International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 7.328
Peer Reviewed Bi-Monthly
Vol.9 No.6 July – Aug 2022

ENERGY LITERACY AND USE OF SUSTAINABLE ENERGY MANAGEMENT PRACTICES

Dr C. S. Kale
Assistant Professor, CSIBER, University Road, Kolhapur
***Corresponding Author*- Dr C. S. Kale**
Email- cskale@siberindia.edu.in
DOI- 10.5281/zenodo.7073504

Abstract
As it is known, the entire world is trying to prevent global warming, which is one of the major problems in the world. The easiest and effective solution to this problem is using energy efficiently. Hence the present study emphasizes on the nexus between the energy literacy and the use of sustainable energy management practices among the end users of Gadhinglaj block. As there is increasing awareness for the use of renewable energy but the dissemination of the renewable energy technology among the rural people is very low. The energy consumption pattern in rural is far different than in urban areas. Hence the current study is based on the variables that influence the usage of renewable energy use. This research tries to find out the relation between the energy literacy and use of renewable energy technology in rural. The main objective of this study is to understand the relation between use of sustainable energy management practices and literacy rate, whether the increase in literacy rate influences positive usage of sustainable energy management practices. In involves collection of data with a survey questionnaire, evaluation of the energy knowledge, behavior and attitudes of respondents, towards the renewable energy management practices. Therefore, a survey was conducted among the selected villages of Gadhinglaj Block of Kolhapur district by using suitable sampling design. A survey questionnaire consisted of 50 questions with four sub sections like personal information, type of house, type of energy equipment at home, knowledge about energy consumption and also their families' behaviors on energy. 500 responses from the villagers were recorded by using interview schedule technique. This study reveals that the overall knowledge level of the respondents on energy issues is very low. In order to increase energy literacy there is need of energy awareness programmes Thus, an energy awareness programmes should be implemented in the schools also community outreach activities should be organized in Gadhinglaj block of Kolhapur district.

***Keywords**: Energy Literacy, Energy Education, Survey, Renewable Energy Technology*

Introduction

Energy planning and management is complex and need to be addressed in an organized manner. For instance, carbon reduction in the electricity sector is one of the priorities for climate change mitigation, as most electricity is generated from fossil fuels in many countries. However, the rapid increase of electricity from wind and the solar photovoltaic (PV) cannot support the transition to meet the <2 °C goal [3]. More issues related to market mechanisms, such as economic incentives, carbon pricing, and corresponding benefit/cost analysis, need to be incorporated [5]. That is, energy is not just about science, but also about daily lives, along with related economic and social issues. 234wThus, energy is about decision-making; hence, energy literacy plays a crucial role as

well-informed and well-educated citizens are the basis for the design and implementation of smart and forward-looking policies. In addition to support from technological innovation, energy-literate citizens, instead of decision-makers, who can engage in the decision process and commit to action, help bring about a successful paradigm shift in terms of energy use, e.g., from a heavy reliance on fossil fuels to low-carbon renewable energy sources [6]. It was argued that knowledge about energy is required to make people citizens with basic competence [7]. However, energy literacy is not just about knowledge, which is cognitive, but also aspects related to affect and behavior. People with energy literacy are expected to take responsible actions according to their assimilated knowledge and constructed value [8]Climate change and global warming is becoming crucial environmental fear to tackle for the today's world. It is the consequence of green house gas emissions such as CO_2 from burning of fossil fuels and transportation sector. Thus it has become necessary to reduce the burning of fossil fuels. The policy makers and end users o Therefore, it is important to decrease the burning of fossil fuels and there are some actions which can be done by consumers and also by the policy makers. Some solution advices are given; using energy efficiently, using renewable energy sources and resources, and also educating people about these energy issues, respectively. These solution advices are discussed in the following sections. Energy, energy education and energy efficiency gains importance in reducing global warming (De Waters & Powers, 2010). When it is looked all over the world; using renewable energy sources and improving techniques for this technology gain importance as well. For this reason, energy-related choices, energy efficiency, renewable energy resources must be learnt and the knowledge of these issues should be at high level. As the knowledge on clean energy technologies and energy usage increases, better choices about energy efficiency, and consumers' attention for their daily life habits about energy or their habits to improve energy usage will change (De Waters & Powers, 2007).

Objective of the paper

To understand the relation between energy literacy and use of sustainable energy management practices among the end users of Gadhinglaj block,

Hypotheses

1. H_1: The increase in energy literacy rate tends to increase in usage of sustainable energy management practices.
2. H_0: The increase in energy literacy rate no change in usage of sustainable energy management practices.

Scope of study

The present study will focus on certain specified functional areas within the regular limits and is restricted to selected villagers of Gadhinglaj Block.

1. The geographical scope of the study covers Gadhinglaj Block.
2. The functional scope of the present work was to establish a relationship between energy literacy and use of sustainable energy management practices.

Review of literature

Social acceptance for the sustainable energy management practices can be gained through the improvement of community energy knowledge and literacy, and a re-orientation of public education to adopt renewable energy education strategies in formal and informal background (Kandpal and Broman 2014; De Waters and Powers 2011; Mälkki et al. 2014) Education should be aimed at fostering public knowledge of new or complex issues in order to fully understand the issues, identify realistic solutions, reach reasonable conclusions, and thus influence decision making and policy

formulation (Stoutenborough et al. 2013). A well learned and environmentally aware society may maintain policies that prioritize the national interests over the individual interests (also referred to as *social orientation*) (Kollmuss and Agyeman 2000). It can also be dispute that simplified knowledge influences an individual's reactive thinking of a given problem and thus may stimulate changes to his/her approach and performance accordingly (Barr 2007). A basic understanding of energy production and its uses, and how to conserve it, is very essential to make right decisions on issues, such as technology choice, energy use at the domestic level, and national and international policies (De Waters and Powers 2011; US. Department of Energy 201).

Sampling Design

To collect the data regarding the energy consumption and identification of local energy supply sources survey method was used, by conducting energy consumption survey among the selected sample villages in Gadhinglaj block in which questionnaire was formulated. The population size is 53000 households approximately thus using Cochran's formula with the level of significance equal to 0.025 (Z=5.02) and margin of error E=0.05 we get sample size n=498. Therefore sample size 501 was greater than the required sample size 498. There are 7 circles in the study area circle consists of a group of villages. Hence 10% villages approximately from each circle purposively (as per the energy demand supply potential) were selected for the survey. Further from each of the selected villages 10% simple random sample was drawn to get overall sample size n=501.

Tools and techniques used:

The analysis of data was carried out using measures of central tendency, measures of dispersion, correlation, Z-Test, Chi-Square test, one sample proportion, Time series, graphs and charts, etc.

Data analysis and Interpretation

H_0: The increase in energy literacy rate tends to no change in usage of sustainable energy management practices.

14 sub hypothesis are formulated and discussed below

Sub-hypothesis,

H_0: More than 50% respondents have got knowledge of the energy use from school college education.

H_1: Less than 50% respondents have got knowledge of the energy use from school college education.

Table no 1: Knowledge of the energy use from school college education

Knowledge of the energy use from school college education	Frequency	Proportion	Z	P value	Decision
No	61 (12.18)	0.8782	16.9325	1	Accept
Yes	440 (87.82)				
Total	501 (100.00)				

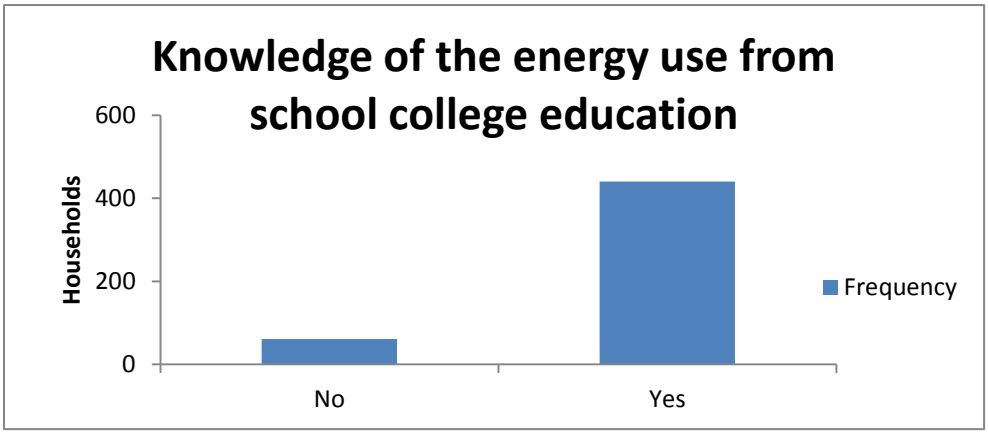

Fig no 1

Conclusion:
Accept H_0 at 5% LOS. More than 50% respondents have got knowledge of the energy use from school college education.

2. H_0: More than 50% respondents are agreed that education has role in switching to sustainable energy sources.
H_1: Less than 50% respondents are agreed that education has role in switching to sustainable energy sources.

Table no 2 Role of education in switching to sustainable energy sources

Education has role in switching to sustainable energy sources	Frequency	Proportion	Z	P value	Decision
No	51 (10.18)	0.8982	17.8260	1	Accept
Yes	450 (89.82)				
Total	501 (100.00)				

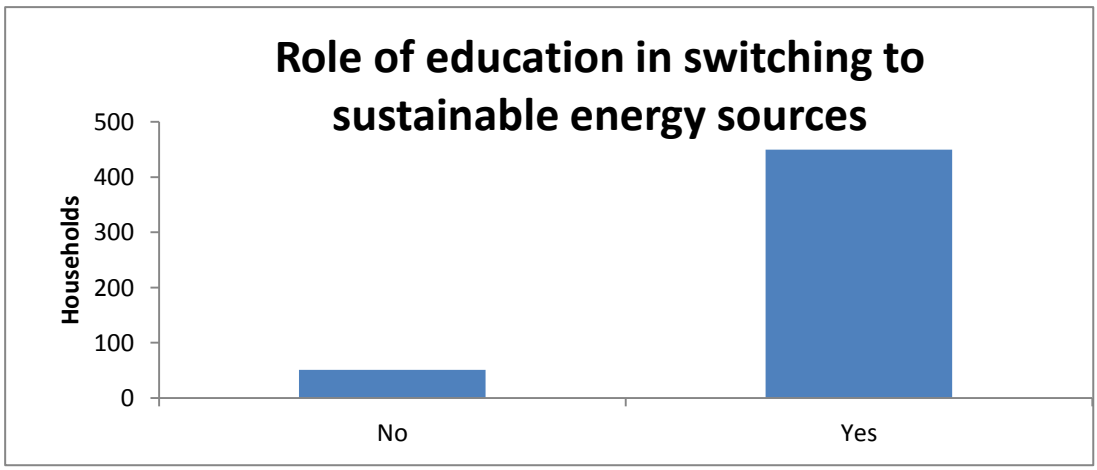

Fig no 2

Conclusion: Accept H_0 at 5% LOS. More than 50% respondents are agreed that education has role in switching to sustainable energy sources.

3. H_0: Use of fossil fuel does not depend on literacy of the family.
H_1: Use of fossil fuel is depends on literacy of the family.

Table no 3: Use of fossil fuel

Educational Status of Family	Daily	Weekly	Monthly	Yearly	Total	Likelihood Ratio	df	P value	Decision
Uneducated	113 (72.44)	28 (17.95)	13 (8.33)	2 (1.28)	156 (100.00)				
Educated	26 (50.00)	12 (23.08)	3 (5.77)	11 (21.15)	52 (100.00)				
Well Educated	193 (65.87)	73 (24.91)	17 (5.80)	10 (3.41)	293 (100.00)				
	332 (66.27)	113 (22.55)	33 (6.59)	23 (4.59)	501 (100.00)	29.017	6	0	Reject

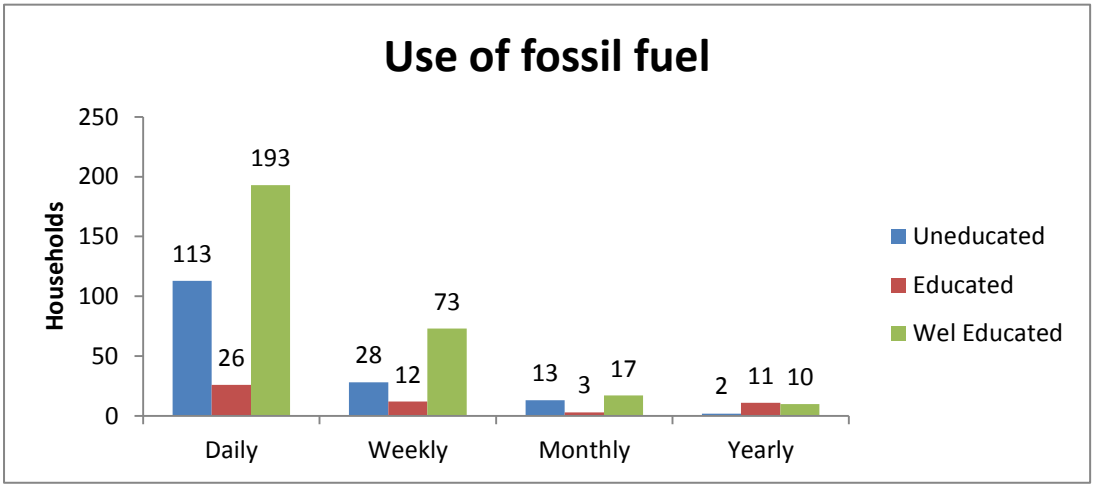

Fig no 3

Conclusion:

We reject H_0 at 5% level of significance (LOS). That is, use of fossil fuel is depends on literacy of the family. 66.27% families uses fossil fuel daily. Moreover, the percentage is high among uneducated families.

4. H_0: The use of L.P.G. does not depend on literacy of the family.

H_1: The use of L.P.G. is depends on literacy of the family.

Table no 4: Use of L.P.G.

Educational Status of Family	Daily	Weekly	Monthly	Yearly	Total	Likelihood Ratio	df	P value	Decision
Uneducated	110 (70.51)	15 (9.62)	19 (12.18)	12 (7.69)	156 (100.00)				
Educated	45 (86.54)	3 (5.77)	3 (5.77)	1 (1.92)	52 (100.00)				
Well Educated	193 (65.87)	38 (12.97)	38 (12.97)	24 (8.19)	293 (100.00)				
	348	56	60	37	501	10.987	6	0.089	Accept

	(69.46)	(11.18)	(11.98)	(7.39)	(100.00)				

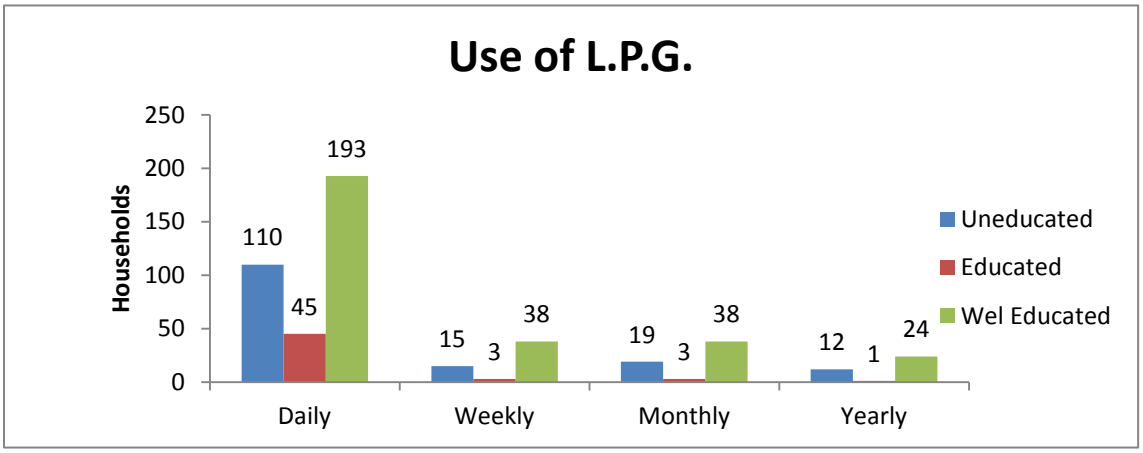

Fig no 4

Conclusion:

We accept H_0 at 5% LOS. That is, the use of L.P.G.

5. H_0: The use of kerosene does not depend on literacy of the family.

H_1: The use of kerosene is depends on literacy of the family.

Table no 5: Use of kerosene

Educational Status of Family	Daily	Weekly	Monthly	Yearly	Total	Likelihood Ratio	df	P value	Decision
Uneducated	46 (29.49)	64 (41.03)	39 (25.00)	7 (4.49)	156 (100.00)				
Educated	10 (19.23)	17 (32.69)	10 (19.23)	15 (28.85)	52 (100.00)				
Wel Educated	92 (31.40)	107 (36.52)	75 (25.60)	19 (6.48)	293 (100.00)				
	148 (29.54)	188 (37.52)	124 (24.75)	41 (8.18)	501 (100.00)	24.707	6	0	Reject

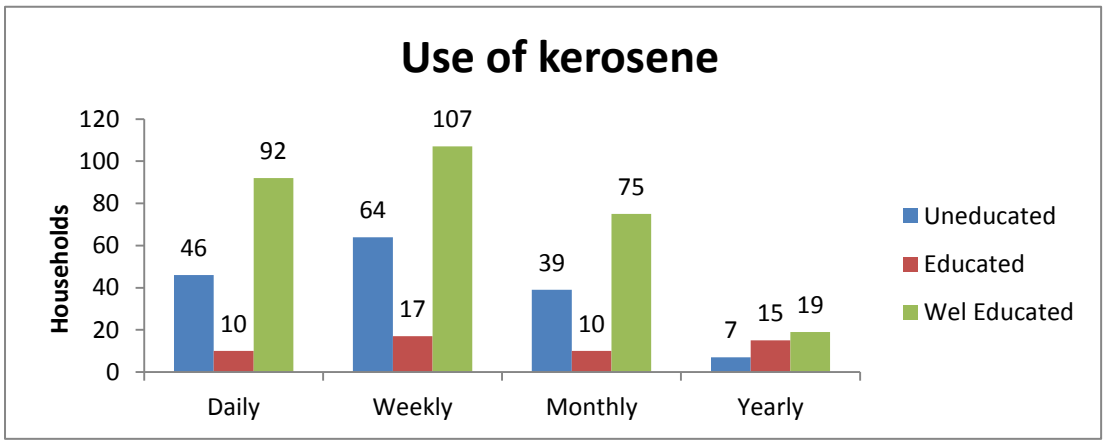

Fig no 5

Conclusion: We reject H_0 at 5% LOS. That is, the use of kerosene is depend on literacy of the family. It is observed that, 31.40% well educated families uses kerosene daily and 36.52% well educated families uses kerosene weekly, which is highest as compare to uneducated and educated families.

6. H_0: The use of biogas does not depend on literacy of the family.

H_1: The use of biogas is depend on literacy of the family.

Table no 6: Use of biogas

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	134 (85.90)	22 (14.10)	156 (100.00)				
Educated	46 (88.46)	6 (11.54)	52 (100.00)				
Well Educated	234 (79.86)	59 (20.14)	293 (100.00)				
	414 (82.63)	87 (17.37)	501 (100.00)	4.091	2	0.129	Accept

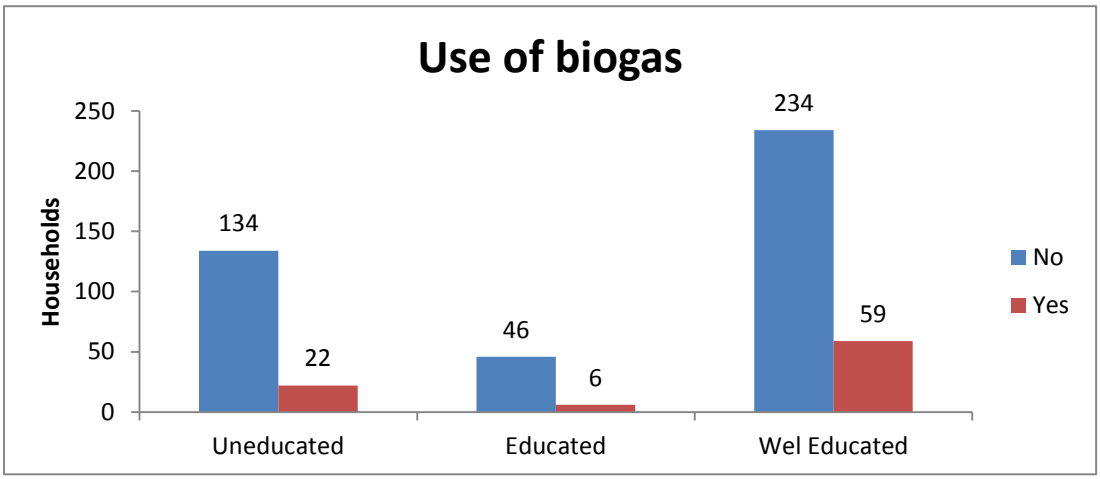

Fig no 6

Conclusion: We accept H_0 at 5% LOS. The use of biogas does not depend on literacy of the family. Use of Electric Components

7. H_0: Use of tube lights does not depend on literacy of the family.

H_1: Use of tube lights depends on literacy of the family.

Table no 7: Use of tube lights

Educational Status of Family	0	1	2	3	More than 3	Total	Likelihood Ratio	df	P value
Uneducated	115 (73.72)	33 (21.15)	5 (3.21)	2 (1.28)	1 (0.64)	156 (100.00)			
Educated	29 (55.77)	13 (25.00)	7 (13.46)	0 (0.00)	3 (5.77)	52 (100.00)			
Well Educated	220 (75.09)	58 (19.80)	10 (3.41)	5 (1.71)	0 (0.00)	293 (100.00)	28.123	10	0.002

	364 (72.65)	104 (20.76)	22 (4.39)	7 (1.40)	4 (0.80)	501 (100.00)			

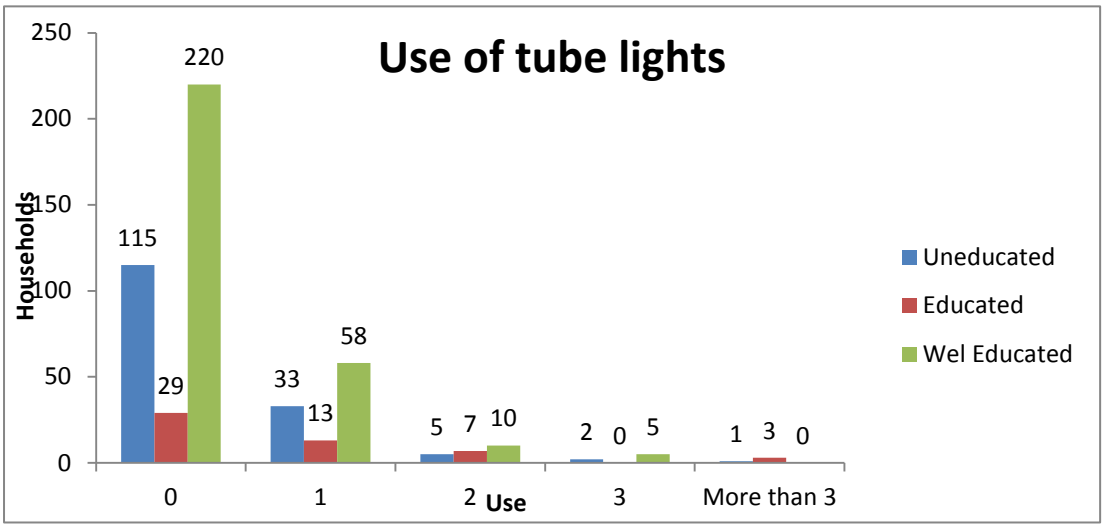

Fig no 7

Conclusion: We reject H_0 at 5% LOS. That is, use of tube lights is depend on energy literacy of the family. Most of the families do not use the tube lights.

8. H_0: Use of LED bulbs does not depend on energy literacy of the family.

H_1: Use of LED bulbs is depend on energy literacy of the family.

Table no 8: Use of LED bulbs

Educational Status of Family	0	1	2	3	More than 3	Total	Likelihood Ratio	df	P value
Uneducated	62 (39.74)	20 (12.82)	34 (21.79)	33 (21.15)	7 (4.49)	156 (100.00)			
Educated	10 (19.23)	2 (3.85)	10 (19.23)	15 (28.85)	15 (28.85)	52 (100.00)			
Well Educated	87 (29.69)	31 (10.58)	59 (20.14)	79 (26.96)	37 (12.63)	293 (100.00)			
	159 (31.74)	53 (10.58)	103 (20.56)	127 (25.35)	59 (11.78)	501 (100.00)	28.123	10	0.002

Fig no

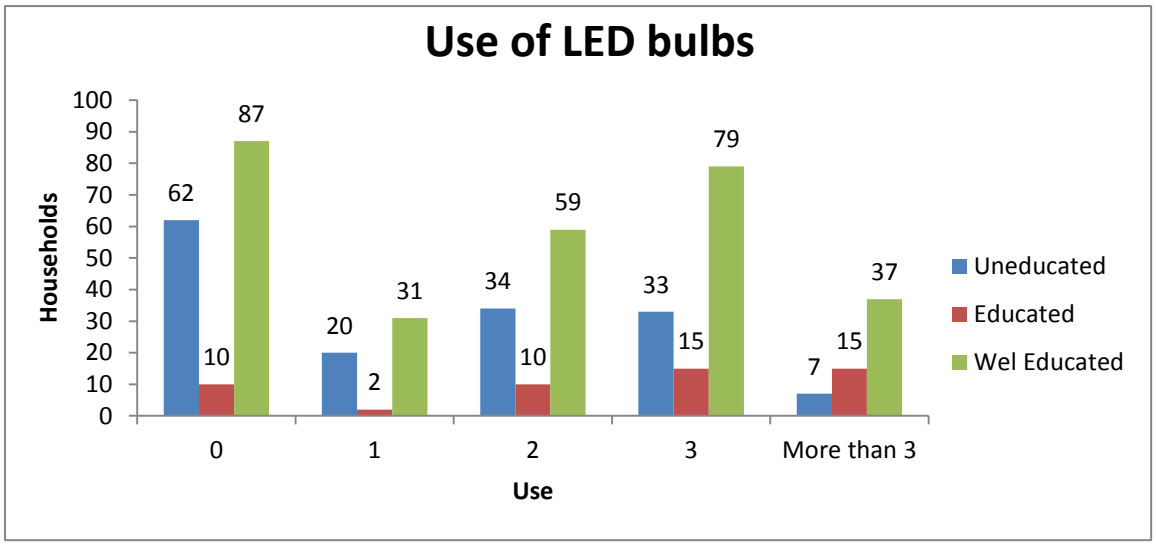

Fig no 13

Fig no 8

Conclusion:

We reject H_0 at 5% LOS. That is, use of LED bulbs is depend on energy literacy of the family. Most of the families using LED bulbs and percentage of use is higher among well educated families.

9. H_0: Use of 60V bulbs does not depend on energy literacy of the family.

H_1: Use of 60V bulbs is depend on energy literacy of the family.

Table no 9 Use of 60V bulbs

Educational Status of Family	0	1	2	3	More than 3	Total	Likelihood Ratio	df	P value
Uneducated	31 (19.87)	48 (30.77)	42 (26.92)	28 (17.95)	7 (4.49)	156 (100.00)			
Educated	15 (28.85)	16 (30.77)	8 (15.38)	6 (11.54)	7 (13.46)	52 (100.00)			
Well Educated	60 (20.48)	80 (27.30)	93 (31.74)	38 (12.97)	22 (7.51)	293 (100.00)			
	106 (21.16)	144 (28.74)	143 (28.54)	72 (14.37)	36 (7.19)	501 (100.00)	20.168	10	0.028

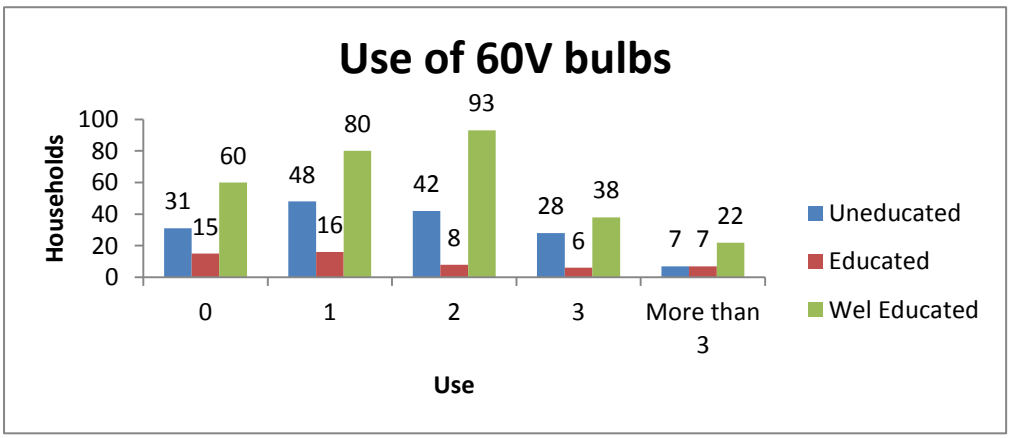

Fig no 9

Conclusion:
We reject H_0 at 5% LOS. That is, use of 60V bulbs is depend on energy literacy of the family. Most of the families using 60V bulbs and percentage of use is higher among uneducated families.

10. H_0: Use of cooker does not depend on energy literacy of the family.
H_1: Use of cooker is depend on energy literacy of the family.

Table no 10: Use of cooker

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	46 (29.49)	110 (70.51)	156 (100.00)				
Educated	9 (17.31)	43 (82.69)	52 (100.00)				
Well Educated	55 (18.77)	238 (81.23)	293 (100.00)				
	110 (21.96)	391 (78.04)	501 (100.00)	7.3	2	0.026	Reject

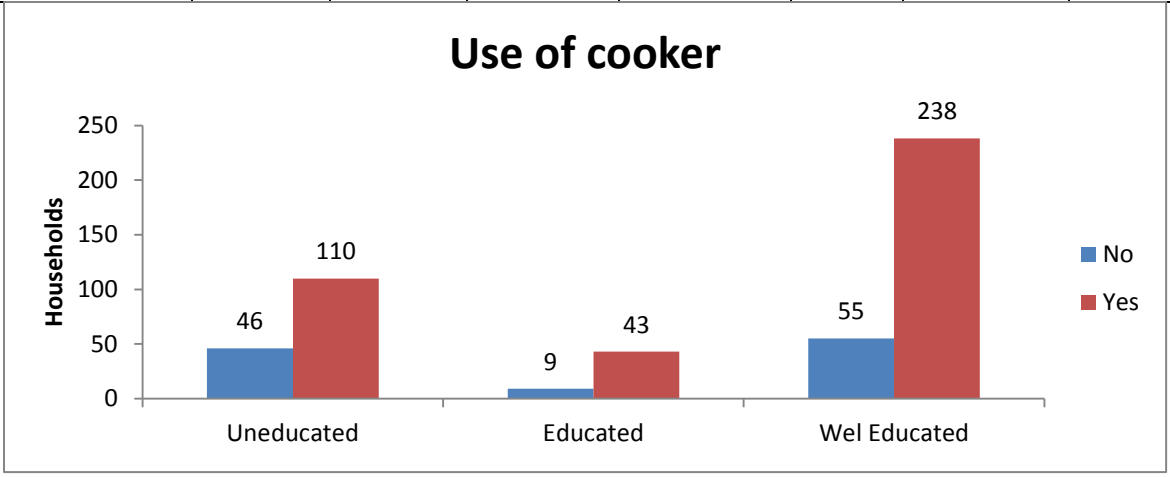

Fig no 10

Conclusion:
We reject H_0 at 5% LOS. That is, use of cooker is depend on energy literacy of the family. Most of the families using cookers and percentage of use is higher among well educated and educated families.

11. H_0: There is no association between use of biomass briquette and energy literacy.
H_1: There is association between use of biomass briquette and energy literacy.

Table no 11 Use of biomass briquette and literacy

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	111 (71.15)	45 (28.85)	156 (100.00)				
Educated	34 (65.38)	18 (34.62)	52 (100.00)				
Well Educated	204 (69.62)	89 (30.38)	293 (100.00)	0.605	2	0.739	Accept

	349 (69.66)	152 (30.34)	501 (100.00)				

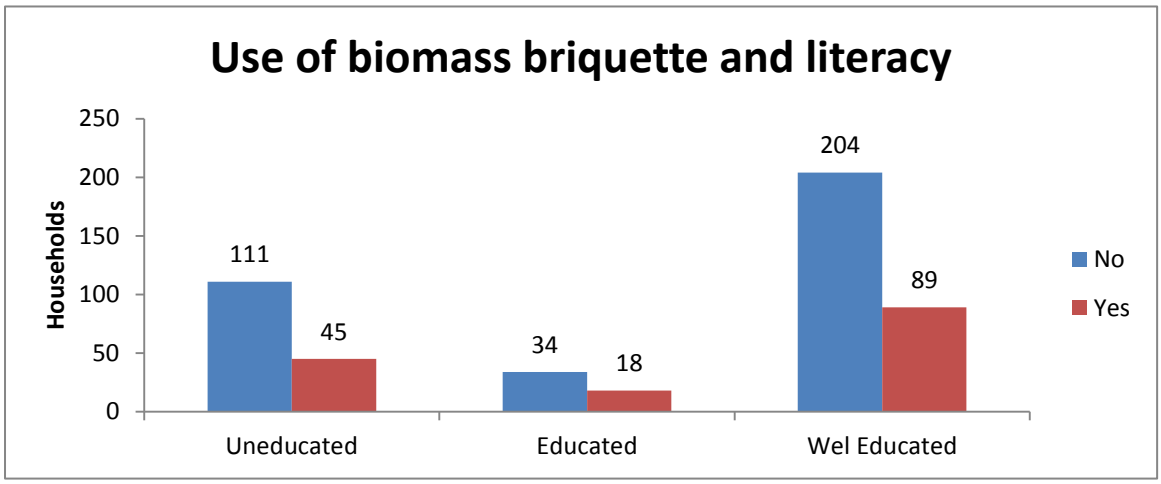

Fig no 11

Conclusion: We accept H_0 at 5% LOS. Use of biomass briquette does not depend on energy literacy of the family. Percentage of use is high among educated and well educated families.

12 H_0: There is no association between knowledge about biomass briquette and energy literacy.

H_1: There is association between knowledge about biomass briquette and energy literacy.

Table no 12: Knowledge about biomass briquette and literacy

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	93 (59.62)	63 (40.38)	156 (100.00)				
Educated	27 (51.92)	25 (48.08)	52 (100.00)				
Well Educated	158 (53.92)	135 (46.08)	293 (100.00)				
	278 (55.49)	223 (44.51)	501 (100.00)	1.639	2	0.441	Accept

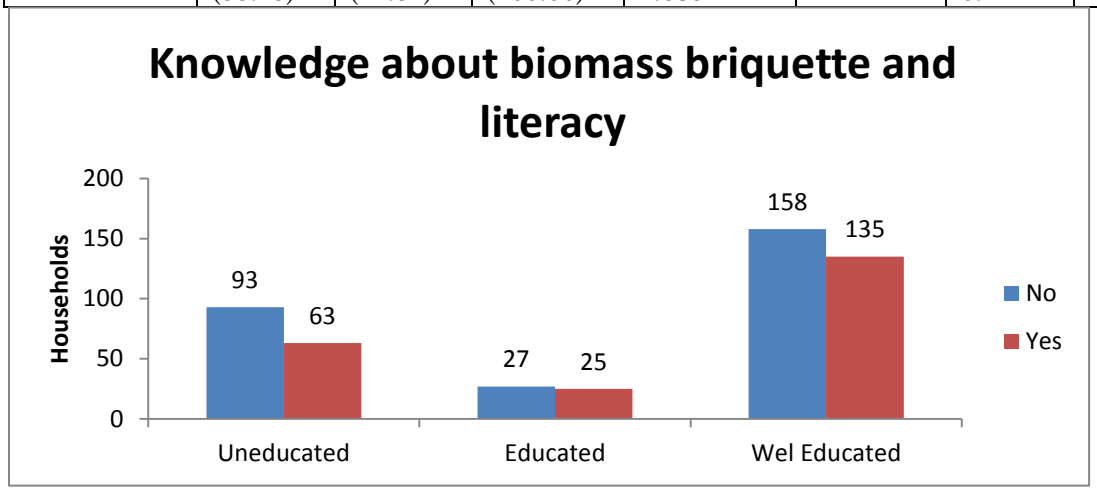

Fig no 12

Conclusion: We accept H0 at 5% LOS. There is no association between knowledge about biomass briquette and energy literacy.

13. H_0: There is no association between knowledge about sustainable energy production from there industry and energy literacy.

H_1: There is association between knowledge about sustainable energy production from there industry and energy literacy.

Table no 13: Knowledge about sustainable energy production from there industry

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	117 (75.00)	39 (25.00)	156 (100.00)				
Educated	42 (80.77)	10 (19.23)	52 (100.00)				
Well Educated	215 (73.38)	78 (26.62)	293 (100.00)				
	374 (74.65)	127 (25.35)	501 (100.00)	1.35	2	0.509	Accept

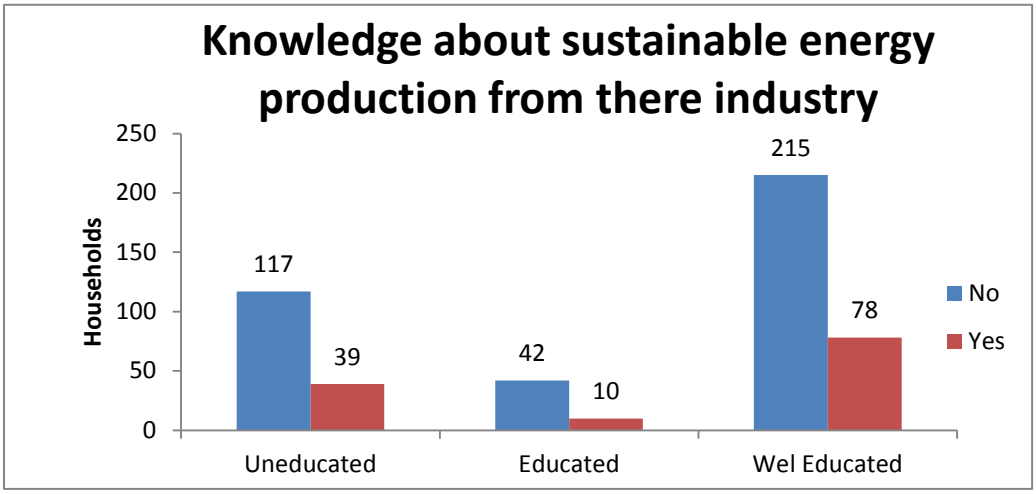

Fig no 13

Conclusion: We accept H_0 at 5% LOS. There is no association between knowledge about sustainable energy production from there industry and energy literacy. Most of the families are unaware about sustainable energy production from there industry.

14 H_0: There is no association between sustainable energy production and energy literacy of family.

H_1: There is association between sustainable energy production and energy literacy of family.

Table no 14: Sustainable energy production and literacy

Educational Status of Family	No	Yes	Total	Likelihood Ratio	df	P value	Decision
Uneducated	115 (73.72)	41 (26.28)	156 (100.00)				
Educated	43 (82.69)	9 (17.31)	52 (100.00)	1.856	2	0.395	Accept

Well Educated				225 (76.79)	68 (23.21)	293 (100.00)				
	383 (76.45)	118 (23.55)	501 (100.00)							

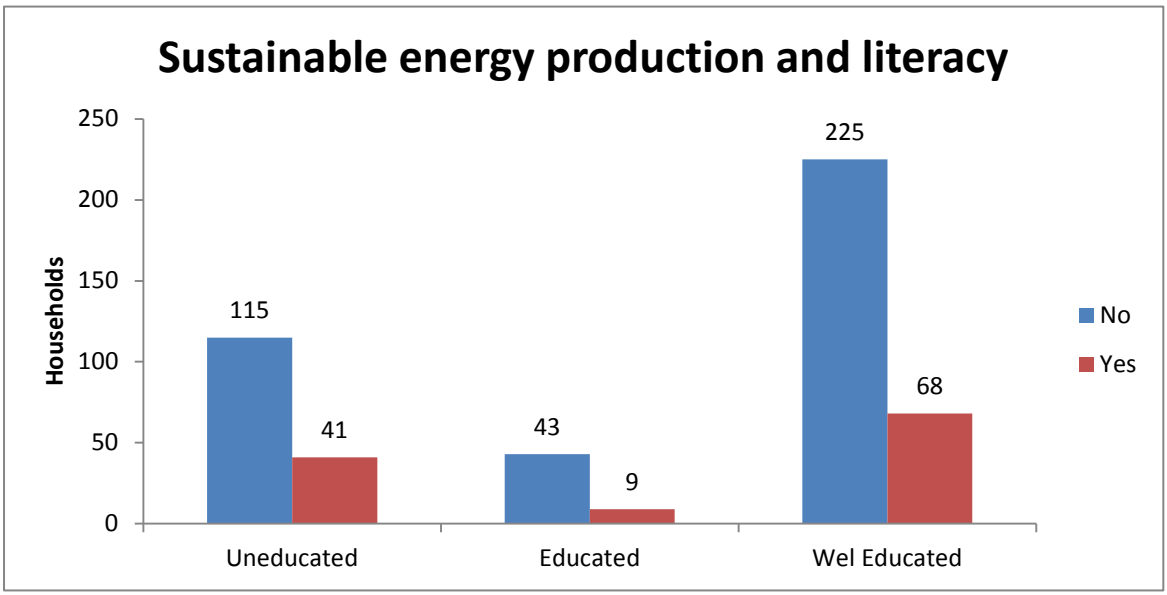

Fig no 14

Conclusion: We accept H_0 at 5% LOS. There is no association between sustainable energy production and energy literacy. Most of the families do not produce sustainable energy.

VII Conclusion and Recommendations

In order to develop energy literacy there is need for increase awareness about sustainable energy management practices among the villagers of Gadhingalj block of Kolhapur District. This can be only achieved by organizing special outreach activities on sustainable energy management for school students and also for the community. The respective policy makers should also take certain steps to enhance the dissemination of renewable energy technologies and make the villages to adopt sustainable energy management practices. Rewards and recognitions should be given by the energy department and the government bodies in order to motivate the students and people those are already using sustainable energy management practices. This will improve the usage of sustainable energy management practices and habit of energy management and use of renewable energy will be inculcated in the students at an early age. Hence energy literacy education is must for sustainable energy management practices.

References

1. Annan, K. (2005). *Literacy and sustainable development*. Bangkok: UNESCO.
2. Bhola, H.S. & Gomez, S.V. (2008).*Signposts to literacy for sustainable development complementary studies*. Hamburg: UNESCO.
3. International Energy Agency (IEA). Tracking Clean Energy Progress 2016—Energy Technology Perspectives 2016

4. Excerpt, IEA Input to the Clean Energy Ministerial; OECD/IEA: Paris, France, 2016.
5. Noe-Hays, A. Energy Literacy: Learning with Body and Mind. Synergy Learn. 2011, 25, 1–3.
6. Baron, R. Energy Transition after the Paris Agreement Policy and Corporate Challenges. In Proceedings of the 34th Round Table on Sustainable Development, WindEurope Summit, Hamburg, Germany, 28–29 September 2016.
7. DeWaters, J.; Powers, S. Establishing Measurement Criteria for an Energy Literacy Questionnaire. J. Environ.Educ. 2013, 44, 38–55. [CrossRef]
8. Newborough, M.; Probert, D. Purposeful Energy Education in the UK. Appl. Energy 1994, 48, 243–259. [CrossRef]
   St. Clair, R. Words for the World: Creating Critical Environmental Literacy for Adults. New Dir. Adult Contin. Educ. 2003, 99, 69–78. [CrossRef]
9. DeWaters, J. and Powers, S. (2008). Energy Literacy Among Middle and High School Youth. Clarkson University – Session T1A –Session T2F
10. DeWaters, J. and Powers, S. (2010). Energy Literacy of Secondary Students in New York States (USA): A measure of knowledge, affect, and behaviour. Clarkson University - Energy Policy 39 (2011) 1699-1710
11. Energy Efficiency Watch Project. (2012). SURVEY REPORT: Progress in energy efficiency policies in the EU MemberStates – the experts perspective. Energy Efficiency Watch- Intelligent Energy, Europe
12. Enve Enerji (2011). Enerji Verimliliği Genel Bilgilendirme. www.enve.com.tr
13. EUROPEAN COMMISSION (2006). EDUCATON ON ENERGY, Teaching tomorrow's energy consumers. EuropeanCommunities
14. International Energy Agency (2013). Key World Energy STATISTICS 2013 – The International Energy Agency, p: 6-7