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Awareness and Problems Faced by Rural Respondents using Solar Technologies

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Abstract

For the present study, Bherian village of Hisar district in Haryana state was purposively selected because no family was possessing/using any solar technology in the village. A total sample of 190 rural women was selected randomly as respondents out of total 325 families in the village. Data were collected with the help of well structured interview schedule which was prepared in accordance with methodological procedure and objectives of the study. Pre-exposure knowledge of 190 rural women regarding three household solar technologies (i) solar cookers- dish type and box type, (ii) solar lantern and (iii) solar transistor) was studied and after that trainings were imparted to 190 women on advantages and use of household solar technologies. After 15 days of imparting trainings, post-exposure knowledge of respondents was also studied. After that, solar cookers (box type and dish type), solar lanterns and solar transistors were distributed for actual usage in the families of 190 respondents on rotation basis and the problems and constraints felt by them were studied.. The results showed that the post exposure knowledge of the respondents regarding solar technologies increased to high level which was at low level during pre-exposure. It was also found that some constraints/ problems were reported by all the 190 respondents while using the technologies. In spite of the problems/constraints faced by the rural families in using solar technologies, majority of them were willing to purchase and use these technologies because of the large number of advantages felt by users while using these i.e. saving in time, human energy, fuel and money besides being eco-friendly as these do not pollute the environment and smoke emission does not cause harm to lungs and eyes of the users as in the case of solar cooker. But the main factor/reason for non-adoption of these technologies is the high cost of solar devices and poor financial condition of rural families as it was found that most of the rural families were not in a position to buy these devices. Also one more constraint felt by the respondents was that repair/ mending of solar technologies was a difficult process. On the basis of the problems/constraints faced by the users during use of these technologies, some strategies for popularization and more adoption of solar energy technologies were recommended so that more and more number of people may adopt these energy saving and eco-friendly technologies and problems of energy crisis and environmental pollution may be solved to some extent.

Keywords: Solar Technologies, Constraints, Pre and Post-Knowledge Level, Energy Crisis and Environmental Pollution

Introduction

Solar energy which is inexhaustible and does not cause any pollution is of paramount importance for India where energy demand is far more than the energy availability. Hence, there is rowing interest of scientists in Solar energy. The main advantage of solar energy is that we get the energy free of cost and also without pollution problem. Also it is permanent in nature and there is no question of energy depletion. A large amount of solar radiation is received in India, hence the solar devices can be utilized throughout the year in almost all parts of the country.

Two most important modes of utilizing solar radiations are: Solar thermal conversion and Photovoltaic conversion. A large number of solar devices like solar cooker, solar water heater, solar dryer, solar home lighting system, solar desalination system, solar tube well etc. have been developed in India and are being manufactured. One factor that leads to

extra consumption of energy is the less awareness of the consumers regarding use of renewable sources of energy particularly rural consumers.

Keeping the above facts in mind, the present study was undertaken with the following objectives:

1. To study the pre and post-exposure knowledge of rural women regarding solar energy technologies
2. To study the problems and constraints faced while using solar energy technologies
3. To develop strategies for adoption of solar energy technologies by more people in rural areas.

Review of Literature

According to Patil *et al.* (2013) solar panels which are used are stationary which give less output and hence decrease the efficiency. But by making use of tracker solar panels we can increase efficiency of solar system. The operator interference is minimal since the system is automated which increases efficiency of the stationary solar system. The GSM facility provided by the system helps the user to monitor the system from anywhere in the world.

Borah *et al.* (2014) found from a study that 80 per of the women faced health related issues earlier due to usage of kerosene lamps. The common issues faced were red eyes, headache, watery eyes, blocked nostrils and cough. It was also observed that PV based lighting in comparison to kerosene based lighting was used for longer hours by children to study in the households. This is due to better illumination from PV light in comparison to kerosene base lamps; as a result the children did not strain their eyes during studying under solar light. Solar light has helped in eradicating such health related issues in the households.

Komal (2014) found that solar lantern was found to be useful and handy by rural people while going to the field and working there in dark ours (88.24%). She further found that economic benefits ranked highest among all benefits with WMS of 1.91 which means that the respondents perceived the use of solar technologies as economically beneficial. Personal and family related benefits ranked next in order with WMS of 1.86. This was followed by environment related benefits which ranked third with WMS of 1.84. Technical benefits ranked lowest with WMS of 1.78.

As per Khambalkar *et al.* (2014), the household survey indicated that people strongly agree with the use of renewable energy sources. It was seen that nowadays the public is taking an interest in the problem of global warming. People are ready to pay for lowering global warming by using electricity generated from renewable energy. It is concluded that in this region initiatives should be taken to promote renewable energy equipment especially solar energy devices.

Venkatraman and Sheeba (2014) found that customer's attitude towards solar energy devices was definitely changing and there had been a significant increase in the awareness and benefits of using solar energized devices over electrical devices and also increase the consumer's responsibility towards the environment and eco-friendliness**.**

Sujata (2015) found that all the user families (100%) were using the solar water heating system as it is environment frindly followed by its being mandatory by the government (72%), safe technology (62%), convenient to use (58%) and economical (48%). 94 percent families were satisfied with the cost of solar water heating system where as only 6 percent of families were not satified. Simililarly, 88 percent of families were satified with its working while only 12 percent were not satified with the working of Solr water heaters.

Nagamani (2016) remarked that 34% of the respondents were aware and came to know about the solar products through their friends, 30% of them were aware through newspaper, 12% through their relative, 10% through their colleagues, 8% through TV/ radio and 6% through their family.

Aim of the Study

By finding out the extent of knowledge of rural women regarding different solar technologies which is very low, new and different ways and methods for dissemination of information regarding these technologies can be adopted by the government so that more and more people may adopt and use these energy saving and eco-friendly technologies. Also by adopting the strategies by the government for tackling/ solving the problems and constraints faced by users, the number of users can be increased which can which can play a great role in combating the problems of worldwide energy crisis and environmental issues.

Research Design

Locale of Study

Hisar district of Haryana state was purposively selected for the study due to easy accessibility of the respondents as the researcher belonged to this place. Further Bherian village of Hisar district was also purposively selected because no family was possessing/ using any solar technology in the village. Also the village is situated near Hisar town and project demanded frequent trips (for transportation of solar energy technologies) and regular contact with respondents.

Selection of Sample

A total sample of 190 rural women was selected randomly as respondents out of total 325 families in the village.

Collection of Data

Data were collected with the help of well structured interview schedule which was prepared in accordance with methodological procedure and objectives of the study. Pre-exposure knowledge of 190 rural women regarding three household solar technologies (viz. solar cookers- dish type and box type, solar lantern and solar transistor) was studied and after that trainings were imparted to 190 women on advantages and use of household solar technologies through actual demonstration and instructional material on the following five technologies:

1. Solar cookers (dish type and box type)
2. Solar lanterns
3. Solar home lighting system (fan and light)
4. Solar geyser

5. Solar transistor

After imparting training to 190 interested families, solar cookers (box type and dish type), solar lanterns and solar transistors were distributed for actual usage in the families of 190 respondents on rotation basis and their post-exposure knowledge was also studied about these three technologies.

Solar home lighting system (consisting of 1 fan and 1 CFL) was installed in *sarpanch* office which was also used by rural people from time to time (being a common place). Solar water heater/geyser was installed in Government High School of the village where hot water was used by the students and school staff in winter season for different purposes.

After actual usage of these five solar energy technologies in the rural families, *sarpanch* office and village school, the problems and constraints faced while using these technologies were also noted.

Analysis and Interpretation of Data

This included the tabulation and quantification of data. After the collection of data, coding was done for the detailed analysis. Frequencies and percentages were calculated to draw meaningful inferences. 'Z' test was applied to find out the significance of gain in knowledge after exposure through trainings and demonstration.

Findings

I. Pre and post-Exposure Knowledge Level of Respondents

The information about pre and post-exposure knowledge level of respondents regarding different solar technologies is presented in Table 1 to 3.

1. Pre and Post-Exposure Knowledge Level about Solar Cooker

Table 1 shows the knowledge level regarding solar cooker. The pre-exposure knowledge regarding concept and importance was low (94.21 % respondents) and it increased to high level after exposure (93.16 % respondents). Similarly 98.42 per cent respondents had low knowledge level regarding advantages but 84.74 percent women had high knowledge level after exposure.

It was found that majority of the respondents (98.95%) had low level of knowledge regarding limitations of solar cooker before exposure and only 1.58 per cent respondents had medium level of knowledge. After being exposed to trainings, 66.84 per cent respondents gained high level of knowledge followed by medium level of knowledge (24.32%). Cent per cent of the respondents had low level of knowledge before exposure regarding general precautions to be taken in the use of box type solar cooker and after providing exposure to them, it was observed that more than half of the respondents (58.95 %) had gained high level of knowledge followed by medium (37.89 %) level of knowledge.

Table 1
Pre and Post-Exposure Knowledge Level about Solar Cooker

n= 190

S. No.	Aspects	Knowledge Level	Pre-exposure		Post-exposure		z value
			f	%age	f	%age	
1.	Concept and importance	Low(5-6)	179	94.21	-	-	18.40** 0.42
		Medium (7-8)	11	5.79	13	6.84	18.20**
		High (9-10)	-	-	177	93.16	
2.	Advantages	Low (5-6)	187	98.42	2	1.05	18.98**
		Medium (7-8)	3	1.58	27	14.21	4.56*
		High (9-10)	-	-	161	84.74	16.72**
3.	Limitations	Low (5-6)	188	98.95	13	6.84	17.98**
		Medium (7-8)	2	1.05	60	24.32	8.05*
		High (9-10)	-	-	127	66.84	13.81**
4.	Precautions	Low (5-6)	190	100	6	3.16	18.88**
		Medium (7-8)	-	-	82	37.89	10.22**
		High (9-10)	-	-	112	58.95	12.60**

*significant
** Highly significant

2. Pre and post-exposure knowledge level about Solar Lantern

Table 2 reveals that 93.16 per cent of the respondents had low level of knowledge regarding the concept and importance of solar lantern followed by medium level of knowledge (6.84%) before training. After being exposed to the training, 90.53 per cent of respondents were found to have high level of knowledge followed by medium level of knowledge (9.47%).

Table 2
Pre and Post-Exposure Knowledge Level about Solar Lantern

n=190

Aspects	Knowledge level	Pre -exposure		Post-exposure		z value
		f	% age	f	% age	
Concept and importance	Low (5-6)	177	93.16	0	0	18.20**
	Medium (7-8)	13	6.85	18	9.47	0.93
	High	0	0	172	90.53	17.72**

	(9-10)					
Advantages	Low (5-6)	188	98.95	0	0	19.28**
	Medium (7-8)	2	1.05	27	14.21	4.83*
	High (9-10)	0	0	163	85.79	17.35**
Limitations	Low (4-5)	190	100	6	3.16	18.88**
	Medium (6-7)	0	0	32	16.84	5.92*
	High (8-9)	0	0	152	80.00	15.91**
Precautions	Low (4-5)	190	100	3	1.58	19.18**
	Medium (6-7)	0	0	48	25.26	7.42*
	High (8-9)	0	0	139	73.16	14.81**

* Significant
** Highly significant

Regarding advantages of solar lantern, 98.95 per cent of respondents had low level of pre-exposure knowledge followed by medium level of knowledge (1.05%). After exposure to training, 85.79 per cent of respondents had gained high level of knowledge followed by medium level of knowledge (14.21%).

Low level of pre-exposure knowledge was observed in cent per cent respondents regarding limitations of the solar lantern. But post-exposure results showed that 80.00 per cent respondents had achieved high level of knowledge followed by medium (16.84%) level of knowledge. Before exposure all the 190 respondents had low level of knowledge regarding precautions in the use of solar lantern but after providing training and mass media exposure, it was found that near about three forth of the respondents (73.16%) had high level of knowledge followed by medium (25.26%) level of knowledge.

3. Pre and post-exposure knowledge level about solar radio/transistor

Data presented in table 3 depict that all the respondents had low level of knowledge regarding concept and importance of solar radio before proving them training but after exposure majority of the respondents (83.68%) scored high level of knowledge followed by medium level of knowledge (16.32%).

Table 3.
Pre and Post-Exposure Knowledge Level about Solar Radio

n=190

Aspects	**Knowledge level**	**Pre -exposure**		**Post-exposure**		**z value**
		f	**% age**	**f**	**% age**	
Concept and importance	Low (4-5)	190	100	0	0	19.49**
	Medium (6-7)	0	0	31	16.32	5.81*
	High (8-9)	0	0	159	83.68	16.53**
Advantages	Low (2- 3)	190	100	5	2.63	18.98
	Medium (4-5)	0	0	41	21.58	6.77*
	High (6-7)	0	0	144	75.79	15.22**
Limitations	Low (2- 3)	190	100	3	1.58	19.18**
	Medium (4-5)	0	0	54	28.42	7.93*
	High (6-7)	0	0	133	70.00	14.31**
Precautions	Low (2- 3)	190	100	6	3.16	18.88**
	Medium (4-5)	0	0	47	24.74	7.32*
	High (6-7)	0	0	137	72.10	14.63**

*Significant
** Highly significant

In case of advantages of using solar radio, it was found that cent per cent respondents had low level of knowledge before training but after getting trainings and exposure, more than three fourth of the respondents (75.79%) had high level of knowledge followed by medium (21.58%) and low (2.63%) level of knowledge.

Results regarding limitations of solar radio showed that all the respondents had low level of knowledge before exposure, but after providing trainings, it was found that 70.00 per cent of the respondents had high level of knowledge followed by medium (28.42 %) level of knowledge.

Regarding precautions of the solar radio, it was found that cent per cent respondents had low level of knowledge before providing exposure through trainings but after giving exposure regarding use of solar radio, 72.10 percent respondents achieved high level of knowledge followed by medium (24.74%) level of knowledge.

Thus, it can be concluded that the post exposure knowledge of the respondents regarding solar technologies increased to high level which was at low level during pre-exposure.

II. Constraints/ Problems Faced by the Respondents While Using Different Technologies

It was found that some constraints/ problems were reported by all the 190 respondents while using the five different solar technologies. These constraints are listed below:

1 (a) Box Type Solar Cooker

1. Cost is quite high
2. Chapatis cannot be made
3. Frying and seasoning cannot be done
4. Very less quantity of food can be cooked
5. Easy breakage of glass and mirror
6. Needs timely adjustment in the direction of the sun
7. Required temperature always not available
8. Can not be used on rainy/cloudy day
9. Can not be used after sunset
10. Repair/ mending of solar cooker is difficult

1 (b) Dish Type Solar Cooker

1. Cost is quite high
2. Size is too big, thus occupies too much space
3. Size is too big, so is not portable
4. Needs adjustment in the direction of the sun
5. Glare due to sunrays can harm the eyes
6. Required temperature always not available
7. Can not be used on rainy/cloudy day
8. Can not be used after sunset
9. Repair/ mending of solar cooker is difficult

2. Solar Lantern

1. Cost is quite high
2. Can be used only for 5-6 hours after each charging
3. Requires change of battery after 2-3 years
4. Battery can not be charged on a rainy/cloudy day
5. Repair/ mending of solar lantern is difficult

3) Solar Home Lighting System (Light and Fan)

1. Cost is quite high
2. Require regular charging.
3. Battery can not be charged on rainy/cloudy day
4. Repair/ mending of solar home lighting system is difficult

4) Solar Water Heater/Geyser

1. Cost is very high
2. Size is very big, thus occupies too much space
3. Requires technical assistance for installation
4. Required temperature is always not available
5. Can not be used on rainy/cloudy day
6. Can not be used after sunset
7. Repair/ mending of solar water heater is difficult

5) Solar Transistor/Radio

1. Can not be charged on rainy/cloudy day
2. Repair/ mending of solar transistor is difficult

In spite of the problems/constraints faced by the rural families in using solar technologies, majority of them were willing to purchase and use these technologies because of the large number of advantages felt by users while using these i.e. saving in time, human energy, fuel and money besides being eco-friendly as these do not pollute the environment and do not cause harm to lungs and eyes of the users in case of solar cooker. But the main factor/reason for non-adoption of these technologies is the high cost of solar devices and poor financial condition of rural families as it was found that most of the rural families were not in a position to buy these devices.

III. Strategies Developed for Popularization of Solar Energy Technologies

On the basis of the problems/constraints faced by the users during use of these technologies, the following strategies for popularization of solar energy technologies are recommended:

1. Low cost solar devices should be designed.
2. Cost of solar voltaic panels should be reduced and efficiency should be increased to make solar photovoltaic system affordable.
3. Large sized boxes of 2-3 liters capacity should be provided with box type solar cookers.
4. Hybrid system/power back-up of cooking should be provided in box type solar cooker.
5. Some automatic system of orientation/rotation of solar cooker in the direction of sun should be provided.
6. The capacity of the storage batteries of solar lanterns should be increased so that it can be used for at least 8 hours. Some energy saving lights (LED-Light Emitting Diodes) should be provided in solar lanterns and solar home lighting systems.
7. Rural masses are not aware of usefulness of solar devices so government should make more efforts to popularize these technologies in rural as well as urban areas.
8. More incentives/subsidy should be provided by government to popularize these devices so that more and more number of people may purchase these.

9. People should be trained for repair/mending of different solar technologies.

Conclusion

It was found that level of knowledge of majority of respondents increased from low level (pre-exposure) to medium and high level (after exposure). Cent percent respondents (190 respondents) felt some common problems and constraints while using different solar technologies on the basis of which strategies are recommended so that more and more number of people may adopt these eco-friendly technologies and problem of energy crisis may be solved to some extent.

Suggestions

It is very much felt that after continuous efforts of DRDA and by other government schemes and projects, the awareness of the rural people regarding solar energy technologies is increasing and the number of users of these technologies is also increasing. The common main problem being faced after continuous use of all these technologies is pertinent to repair of these technologies. Though one post of Technical assistance is there in ADC office in each district, but this problem cannot be solved by one person. There is urgent requirement of trained persons who can repair these technologies in village itself so that rural people need not travel and waste time and money in getting these repaired. Thus, there is urgent need and demand for rural youth to get training on repairing of solar technologies which can largely contribute in enhancing their household income. Even rural girls and women can be financially self reliant and empowered through such trainings.

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