

# Use pattern of solar lighting system in rural households

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## ARTICLE INFO :

Received : 16.07.2014  
Revised : 03.10.2015  
Accepted : 17.10.2015

## KEY WORDS :

Solar energy, Solar light, Use pattern, Awareness

## HOW TO CITE THIS ARTICLE :

Komal and Singal, Savita (2015). Use pattern of solar lighting system in rural households. *Adv. Res. J. Soc. Sci.*, 6 (2) : 113-118.

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## ABSTRACT

Over the last few decades, India's energy consumption has been increasing at a very fast rate due to population growth and economic development. Due to the increasing demand of energy day by day and depleting sources of conventional energy sources *i.e.*, coal, oil and natural gas, solar energy sources offer viable options to address the energy scarcity of the country. The objective was to study the use pattern of solar technologies in rural areas. The present study was conducted in two villages *viz.*, Ludas and Patan of Hisar block II, district Hisar selected randomly. For collecting the data pertaining to use pattern of solar technologies was collected by using, duly pretested interview schedule. A sample of 100 rural women respondents were taken randomly. A field survey was done to study the use pattern of solar lighting system in rural areas. It observed that respondents belonged to middle aged group (60.00%), were housewives (87.00%) and educated upto primary level (28.00%). Respondents were aware of CFL based solar lighting system (100%) and solar lantern (85.00%) but they had only CFL based solar lighting system (83.00%) and solar lantern (17.00%). Respondents placed their lights in bed room (60.71%) and solar lantern in field (88.24%). Respondents used light for 9-10 months (87.50%) and fan for 7-8 months (90.75%). It can be concluded that respondents were used only solar lighting system and solar lantern. Hence there is a need for the development of awareness about benefits of all type of solar technologies.

## INTRODUCTION

Over the last few decades, India's energy consumption has been increasing at a very fast rate due to population growth and economic development. India ranked fifth in the world in terms of primary energy consumption and accounted for about 3.5 per cent of the world commercial energy demand in the year 2003. Demand for primary commercial energy resources *i.e.* coal, oil and natural gas has grown at the rate of six per cent between 1981 and 2001. Per capita electricity consumption rose from merely 15.6 kW/h (kilowatt hour

per hour) in 1950 to 592 kW/h in 2003-04 (Energy Planning Commission, 2002).

Presently, severe energy crisis is being felt in all sectors because of the depletion of fossil fuels and frequent increase in fuel prices. Its adverse effects have trickled down to household level and families are experiencing economic and emotional stress in meeting their energy requirements. Thus, there is an urgent need to supplement their present energy sources with renewable and economical energy sources. Use of solar energy is one such option which can be easily adopted by the families to supplement the existing energy use

patterns for cooking, heating, and lighting. Moreover, solar energy is inexhaustible and also supplies clean energy without endangering or polluting the environment.

Government of India has taken many initiatives in the area of solar energy, to harness this vast source as it is the cleanest and cheapest source of energy. Ministry of Non-Conventional Energy Sources, Government of India, launched Integrated Rural Energy Programme (IREP) in the year 1986-87 (PIB, 2007). The objective of this programme is to supplement the total energy demand by using solar energy and to promote energy conservation devices. Under this programme, several renewable energy devices like solar cooker, solar home lighting system, solar pumps, solar radio, solar lantern, solar water heating system etc. and energy conservation devices like pressure cookers, Nutan stove, energy efficient motor, CFLs and tube lights were promoted by providing them at subsidized rates to the rural masses. Under another programme *i.e.* Solar Thermal Programme (STP), devices like solar cookers (dish type and box type), solar water heating system and solar still are also being promoted.

Although government and non-government organizations are working hard to improve the awareness of people pertaining to use of renewable energy technologies but not much impact is visible till date. Therefore, use of solar energy in rural households was selected for the present study with the following specific objective to study the use pattern of solar technologies in rural households.

## MATERIAL AND METHODS

The present study was conducted in Hisar district of Haryana state which was selected purposively as the researcher belongs to this district and is well-versed with the socio-cultural traits of this region. Hisar district is divided into 9 blocks, out of which Hisar block II was selected randomly and the list of villages falling under this Block and having solar energy programmes was obtained from Project Officer, Department of Renewable Energy. Two villages *viz.*, Ludas and Patan were randomly selected from this list. Lists of all households having one or more type of solar technologies were obtained for the selected villages from the Department of Renewable Energy. Fifty households having some form of solar technology, were selected randomly from the list for each village, making a total of 100 rural households.

Further, the homemaker from each selected household was taken as the respondent for collection of data. Thus, the total sample size comprised of 100 women respondents.

Interview schedule was developed in accordance with the objective of the study to collect the data pertaining to socio-economic profile of the respondents, and use pattern of solar technologies. For this, an exhaustive inventory of solar technologies was prepared by consulting relevant literature and discussions with the experts from the Department of Renewable Energy. The interview schedule was duly pre-tested and finalized. Data were collected personally by the researcher with the help of interview schedule developed for this purpose. The collected data were suitably coded, tabulated and analyzed to draw meaning inferences.

## OBSERVATIONS AND ANALYSIS

The results of the present research have been presented under the following heads:

- Background profile of the respondents
- Use pattern of solar lighting system

### **Background profile of the respondents :**

#### *Personal and demographic attributes:*

Majority of the respondents (60.00%) belonged to middle age group (36-45years), were married (90%), were illiterate (38.00%), and belonged to nuclear family (66%) with family size of 4-6 members (73%).

#### *Socio-economic attributes:*

Majority of the respondents belonged to middle caste (50%), were housewives (87%) and had medium education status (64%). Majority of the respondents belonged to middle income group (78%) having income of Rs. 10,000-20,000, had mixed type of house (60%) and had no land (52%).

### **Communication profile:**

Majority of the respondents had medium mass media exposure (45%) and received information through government agency (77%).

### **Use pattern of solar lighting system :**

#### *Awareness and use of solar technologies :*

Majority of the respondents were aware of 'dish type' of solar cooker (68.00%) and 'box type' of solar

Table 1: Background profile of the respondents			(n=100)	
Sr. No.	Attributes	Category	Percentage	
1.	<b>Personal attributes</b>	Age	26-35 yrs	24
			36-45 yrs	60
			46-55 yrs	06
		Marital status	Married	90
			Widow	10
		Education	Illiterate	38
			Primary	28
			Middle	18
			High school/10+2	10
		Graduate or above	6	
2.	<b>Demographic attributes</b>	Family type	Nuclear	66
			Joint	34
		Family size	Small (upto 4 members)	18
			Medium (4-6 members)	73
			Large (more than 6 members)	9
3.	<b>Social attributes</b>	Caste	Lower	39
			Middle	50
			High	11
		Occupation	House wife	87
			Government employed	4
			Private employed	9
		Family Education Status	Low (2.5 – 3.5)	26
			Medium (3.6 – 4.5)	64
			High (4.6-5.5)	10
		4.	<b>Economic attributes</b>	Total family income (Rs.)
Medium (Rs.10000-20,000/-)	78			
High (Above Rs. 20,000/-)	12			
House type	<i>Pucca</i>			40
	Mixed			60
Land holding	Landless			52
	Marginal (upto 1.0 hectare)			19
	Small (1.01-1.61 hectare)			19
	Medium (1.62-3.23 hectare)			9
	Large (3.24- 4.85 hectare)			1
5.	<b>Communication level</b>			Mass media exposure
		Medium (6-10)	45	
		High (11-15)	36	
		Source of information	Relatives	8
			Friends	6
			Television/radio	4
			Government agency	77
			Private agency	5

cooker (50.00%).

It was encouraging to note that cent per cent respondents were aware of CFL based solar lighting system, while 83 per cent of them possessed and were using CFL based solar home lighting system consisting of one light and one fan (59.00%), consisting of two lights and one fan (3.00%) and one light, one fan and one mobile

charger (21.00%). Only three per cent respondents were not using their lighting system with one light and one fan as it was out of order. Only 40 per cent respondents were aware about LED based solar home lighting system but none of them had this type of system. Majority of the respondents (85.00%) were aware about CFL based solar lantern but only 17 per cent of them possessed it and

Sr. No.	Solar technologies	Awareness*	Ownership	Use
		Percentage	Percentage	Percentage
1.	<b>Solar cooker</b>			
	Box type	50	0	Nil
	Dish type	68	0	Nil
2.	<b>Solar home lighting system</b>			
	LED based lighting system	40	0	Nil
	CFL based lighting system	100	83	83
	One light and one fan	75	59	56
	Two lights and one fan	20	3	3
	One light, one fan and one mobile charger	50	21	21
3.	<b>Lantern</b>			
	LED based lantern	20	0	Nil
	CFL based lantern	85	17	17
4.	<b>Solar water heater</b>	67	0	Nil
5.	<b>Solar pump</b>	76	0	Nil
6.	<b>Solar TV</b>	15	0	Nil
7.	<b>Solar radio</b>	15	0	Nil

\*=Multiple response

Sr. No.	Parameters	Solar home lighting system (n=80)								Solar lantern (n=17)
		System I (n=56)		System II (n=3)			System III (n=21)			
		Light	Fan	Light I	Light II	Fan	Light	Fan	Charger	
1.	<b>Duration of use per year</b>									
	Upto 6 months	0	0	0	0	0	0	0	0	2
		-	-	-	-	-	-	-	-	(11.76)
	7-8 months	9	56	0	0	3	1	20	0	6
		(16.07)	(100)	-	-	(100)	(4.76)	(95.24)	-	(35.30)
	9-10 months	47	0	3	3	0	20	1	21	9
		(83.93)	-	(100)	(100)	-	(95.24)	(4.76)	(100)	(52.94)
2.	<b>Summer</b>									
	Every day	56	56	3	2	3	20	21	6	15
		(100)	(100)	(100)	(66.67)	(100)	(95.24)	(100)	(28.57)	(88.24)
	Alternate day	0	0	0	1	0	1	0	15	2
		-	-	-	(33.33)	-	(4.76)	-	(71.43)	(11.76)
3.	<b>Winter</b>									
	Every day	48	0	3	1	0	20	0	10	13
		(85.71)	-	(100)	(33.33)	-	(95.24)	-	(47.62)	(76.47)
	Alternate day	8	0	0	2	0	1	0	11	4
		(14.29)	-	-	(66.67)	-	(4.76)	-	(52.38)	(23.53)

Figures in parentheses indicate percentages

were using it. More than three-fourth of the respondents were aware of solar pumping system (76.00%) and solar water heater (67.00%) but none of the respondents owned these technologies. Some respondents were also aware of solar TV and radio but none of them owned these.

**Duration of use per year:**

Majority of the respondents having solar lighting (system I-83.93 %, system II-100 %, system III-95.24 % and solar lantern 52.94%) used their light for 9-10 months and their fan (system I-100%, system II-100% and system III-95.24%) for 7-8 months in a year. Except few respondents having solar lighting system II (33.33%), system III (4.76%) and solar lantern (11.76%) used their lights everyday and cent per cent respondents used their fans everyday in summer season. Majority of the respondents of system I (85.71%), system II (100%), system III (95.24%) and solar lantern (76.47%) used their light everyday in winter season.

**Duration of use:**

Majority of the respondents having solar lighting (system I- 35.71%, system II-100%, system III-66.67% and solar lantern-52.94%) used their lights for 3-5 hours and fans (system I- 53.57%, system II-100%, system III-71.43%) for 6-8 hours in a day in summer season.

Majority of the respondents of system I (60.71%), system II (100%), system III (71.43%) and solar lantern (70.59%) used their lights for 3-5 hours in a day in winter season. Remaining respondents used their lights for upto two hours and 6-8 hours in a day in winter season.

**Summary and conclusion:**

Respondents (60%) belonged to middle age group (36-45years), were married (90%), were illiterate (36%) and belonged to nuclear family (66%) with family size of 4-6 (73%) members. They belonged to middle caste (50%), were housewives (87%), and had medium education status (64%). Respondents belonged to middle income group *i.e.*, Rs. 10,000-20,000 (78%), had mixed type of house (60%) and had no land (52%). They had medium mass media exposure (45%) and received information through government agency (77%).

It was encouraging to note that cent per cent respondents were aware of CFL based solar lighting system, while a vast majority of them possessed and were using CFL based solar home lighting system consisting of one light and one fan (59.00%), consisting of two lights and one fan (3.00%) and one light, one fan and one mobile charger (21.00%). Respondents (85.00%) were also aware of CFL based solar lantern but only 17 per cent of them possessed it and were using it. Respondents having solar lighting used light for 9-10 months and fan for 7-8

Table 4 : Use of solar lighting system in summer and winter season (n= 97)										
Sr. No.	Parameters	Solar home lighting system (n=80)								
		System I (n=56)		System II (n=3)			System III (n=21)			Solar lantern (n=17)
		Light	Fan	Light I	Light II	Fan	Light	Fan	Charger	
1.	<b>Duration of use/day in summer season</b>									
	Up to 2 hours	5 (8.93)	0 -	0 -	1 (33.33)	0 -	7 (33.33)	0 -	5 (23.81)	0 -
	3-5 hours	20 (35.71)	10 (17.86)	3 (100)	2 (66.67)	0 -	14 (66.67)	1 (4.76)	16 (76.19)	9 (52.94)
	6-8 hours	31 (55.36)	30 (53.57)	0 -	0 -	3 (100)	0 -	15 (71.43)	0 -	8 (47.06)
	More than 8 hours	0 -	16 (28.57)	0 -	0 -	0 -	0 -	5 (23.81)	0 -	0 -
2.	<b>Duration of use/ day in winter season</b>									
	Up to 2 hours	12 (21.43)	0 -	0 -	0 -	0 -	5 (23.81)	0 -	7 (33.33)	0 -
	3-5 hours	34 (60.71)	0 -	3 (100)	3 (100)	0 -	15 (71.43)	0 -	14 (66.67)	12 (70.59)
	6-8 hours	10 (17.86)	0 -	0 -	0 -	0 -	1 (4.76)	0 -	0 -	5 (29.41)

Figures in parentheses indicate percentages

months in a year. Except few respondents having solar lighting system II (33.33%), system III (4.76%) and solar lantern 11.76 per cent used lights everyday and cent per cent respondents used fans everyday in summer season. Respondents having solar lighting system used lights for 3-5 hours and fans for 6-8 hours in a day in summer season. Respondents of system I (60.71%), system II (100%), system III (71.43%) and solar lantern (70.59%) used lights for 3-5 hours in a day in winter season (Joshi and Sharma (2014).

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