Indian Journal of Extension Education
Vol. 51, No. 3 & 4, 2015 (112-116)

Adoption Pattern of Solar Cooker in different Agro- ecological Situations of District Ropar (Punjab)

Purva Jaggi[1] and Harinder Singh[2]

ABSTRACT

Sustainable development requires an organized efforts to develop and defuse new technology appropriate for agricultural production system, renewable energy systems and pollution controls. Energy is one of the vital resources for development and survival of mankind. We are fortunate to have abundant sunlight during most part of the year. This untapped renewable energy could be the best substitute to save conventional fuels used for domestic cooking and at the same time keep the environment clean. The solar cookers if available can offer a partial solution to multitude of cooking problems faced by people of low income. A properly designed and improved cooker if introduced in the market in mass scale can supplement the cooking energy requirement of several millions of people and reduce deforestation and environmental problems associated with the use of fossil fuels. Solar cooker which is safe and simple to operate can satisfactorily be used for cooking in the presence of sunshine. The present study has been designed with the objective know the fuel management practices adopted by women in rural areas of three agro-ecological situations of Punjab. The results showed that the usage varies with the topographical situation. In sub-mountainous area, the usage of electricity and LPG is 24per cent and 48per cent respectively whereas the usage of firewood is maximum (88per cent). On the other hand, in the plain area, the usage of electricity and LPG is 48per cent and 96per cent respectively and that of firewood is 40 per cent only. Electricity which is used by 40per cent households is considered dangerous, expensive and irregular in supply due to frequent power failure. LPG, which is used by 80per cent households, is also considered as dangerous, having high initial investment and limited in supply. Problem reported with the use of kerosene, which is used by 33.33 per cent households includes unpleasant odour, limited supply and adulteration. In case of non- commercial. Firewood which is used by 63.33per cent households with maximum usage in the sub- mountainous area , where it is used by 88per cent households is considered as unclean, giving smoke, creating health problems, laborious to collect, difficult to procure and difficult to store. Average saving on fuel per year by the rural households after adopting solar cooker is calculated as a gross reduction of ₹ 1740 per year and a net saving of 33.33 per cent.

Keywords: Solar cooker, renewable energy, household fuel management

INTRODUCTION

Energy is the basic natural resource, without which the existence of mankind is almost impossible. The human civilization started with the historic revolutionary invention of fuel energy which today has become a universal concern. Energy plays a vital role in human development and welfare, since all the important economic activities of present civilization are dependent on availability and level of consumption of energy (Rajgopal and Mishra, 1994).We are fortunate to have abundant sunlight during most part of the year. This untapped renewable energy could be the best substitute to save conventional fuels used for domestic cooking and at the same time keep the environment clean. Rural women have been shouldering the burden of domestic fuel management in most of the developing countries. As a direct consequence of this, they are worst affected by environmental degradation and economic distress. Women are often preoccupied with the ever increasing and overriding burden of collecting fuel, fodder and water for their families. Introduction of solar cookers could play a tremendous role not only in reducing the demand for fossil fuel resources for cooking but also improving the work efficiency of the rural home makers. Due to the increase in prices of fuel and energy, solar energy is becoming a viable option. A solar cooker is the simplest technology which has been developed for cooking the food without requiring any conventional fuel. Today solar energy is used in various applications such as solar heating, distillation, drying, cooking etc. The use of solar cooker for cooking purpose is spreading widely in most developing countries particularly in villages and remote areas. The solar cooker must be of high quality, affordable, user friendly, light weight, stackable and of family size. Current designs of solar cookers normally

[1.]Assistant Professor (Home Science, KVK, Ropar) [2.] Deputy Director (KVK, Ropar)

used are box cookers, concentrators and flat plate collector cookers. Increased awareness of the global need for alternative energy source has led to proliferation of research and development in solar cooking. Solar cooking can be used as an effective mitigation tool with regards to global climate change, deforestation and economic debasement of the world's poorest people. Utilization of solar Energy has tremendous advantages in tropical country like India because of the abundance and sustainability of solar energy.

Objectives

- To study the fuel management practices adopted by rural women in three agro-ecological situations of Punjab.

- To study the problems associated with the use of conventional fuels.

- To examine the impact on life of women after adopting solar cooker.

METHODOLOGY

The study was conducted in the form of a household survey of the adopted villages in three different agro-ecological situations. Survey included the administration of a questionnaire to find out the fuel management practices adopted by women in rural areas and the problems faced by women while using the conventional fuels.

A three point continuum scale varying from "Strongly Agree", "Agree" and "Disagree" and having statements regarding acceptability for adoption of solar cooker was also administered to observe the subjective responses of women regarding the acceptability for adoption of solar cooker and the mean scores were worked out for each of the statements included in this scale.

Besides, qualitative changes in the life of rural women after adopting solar cooker were also observed and recorded during the study and the economics of using solar cooker was worked out by calculating the net saving per year after the adoption of solar cooker. The data was analyzed by calculating frequencies, percentages and mean scores.

RESULTS AND DISCUSSION

In India, about 50 per cent of the total energy consumption is met from the non-commercial energy sources like wood, vegetable/ agricultural wastes/ dried cattle dung cakes etc. In Punjab, though most of the households are having a good standard of living, but due to the traditional way of living, especially in the rural areas, fire wood, cow dung cakes and agricultural wastes are also used considerably for domestic cooking and heating of water due to a chilling winter season. According to a study conducted by Sumangala (1997), cooking alone consumes maximum energy in the households and firewood is the primary source for more than 90 per cent of the households. Every household uses various energy sources to satisfy the needs of the family. Table 1 depicts the types of energy sources used for household/ domestic cooking and water heating by the rural households in three agro-ecological situations of the district Ropar of Punjab.

The usage varies with the topographical situation. In sub-mountainous area, the usage of electricity and LPG is 24 per cent and 48 per cent respectively, whereas the usage of firewood is maximum, *i.e,* 88 per cent and its collection consumes most of the day's time of rural women in this agro-ecological situation. Similar results were reported by Hooper-Box in 1999 in a study where it was evident that collecting firewood demanded a larger part of many rural women's daily household responsibilities.

In another study conducted by Green and Erskine (1999) in Maphephethe, a rural community about 80 km to the west of Durban in ZwaZulu- Natal, found that collecting firewood was one of the greatest burdens for many women and that it had a significant impact on their quality of life. On the other hand, in the plain area, the usage of electricity and LPG is 48 per cent and 96 per cent respectively and that of firewood is 40 per cent only.

Table 1: Fuels used by the households in three agro-ecological situations of district Ropar

Fuel used	Sub-mountainous Area (n=50)	Bait Area (n=50)	Plain Area (n=50)	Total
Commercial Energy Sources				
Electricity	12 (24.00)	24(48.00)	24(48.00)	60 (40.00)
LPG	24(48.00)	48(96.00)	48(96.00)	120 (80.00)
Kerosene	18(9.00)	18(36.00)	14(28.00)	50 (33.33)
Non- Commercial Energy Sources				
Firewood	44(88.00)	31(62.00)	20(40.00)	95 (63.33)
Cow dung Cakes	41(82.00)	37(74.00)	37(74.00)	115(76.67)
Agricultural wastes	43(86.00)	32(64.00)	35(70.00)	110(73.33)
Renewable Energy Sources				
Biogas	01(2.00)	05(10.00)	04(8.00)	10(6.67)
Solar Energy	-	02(4.00)	03(6.00)	05(3.33)

Figures in parenthesis indicate percentages

Problems associated with the use of Conventional fuels

It is evident from Table 2 that fuels used by different households can be categorized in mainly three categories: Commercial Energy Sources, Non-Commercial Energy Sources and Renewable Energy Sources. Electricity which is used by 40 per cent households is considered dangerous, expensive and irregular in supply due to frequent power failure. LPG, which is used by 80per cent households, is also considered as dangerous, having high initial investment and limited in supply. Problem reported with the use of kerosene, which is used by 33.33 per cent households is unpleasant odour, limited supply and adulteration. In case of non- commercial energy sources, firewood which is used by 63.33per cent households with maximum usage in the sub- mountainous area, where it is used by 88per cent households, is considered as unclean, giving smoke, creating health problems, laborious to collect, difficult to procure and difficult to store. But the people are still using it as fuel because it is available free of cost and is being collected from the nearby forests. This practice is very common, especially in sub-mountainous area, because people are unable to afford LPG/ electricity/ kerosene in this area. Apart from that, this practice is posing serious threat to the environment in this mountainous belt of Punjab and should be replaced by the use of renewable energy sources like solar energy and biogas etc. Cow dung cakes and agricultural wastes which are being used by 76.67per cent and 73.33 per cent households respectively are associated with the same problems like- unclean atmosphere, difficult to procure & store, causing smoke and health problems which are reported by most of the households (94.78%) for cow dung cakes and (98.18%) for agricultural wastes. Renewable energy sources which are used by only 9 per cent of the households (Table 1) reported that the problem faced by them is seasonal irregularity, choking and irregularity in feeding of the pit in case of bio gas and unpredictable sunlight in case of solar cooker.

Table 2: Problems associated with the use of Conventional Fuels

Energy Sources	Problem faced	Sub-mountainous Area (n=50)	Bait Area (n=50)	Plain Area (n=50)	Total (per cent)
Commercial Energy Sources					
Electricity (n=60)	Expensive	12	23	24	59 (98.33)
	Dangerous	11	24	24	59(98.33)
	Frequent Power failure	12	24	24	60(100)
LPG (n=120)	High initial investment	12	44	48	104(86.67)
	Dangerous	16	41	44	101(84.17)
	Delay in supply	12	45	48	105(87.50)
Kerosene (n=50)	Unpleasant odour	15	17	14	46(92.00)
	Adulteration	17	14	10	41(82.00)
	Limited supply	15	17	13	45(90.0)
Non-Commercial Energy Sources					
Firewood (n=95)	Unclean atmosphere	39	28	19	86(90.53)
	Smoke and Health Problems	42	27	20	89(93.68)
	Laborious	43	27	20	90(94.74)
	Difficulty in procurement	39	28	19	86(90.53)
	Storage Problem	44	27	20	91(95.79)
Cow dung cakes (n=115)	Smoke and Health Problems	40	35	34	109(94.78)
	Laborious	39	29	32	100(86.96)
	Difficulty in procurement	40	29	33	102 (88.69)
Agricultural wastes (n=110)	Unclean atmosphere	43	29	23	95 (86.36)
	Smoke and Health Problems	43	30	35	108 (98.18)
	Laborious	40	31	35	106 (96.36)
	Difficulty in procurement	40	29	34	103(93.63)
	Storage Problem	42	28	34	104(94.55)
Renewable Energy Sources					
Bio- gas (n=10)	Seasonal Irregularity	01	04	03	8(80.00)
	Choking	01	04	03	8(80.00)
	Irregular feeding of the Pit	01	04	04	9(90.00)
Solar Energy (n=5)	Unpredictable sunlight	-	02	02	4 (80.00)

Figures in parenthesis indicate percentages

Adoption Pattern of Solar Cooker in three ago-ecological situations

According to Table 3, solar cooker is being accepted by the households in all the three ago-ecological situations with logical reasoning and the rural women are convinced with the advantages associated with its use. The scores given by respondents on a three point continuum scale varying from "Strongly Agree", "Agree" and "Disagree" is being presented in Table 3. The mean scores for the various statements are more in case of the plain area (greater than 2.00 for each of the statements, with the highest score of 2.24) indicating greater

acceptability of solar cooker in this area and are lower in case of sub-mountainous area with the lowest score of 190, indicating a fairly less acceptability but the mean scores in this case are also above 1.50 which indicates more than 50per cent acceptability. In case of Plain area, the highest acceptability score is 2.08 and the lowest is 1.94 which also indicates a good acceptability and subsequent adoption of solar cooker in this area. It is evident that overall acceptability of solar cooker is fairy appreciable in all the three agro- ecological situations.

Reduction in Fuel Expenditure

The gross reduction in fuel expenditure of households per year was worked out. Table 4 clearly indicates a gross reduction of ₹1740 per year by the rural households after adopting solar cooker and a net saving of 33.33 per cent in fuel expenditure per year.

Qualitative Changes in the life of Rural Women after Adopting Solar Cooker

The various benefits of solar cooker bought appositive impact in the life of women after adopting solar cooker. The women were relieved with the drudgery of collecting firewood which not only reduced physical stress but at the same time saved time and energy which can be now utilized for other income generating activities. Besides, the household now are able to cut on the fuel expenditure. The clean and smoke free kitchen and utensils provides clean indoor environment for the family members, thereby improving the overall quality of life of rural households.

Table 3 : Subjective Responses regarding Acceptability for Adoption of Solar Cooker

Acceptability statement regarding Solar cooker	Sub-Mountainous Area				Bait Area				Plain Area			
	Strongly Agree	Agree	Disagree	Mean Score	Strongly Agree	Agree	Disagree	Mean Score	Strongly Agree	Agree	Disagree	Mean Score
Saves Fuel and Money	15 (30.00)	16 (32.00)	19 (38.00)	1.92	16 (32.00)	19 (38.00)	15 (30.00)	2.02	19 (38.00)	16 (36.00)	15 (30.00)	2.08
Promotes Environmental Cleanliness	15 (30.00)	18 (36.00)	19 (38.00)	2.00	17 (34.00)	18 (36.00)	15 (30.00)	2.04	19 (38.00)	17 (34.00)	14 (28.00)	2.10
Reduces the dependence on Fossil Fuel	15 (30.00)	17 (34.00)	18 (36.00)	1.94	15 (30.00)	18 (36.00)	17 (34.00)	1.96	20 (38.00	15 (30.00)	15 (30.00)	2.10
Exposes to the Novel way of cooking	14 (28.00)	17 (34.00)	19 (38.00)	1.90	14 (28.00)	19 (38.00)	17 (34.00)	1.94	19 (38.00)	17 (34.00)	14 (28.00)	2.10
Requires less attention	16 (32.00)	17 (34.00)	17 (34.00)	1.98	16 (32.00)	18 (36.00)	17 (34.00)	2.02	19 (38.00)	17 (34.00)	15 (30.00)	2.12
Reduces the fear of accidents	16 (32.00)	17 (34.00	17 (34.00)	1.98	16 (32.00)	17 (34.00)	17 (34.00)	1.98	20 (40.00)	16 (32.00)	14 (28.00)	2.12
Keeps kitchen and utensils clean	18 (36.00)	14 (28.00)	18 (36.00)	2.00	17 (34.00)	18 (36.00)	15 (30.00)	2.04	21 (42.00)	15 (30.00)	14 (28.00)	2.14
Relieves Drudgery of Home maker	15 (30.00)	18 (36.00)	19 (38.00)	2.00	18 (36.00)	18 (36.00)	14 (28.00)	2.08	22 (44.00)	18 (36.00)	10 (20.00)	2.24

Figures in parenthesis indicate percentages

Table 4 : Reduction in Fuel Expenditure per year after adopting Solar Cooker.

Avg. Fuel Expenditure/year before adopting Solar Cooker	Avg. Fuel Expenditure/year after adopting Solar Cooker	Gross Reduction in Fuel Expenditure/year	Net Saving/ year
₹ 5220 / year	₹ 3480 / year	₹ 1740 per year	33.33per cent

CONCLUSION

The introduction of solar cooker in the rural households brought notable quantitative change in the lifestyle. It relieved drudgery of women and conserved fuel, thereby lowering the household expenditure on fuel. In addition it helped in keeping the environment clean and protecting forests, especially in the sub- mountainous area, where firewood collection is done on a large scale. Popularization of non- conventional sources of energy like solar energy and bio-gas can help to satisfy household energy needs to a great extent and can reduce the pressure on fossil fuels. Continuous effort to promote these renewable energy resources is the need of the hour.

Paper received on : April 29, 2015
Accepted on : May 30,2015

REFERENCES

Green, J M and Erskine, S (1999). Solar Photovoltaic systems, Energy use and Business activities in Maphephethe, ZwaZulu-Natal, *Development Southern Africa* Vol 16 (2): 221-237.

Hooper - Box, C (1999). Cooking,Cleaning, Energy and Gender. Land and Rural Digest. Vol 1 (6) : 18-19.

Rajgopal, S and Mishra, N (1994). Fuel energy pattern in selected households in Orissa state, Research Highlights. Vol 4 (1) : 65-69.

Sumangala, PR (1997).Energy Systems in peri- urban regions in Hubli- Dharwad city, Karnataka, Paper presented in: *Workshop on Peri- ursban Interface production systems research Programme.* Dharwad, Karnataka.