test which is field validation of Water Boiling Test was conducted in Lomollo B, Mbaruk and Heshima locations in Nakuru County. The choice of the locations was proposal based on low income, post-election violence victims and gender issues. KPT method that was used was the paired-sample study. This was achieved by conducting daily measurements as families use the traditional stoves for a period of three days followed by daily measurements of the same families using the improved stoves that is Electric Pressure Cooker complimented by LPG for the same period of time. This method of test made a comparison of the family's fuel use with the old and improved stove.

The number of households that were selected to participate in testing was thirty seven distributed within the three locations. Since there was a registration fees of Ksh 5,000, random selection of participants was not possible due to affordability capabilities. Eight enumerators were hired based on the respondent from Lomollo B, Mbaruk and Heshima. They were then trained for a day on data collection form using KoBoCollect application. A pre-test was conducted and individual evaluation done.

Day 0 was on a Monday where the enumerators were deployed in their respective field including supervisors. On this day, the enumerators explained to family members the purpose of the test, and arranged to measure their fuel consumption at a roughly the same time each day. It was stressed to household members that their cooking practices was to remain as close to normal as possible for the duration of the test. The enumerators recorded the weight of fuel using a spring balance and moisture content using moisture meter of the initial stock of solid fuels on Kobbocollect. If liquid and/or gaseous fuels was used, the initial stock of fuel was also recorded.

The family was asked to keep newly acquired fuel separate from the fuel that had already been measured. The family was further asked to define an inventory area to store the fuel during the test. If the family was to collect or purchase solid fuel during the days of the test, they were asked to keep newly collected or purchased solid fuel separate from fuel that has already been tested for moisture and weighed.

Enumerators visited each household at roughly the same time each day, without being intrusive. With each daily visit, the number of people that ate their meals in the household since their last visit was recorded. Since this number could vary from one day to the next, an average value was avoided. Gender and age of each person was also recoded calculate the number of standard adult persons served as shown in Table 1. Fuel consumption was recorded by weighing the remaining fuel. In cases where the family was providing their own fuel, the weight and moisture content of newly collected fuel was recorded before it was added to the family's stock.

Table 1: Standard adult equivalence factors defined in terms of sex and age

Gender and Age	Fraction of standard adult
Child 0 – 14 years	0.5
Female Over 15 years	0.8
Male 15 - 59	1
Male Over 59 years	0.8

Fuel was not provided to any of the families hence there was no frequent checks to see that they have adequate supplies and add to their stock. The data was then cleaned at the end of the test period and analysis done.

RESULT AND DISCUSSION

The data on impact of Electric Pressure Cooker on energy used per adult equivalent in thirty seven households is shown in Table 2. The households were given special identification numbers. Total energy used in mega joules before intervention was calculated from traditionally used fuels that include; firewood, charcoal, other biomass (maize residue), electricity and fixed grilled LPG using their respective calorific values from literature. The total energy used after intervention was obtained from mainly EPC and LPG with double burner. The means of total energy used per adult equivalents before are high as compared to after intervention from the visual observation. It was however necessary to conduct a t-test on the two data sets. According to hypothesis, energy used per adult equivalent was expected to decrease on the introduction of EPC unit. Therefore a one tailed t test was conducted with repeated measured design. The value obtained was 0.006782 which is less than the critical value of 0.05. This confirms that there was significant difference in the energy used before intervention and after intervention.

Table 2: Impact of EPC use on energy used per adult equivalent in 35 households

	BEFORE INTERVENTION			AFTER INTERVENTION		
HHID	**No. of adult equiv**	**Total Energy Used**	**Energy used per adult equiv**	**No. of adult equiv**	**Total Energy Used**	**Energy used per adult equiv**
1	5	88.14	17.75	4.8	17.22	3.59
2	2.97	28.75	10.11	2.5	18.01	7.21
3	5.47	99.24	17.05	4.67	26.36	5.93
4	2.8	44.224	15.79	2.8	20.43	7.30
5	2.1	29.87	14.22	2.1	13.96	6.65
6	1.8	80.40	44.67	1.6	12.82	8.02
7	3.33	61.2	18.61	2.6	32.79	12.61
8	5.43	87.3	15.92	5.87	9.12	1.47
9	1.8	106.21	59.0	2.23	4.56	2.13
10	2.47	52.09	23.11	5.13	16.45	3.52
11	2	65.33	32.67	2.83	28.54	9.78
12	2.6	33.92	13.04	2.6	24.61	9.46
13	3.6	46.56	12.93	2.93	12.49	4.31
14	4.4	40.51	9.21	4.4	17.30	3.93
15	3.47	51.18	14.58	1.8	10.24	5.68
16	5.13	105.83	20.52	6.1	11.39	1.87
17	2.8	695.52	248.4	4.17	16.88	4.38
18	3.6	23.09	6.41	5.9	15.12	2.56
19	1.3	12.27	9.44	1.3	1.90	1.46
20	4.2	79.15	18.84	3.4	15.16	4.46
21	3.3	33.03	10.01	2.07	4.24	1.87

	BEFORE INTERVENTION			AFTER INTERVENTION		
HHID	**No. of adult equiv**	**Total Energy Used**	**Energy used per adult equiv**	**No. of adult equiv**	**Total Energy Used**	**Energy used per adult equiv**
22	3.27	66.43	19.78	4.47	17.25	3.56
23	5.17	120	22.75	7.3	10.96	1.38
24	4.8	55.68	12.89	4.43	5.85	1.39
25	6.2	80.29	12.50	6.1	13.48	2.21
27	2.6	24.8	9.53	2.6	17.20	6.61
28	0.8	6.37	7.96	0.8	1.64	2.06
29	1.6	30.96	19.35	1.6	13.51	8.45
30	2.8	6.4	2.29	2.8	22.31	7.97
31	1.8	10.72	5.96	1.8	12.82	7.13
32	2.6	12.8	4.93	2.6	10.92	4.20
33	2.6	8	3.08	2.6	13.15	5.05
34	1.3	6.88	5.29	1.3	9.15	7.04
35	1.6	90.74	56.71	1.8	21.18	11.76
37	3.8	8.32	2.19	3.8	7.36	1.94
MEAN	**3.16**	**68.35**	**23.36**	**3.31**	**14.47**	**5.11**
STDV	**1.38**	**114.17**	**41.36**	**1.65**	**7.17**	**3.07**
			T-test = 0.006782<005			

It can be observed from Table 2 that in every household there was an observable decrease in the amount of energy used per adult equivalent apart from household number 30, 31 and 34. This could be attributed to the cooking behaviour of the four households. Probably because they are addicted to the EPC and therefore less cooking activities took place on the first three days before intervention, however after intervention normal cooking activities returned to normalcy. It's therefore important to note that this study confirms that EPC saves fuel usage. The overall mean of energy consumed per adult equivalent is 23.36 before intervention and 5.11 after intervention. This translates to 82% and 18% respectively. Therefore on introduction of EPC, the users will be able to save the amount of fuel consumed by 64%. Comparing the amount of energy used per adult equivalent before intervention in the three locations; Lomollo B, Echeriria and Heshima, Figure 2.1 gives the summary of the results.

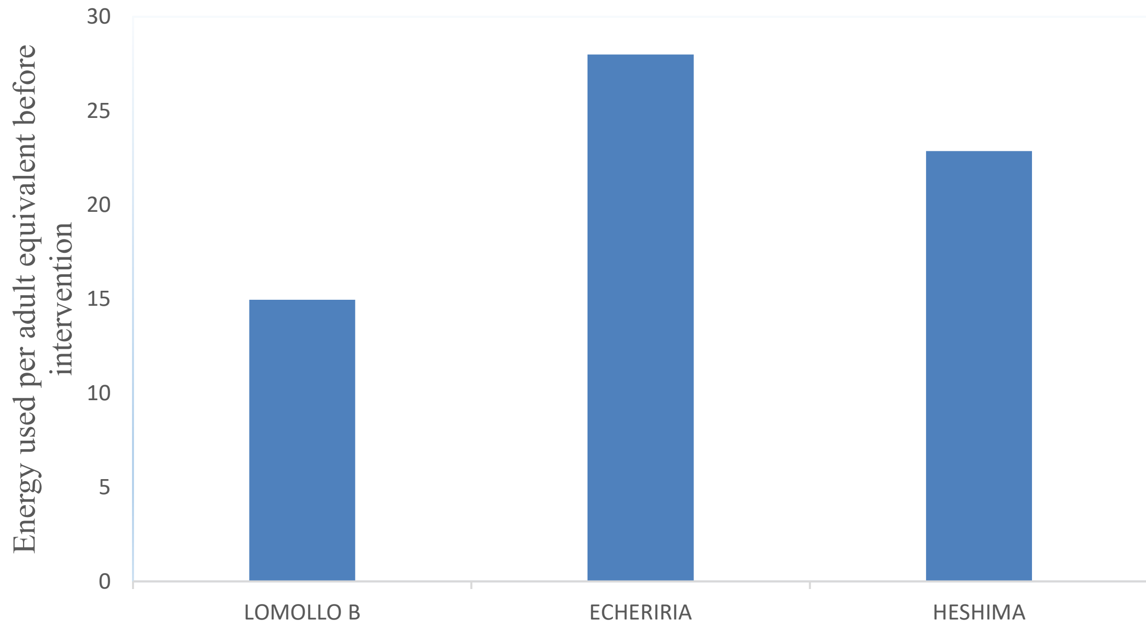

Figure 2.1: Energy used per adult equivalent before intervention in three locations

The three locations have distinct features that vary from each other. From Figure 2.1 it can be seen that Lomollo B had the lowest figure of 14.9 in terms of energy used per adult equivalent. This implies that even before intervention, households in Lomollo B are using less fuel per adult equivalent. This could be attributed to scarcity of fuel in the location, number of meals cooked in a day and energy conversion devices. Out of the three reasons, scarcity of fuel and highly efficient Jikos from Sustainable Community Development Service could be the reason for efficient energy use per adult equivalent. Echeriria is the highest with a figure of 27 mega joules used per adult equivalent followed by Heshima which is at 22.9. This could be interpreted that before intervention, Echeriria had the most inefficient cooking devices or probably there is plenty of fuel available for use. The same reasons could explain the scenario in Heshima which came second in terms of energy consumed per adult equivalent.

It was also important to see what happens on the energy consumed per adult equivalent after intervention. Figure 2.2 indicates the comparison of energy consumed per adult equivalent in the three locations; Lomollo B, Echeriria and Heshima.

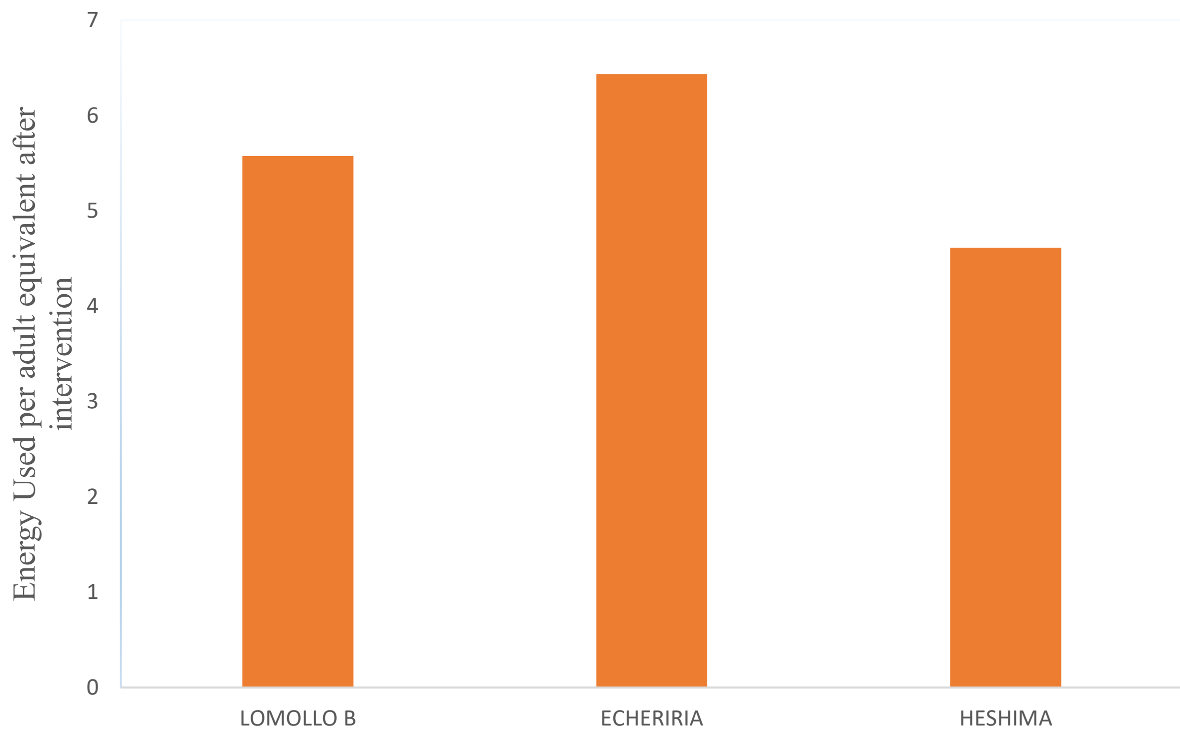

Figure 2.2: Comparison of energy consumed per adult equivalent in three locations

It is interesting to note that Echeriria has remain on top by 6.4 Mega joules consumed per adult equivalent even after introduction of new stove that is electric pressure cooker. The good news is that there has been tremendous decrease from before intervention by 21 Mega joules used per adult equivalent. Since EPC is constant on introduction in the three locations, the complimentary cooking devices is what could the source of the differences observed in Figure 2.2. Lomollo B took the second position in terms of energy consumed per adult equivalent probably because of inadequate training of proper use of EPC and family sizes. Since there were different types of EPC deployed, Lomollo B and Echeriria could have been the recipient of the high energy consumption EPC which are relatively cheap. If this is true, it therefore explain the reason why Heshima had the lowest figure of 4.6 Mega joules consumed per adult equivalent because households in this location could afford the more efficient EPC that consumes less energy. It was also interesting to see graphically the comparison of before and after intervention results in the three locations. Figure

2.3 indicate the comparison of energy used per adult equivalent before and after intervention in the three locations.

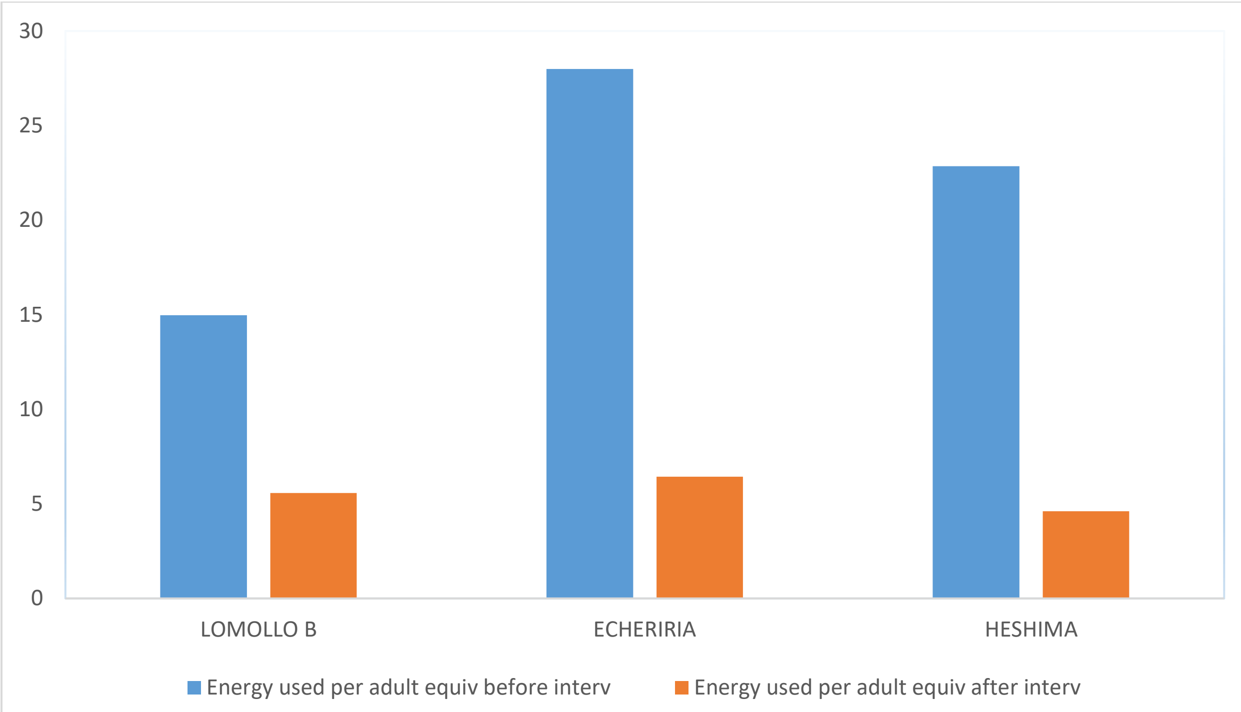

Figure 2.3: Comparison of energy consumed per adult equivalent before and after intervention in the three locations

The observation from Figure 2.3 confirm the hypothesis that there will be decrease in the amount of energy used per adult equivalent in the three location on introduction of electric pressure cooker. Regardless of the type of pressure cookers deployed, the impact is positive in relation to the amount of energy consumed. Other attributes of electric pressure cooker are; cooks faster, its safe, zero emissions, it`s safe and requires less attention while cooking. The adoption of EPC which has combination of this attributes will help Kenya to achieve the ambitious target of universal access to modern cooking solutions by 2030.

In order to compare the differences in average cost of energy used within twenty four hours before and after intervention, the Kenya Power Rate of Ksh. 15.8 per 1 kWh was used. The energy used was then translated to kWh equivalent to one unit. Therefore, when the t-test was conducted using one tailed with repeated measure design, the value was 0.0035 which is less than P-value of 0.05 hence there was significant difference in the average cost of energy used within 24 hours before and after introduction of the electric pressure cooking unit. Table 2.2 indicates the comparison of average cost of energy before and after intervention in 35 households.

Table 2.2: Cost impact of EPC cooking unit introduction in 35 households

BEFORE INTERVENTION			AFTER INTERVENTION	
HHID	**Mean Energy Used**	**Cost of Energy in Ksh**	**Mean Energy Used**	**Cost of Energy**
1.00	88.14	386.84	17.22	75.59
2.00	28.75	126.17	18.01	79.06
3.00	99.24	435.55	26.36	115.69
4.00	44.22	194.09	20.43	89.67
5.00	29.87	131.08	13.96	61.26
6.00	80.40	352.87	12.83	56.31
7.00	61.20	268.60	32.80	143.95
8.00	87.30	383.15	9.12	40.04
9.00	106.21	466.16	4.56	20.00
10.00	52.09	228.60	16.44	72.17
11.00	65.33	286.74	28.54	125.24
12.00	33.92	148.87	24.61	108.03
13.00	46.56	204.35	12.49	54.82
14.00	40.51	177.78	17.30	75.95
15.00	51.18	224.62	10.24	44.92
16.00	105.83	464.49	11.39	50.01
17.00	695.52	3052.56	16.88	74.10
18.00	23.09	101.35	15.12	66.37
19.00	12.27	53.85	1.90	8.35
20.00	79.15	347.37	15.16	66.54
21.00	33.03	144.97	4.24	18.62
22.00	66.43	291.56	17.25	75.70
23.00	120.00	526.67	10.96	48.10

	BEFORE INTERVENTION		AFTER INTERVENTION	
HHID	**Mean Energy Used**	**Cost of Energy in Ksh**	**Mean Energy Used**	**Cost of Energy**
24.00	55.67	244.35	5.85	25.68
25.00	80.29	352.40	13.48	59.18
27.00	24.80	108.84	17.20	75.50
28.00	6.37	27.96	1.65	7.23
29.00	30.96	135.88	13.51	59.31
30.00	6.40	28.09	22.31	97.90
31.00	10.72	47.05	12.82	56.28
32.00	12.80	56.18	10.92	47.93
33.00	8.00	35.11	13.15	57.70
34.00	6.88	30.20	9.15	40.16
35.00	90.74	398.23	21.18	92.96
37.00	8.32	36.52	7.36	32.29
MEAN	**68.35**	**299.97**	**14.47**	**63.50**
STDEV	**114.17**	**501.06**	**7.17**	**31.46**
		T-test = 0.0035 < 0.05		

If the mean energy consumed at household level were valued then Table 2.2 gives the clear indication of how much money is used on fuel before and after intervention. Clearly there is saving in terms of the cost of the energy at every household in this study on introduction electric pressure cooking unit.

CONCLUSIONS AND RECOMMENDATIONS

From the results it can be concluded that EPC cooking unit uses less amount of energy as compared to the traditional energy cooking devices. The overall mean of energy consumed per adult equivalent is 23.36 before intervention and 5.11 after intervention. This translates to 82% and 18% respectively. Therefore on introduction of EPC, the users are able to save the amount of fuel consumed by 64%. Lomollo B had the lowest energy used per adult equivalent before intervention followed by Heshima. Echeriria location had the highest energy consumed per adult equivalent in both before and after intervention. This translates to cheaper cost of energy probably due to high efficiency of EPC cooking unit. Therefore this results challenge the perception that EPC cooking units are expensive on daily use. The contrary is actually true, since apart from daily use being cheaper, they have zero emissions.

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Appendix

				BEFORE INTERVENTION							AFTER INTERVENTION			
HHID_CODE	Enumerator	Family_Name	Location	No. of adult equiv	Total Energy Used	Energy used per adult equiv	HHID	Family Name	Location	Village	Enumerator	No. of adult equiv	Total Energy Used	Energy use
1	Isaac_Kirui	Dominic otieno	Mogotio	5	88.14	17.75170807	1	Dominic otieno	mogotio	Lomolo B	isaac_kirui	4.8	17.224	3.588333
2	Isaac_Kirui	Aggrey Ngesa	Mogotio	2.966666667	28.74666667	10.11295564	2	Aggrey Ngesa	mogotio	Lomolo B	isaac_kirui	2.5	18.014	7.2056
3	Isaac_Kirui	John kirwa	Mogotio	5.466666667	99.24	17.0487395	3	John kirwa	mogotio	Lomolo B	isaac_kirui	4.666666667	26.3608	5.927967
4	francis_gitonga	Francis Mwangi	Mbaruk	2.8	44.224	15.79428571	4	Francis Mwangi	mbaruk	Freehold	francis_gitonga	2.8	20.4304	7.296571
5	francis_gitonga	Ruth Wanjiru	Mbaruk	2.1	29.86666667	14.22222222	5	Ruth Wanjiru	mbaruk	House hold on a rock	francis_gitonga	2.1	13.9584	6.646857
6	francis_gitonga	Joseph Kariuki	Mbaruk	1.8	80.40025	44.66680556	6	Joseph Kariuki	mbaruk	House hold near the	francis_gitonga	1.6	248.7772	155.4858
7	francis_gitonga	Kamau Wachira	Mbaruk	3.333333333	61.2	18.61031746	7	Kamau Wachira	mbaruk	Household near the	francis_gitonga	2.6	32.7988	12.61492
8	victor_muiruri	Mary kimondo	Mbaruk	5.433333333	87.3	15.92226891	8	Mary kimondo	mbaruk	Kasambara	victor_muiruri	5.866666667	9.1232	1.475571
9	victor_muiruri	Faith nduati	Mbaruk	1.8	106.2133333	59.00740741	9	Faith nduati	mbaruk	Kasambara	victor_muiruri	2.233333333	4.5568	2.132703
10	victor_muiruri	Monica mokaya	Mbaruk	2.466666667	52.08666667	23.10595238	10	Monica mokaya	mbaruk	Echariria	victor_muiruri	5.133333333	16.4448	3.512389
11	victor_muiruri	Caleb chege	Mbaruk	2	65.33333333	32.66666667	11	Caleb chege	mbaruk	Echariria	victor_muiruri	2.833333333	28.536	9.778667
12	ruth_mbogo	Ruth Mbogo	Solai	2.6	33.92	13.04615385	12	Ruth Mbogo	scode	Household near sho	ruth_mbogo	2.6	24.6147	9.467192
13	ruth_mbogo	Eunice Nungari	Mbaruk	3.6	46.56	12.93333333	13	Eunice Nungari	mbaruk	Household within th	ruth_mbogo	2.933333333	12.4896	4.307624
14	ruth_mbogo	Joseph Mwando	Mbaruk	4.4	40.50666667	9.206060606	14	Joseph Mwando	mbaruk	House hold with few	ruth_mbogo	4.4	17.3048	3.932909
15	ruth_mbogo	Hilda Ong'ang'a	Mbaruk	3.466666667	51.18	14.57932331	15	Hilda Ong'ang'a	mbaruk	Household within th	ruth_mbogo	1.8	10.2356	5.686444
16	victor_muiruri	Esther kangethe	Mbaruk	5.133333333	105.8333333	20.52134032	16	Esther cherono	mbaruk	Echariria	victor_muiruri	6.1	11.394	1.867869
17	teresia_matenjwa	Freidrick Njuguna	Solai	2.8	695.52	248.4	17	Freidrick Njuguna	scode	Kiamaina	teresia_matenjwa	4.166666667	16.8832	4.383688
18	teresia_matenjwa	John Waweru	Solai	3.6	23.09333333	6.414814815	18	John Waweru	scode	Kiamaina	teresia_matenjwa	5.9	15.1232	2.563254
19	teresia_matenjwa	Mercy Kamau	Solai	1.3	12.2688	9.437538462	19	Mercy Kamau	scode	Kiamaina	teresia_matenjwa	1.3	1.9036	1.464308
20	teresia_matenjwa	Elizabeth Maina	Solai	4.2	79.14666667	18.84444444	20	Elizabeth Maina	scode	Kiamaina	teresia_matenjwa	3.4	15.1616	4.459294
21	teresia_matenjwa	Mary Waweru	Solai	3.3	33.03	10.00909091	21	Mary Waweru	scode	Kiamaina	teresia_matenjwa	2.066666667	4.2424	1.863145
22	dennis_were	Benedetta kamau	Solai	3.266666667	66.432	19.78580576	22	Benedetta kamau	scode	Good samaritan	dennis_were	4.466666667	17.248	3.557016
23	dennis_were	Joshua mwangioedl z	Solai	5.166666667	120	22.74762551	23	Joshua mwangi	scode	Kabatini	dennis_were	7.3	10.9596	1.373456
24	dennis_were	Daniel mugwimi	Solai	4.8	55.67466667	12.89990404	24	Daniel mugwimi	scode	Nyathuna	dennis_were	4.433333333	5.8512	1.390049
25	dennis_were	Harun luyali	Solai	6.2	80.29333333	12.50275155	25	Harun luyali	scode	Nyathuna	dennis_were	6.1	13.484	2.203698
27	rosemary_ndung_u	Joseph thaba	Solai	2.6	24.8	9.538461538	27	Joseph Thaba	scode	Kiamaina	rosemary_ndung_u	2.6	17.2016	6.616
28	rosemary_ndung_u	Anastacia Kamau	Solai	0.8	6.3712	7.964	28	Anastacia Kamau	scode	Kiamaina	rosemary_ndung_u	0.8	1.6484	2.0605
29	rosemary_ndung_u	Teresiah Matenjwa	Solai	1.6	30.96	19.35	29	Teresiah Matenjwa	scode	Heshima	rosemary_ndung_u	1.6	13.5128	8.4455
30	rosemary_ndung_u	Peter Maina	Solai	2.8	6.4	2.285714286	30	Peter Maina	scode	Heshima	rosemary_ndung_u	2.8	22.3056	7.966286
31	mary_thuo	Dorcas Kamau	Solai	1.8	10.72	5.955555556	31	Dorcas Kamau	scode	Gituamba	mary_thuo	1.8	12.8244	7.124667
32	mary_thuo	Mary Thuo	Solai	2.6	12.8	4.923076923	32	Mary Thuo	scode	Scode	mary_thuo	2.6	10.9216	4.200615
34	mary_thuo	Irene kago	Solai	2.6	8	3.076923077	33	Irene Kago	scode	Scode	mary_thuo	2.6	13.1464	5.056308
34	mary_thuo	Sabina Noki	Solai	1.3	6.88	5.292307692	34	Sabina Njoki	scode	Gituamba	mary_thuo	1.3	9.1508	7.039077
35	francis_gitonga	Virginia Mwangi	Mbaruk	1.6	90.73666667	56.71041667	35	Virginia Mwangi	mbaruk	Barnabas	francis_gitonga	1.8	21.1812	11.76733
37	mary_thuo	Mercy Wanjiku	Solai	3.8	8.32	2.189473684	37	Mercy Wanjiku	scode	Gituamba	mary_thuo	3.8	7.3572	1.936105