

Farmers' Awareness Level towards Solar Energy Products

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Abstract--- *The solar system opportunities are significant in India and have a potential of replacing huge usage of diesel and kerosene used for lighting and irrigation in rural areas. As a result, Indian government is providing various financial supports and subsidies to buy solar energy products. But still, the demand for these products is not favourable by public. In this aspect, it becomes necessary to find out why people are not buying solar energy products and whether they are willing to buy solar energy products. Therefore, the present study is an attempt to examine the farmers' awareness levels towards solar energy products. To accomplish the objective, respondents were interviewed in three major regions Malwa, Majha, and Doaba of Punjab. Respondents' data was collected through convenience as well as judgmental sampling. The data has been collected during the period of May 2015 to May 2017. Descriptive analysis and Chi-square (χ^2) techniques have been used to examine the collected data. A result of the study concluded that most of the respondents were aware of solar energy products and they got awareness from their friends and family. But they are not adopting solar products due to its high investment cost and government grant aid available is inadequate for buying solar energy products.*

Keywords--- *Solar Energy Products, Farmers, Chi-square (χ^2) Test, Awareness Level.*

I. INTRODUCTION

Indian agriculture energy demand constitutes approximately 20 percent of the total power demand and consumes 85 million tons of coal per year. Moreover, around 4 billion liters of diesel is burnt by diesel based pumps in the agriculture sector. In addition to this, erratic electricity power supply and the high cost of diesel are main issues for the farmers of India. So, these issues result in poor irrigation and yield losses. The crop yield could be easily improved by 10 percent if an essential volume of water for irrigation is available when required. However, India has huge untapped solar off-grid opportunities especially in rural areas, there is a scope of providing power to rural and its inherent potential to replace precious fossil fuels resources.

The solar power opportunities in India are huge, given the fact that approximately 400 million people do not have access to electricity in remote areas. The solar system opportunities are significant and have a potential of replacing huge usage of diesel and kerosene used for lighting and irrigation in rural areas. To decrease the pollution and to save the environment, renewable energy has good potential to meet the energy demand.

It is known that among the renewable energy sources, solar energy is the most capable and reliable energy source. With the solar system, the large amount of energy can be harnessed from the sunshine. The significance of solar energy can be understood by the fact that in a one-day light hour, the amount of solar light which reaches on the earth surface is more than the total amount of energy used by everyone in 1 year, (Prasanth & Ramesh, 2013).

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1.2 Importance of Solar Energy Products

The major advantages of using solar systems are that the consumer is the owner of his own power production and it can be used for flood Irrigation; drip Irrigation; it is used in community water supply; useful in fish and poultry farming; no monthly bills of electricity occurs; no fuel cost is involved; solar systems are durable and reliable; products are suitable for almost all parts of the country; no noise pollution; solar products can be used for poverty reduction; reduce environmental degradation; The enactment of solar system may generate jobs in rural area; children can study in the night where availability of electricity is not possible; Solar systems can be used for power supply to remote areas; for drinking water; for irrigation; for water purification; for lighting in rural areas; for communication; to measure remote area weather; for road sign lighting; for railway crossing and signals; for security lighting; for remote alarm system; for income generation; and for village industry power.

India has installed around 35 thousand agriculture pumps. Approximately 70 percent of these solar pumps are installed in Punjab, Haryana, Rajasthan, and Bihar. These solar pumps are majorly installed by The Ministry of New and Renewable Energy, (MNRE, 2017). It provides 30 percent of capital subsidy assistance. The Ministry supported the sales of solar agricultural pumps for community drinking water and irrigation through financial assistance in the form of subsidy and incentives. Under second phase MNRE is considering a target to set up at least 25000 solar pumps by the end of year 2017. But still, the demands for these products is not favourable by customers, there is a huge gap between demand and supply of solar products due to lack of awareness among public, (Chan, 2001; Mostafa, 2007a). Therefore, the government of India is trying hard to fulfill this gap. In this aspect, it becomes necessary to find out the farmers' awareness level towards solar energy products whether they are willing to buy solar energy products.

II. REVIEW OF LITERATURE

As the research must be supported by some existing and theoretical foundations, hence an extensive literature review becomes essential. It is conducted to have an in-depth idea related to the field of research. Taking this into consideration, literature review of previous studies has been conducted in broad manner. Current review is based on both empirical and conceptual studies. This section provides detailed literature review related to the present research

Zarnikau (2003) concluded that there lies a wide variance in the willingness to pay for renewable energy. The finding of the study suggested that greater information about energy resources option will increase consumer's willingness to pay a premium for renewable energy. So there is a need for greater awareness of solar energy products in the public. **Eriksson (2004)** explored the customers' readiness to pay a premium for the ecological products may be uniformly or non-uniformly distributed. Eco-consumerism will only be modestly powerful in both cases, in spite of the fact that product difference leads to relaxed competition and improved profits.

Jain and Kaur (2004) analyzed the customer environmental awareness, behavior and consumers attitude towards environmental issues in India. Research collected data through field survey and sample size of 209 respondents has been taken. Factor analysis has been applied to examine the data. Results of the study revealed that customers do believe in an unexpected rise in environmental issues and they are ready to take initiatives to improve environmental issues. **Pandey (2007)** stated that solar energy will play a significant role in managing power related

problems of the country. Solar energy is a profitable source of energy as compared to other renewable resources. Some drawbacks of solar energy are installation cost, investment cost, and maintenance cost of products which are very high but it incurred at the initial stage. Research also concluded that solar technology cannot produce electricity during the night, but a battery backup system of solar energy products and Net Metering System (NMS) can solve this problem. **Sudha (2011)** concluded that reasons for not buying solar energy products are long payback period and investment cost. The factors that affect willingness to purchase solar energy products are increasing environmental concern and social responsibility. **Naomi (2014)** concluded that awareness level has a positive impact on the adoption of solar technology and income of households has a negative impact, whereas substitute of power source does not positively influence the adoption of solar technology. **Upadhyay and Chowdhury (2014)** illustrated some challenges of solar energy products in India. The research explored that public as well as private sector adopting the solar energy technology. But still it is very costly to produce electricity from solar photovoltaic technology because of cost aspect solar technology is not growing in the Indian economy, the existing political and fiscal policies are responsible for the growth of the solar technology. The research concluded that technical, economic, instrumental barriers are some major challenges for the growth of these products.

Nagamani and Navaneetha (2016) analyzed the awareness of women graduates towards solar energy products in Coimbatore city. The study also examined their source of information about solar energy products. The study collected primary data from fifty women graduates by random sampling technique. Descriptive statistical tools and Chi-square test were applied to examine the collected data. A result of the study concluded that most women were aware of solar energy products. But they are not adopting solar products due to its high investment cost. **Ing et al., (2017)** recognized the factors that affect customer perception to adopt renewable energy among the public in Kuala Lumpur city. The data were collected through questionnaires from 200 respondents.

To understand the relationship between dependent and independent variables such as economic factors, perceived price, personal characteristics, and perceived product benefits to customers' correlation and multiple regression analysis techniques have been applied. The results concluded that global and local economic factors have a significant effect on consumers' perception while perceived product benefits have little influence.

The current ecological condition requires serious attention and it can be seen that environment is facing problems of air and water pollution, global warming, ozone depletion, hazardous waste disposal, and deforestation. Nowadays, customers are known that their consumption pattern will affect the environment. So, they are more aware of the environmental degradation. As a result, customers are engaging in eco-friendly activities and engaging in green practices. Green buying behavior can help to protect the environment and for sustainable development.

2.1 Objectives of the Study

- To examine the farmers' awareness level towards solar energy products.

2.2 Hypotheses of the Study

The present study includes the hypotheses which were framed on the basis of previous studies and intuition. The hypotheses are mainly related to the association between education with knowledge about solar energy products and

subsidy schemes. To check the association between the education level and awareness of the solar energy products and subsidy schemes these are some hypotheses which have been formulated:

H1₀: There is no association between the education level of the respondents and awareness about solar product subsidy schemes.

H1_a: There is an association between the education level of the respondents and awareness about solar product subsidy schemes.

To check the association between the education level and awareness of the solar energy products warranty period these are the hypotheses which have been formulated:

H2₀ There is no association between the education level of the respondents and awareness about solar energy product warranty period.

H2_a There is an association between the education level of the respondents and awareness about solar energy product warranty period.

III. METHODOLOGY

The study is based on primary data, collected from a total of 510 respondents from different villages and rural areas of Punjab. These respondents were interviewed through a well-structured, pretested research schedule. To accomplish the objective, respondents were interviewed in three major regions of Punjab. Respondents' data was collected through convenience as well as judgmental sampling. The "Statistical Package for Social Sciences" (SPSS) version 20 was used for data analysis. Descriptive Analysis and Chi-Square (χ^2) Techniques have been used to examine the collected data.

The study conducted a small survey of respondents for pre-testing of the research schedule. The pilot study of 120 respondents has been conducted to test the reliability and validity of modified research schedule. The study comprises respondents from different villages and rural areas of Punjab. This study is restricted to Punjab state only and villages nearby Amritsar, Gurdaspur, Taran Taran, Barnala, Bathinda, Faridkot, Ferozpur, Ludhiana, Mansa, Mohali, Moga, Muktsar, Nawashehar, Patiala, Rupnagar, Sangrur, Jalandhar, Hoshiarpur, and Kapurthala districts of Punjab have been taken for data collection.

3.1 Demographic Profile of Non-user Respondents

The table 1 represents the demographic profile of non-user respondents and 91.57% male and only 8.43% female participated in the survey. Moreover, the majority of the sample 45.5% belonged to the age group of 32-41 years, followed by 19.4% in the age group of 42-51 years followed by 19.4% in the age group of 52. Furthermore, 15.7% respondents were falling in the age group less than 31 years. In case of marital status, 95.3% respondents are married and 4.7% were unmarried. As far as educational qualification is concerned, majority 36.1% respondents belonged to higher secondary, followed by 28.2% respondents who were from matriculation, 20.4% respondents belonged to middle standard and very less proportion of only 8.6% belongs to the respondents who have done graduation. Furthermore, only 6.7% of the respondents have completed their primary education.

Table 1: Demographic Profile of Non-users'

		<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
Gender	Male	467	91.57	91.57
	Female	43	8.43	100.00
	Total	510	100	
Age (Years)	Less than 31	80	15.7	15.7
	32-41	232	45.5	61.2
	42-51	99	19.4	80.6
	52 and above	99	19.4	100.0
	Total	510	100	
Marital Status	Married	486	95.3	95.3
	Single	24	4.7	100.0
	Total	510	100	
Educational Qualification	Up to Primary	34	6.7	6.7
	Up to Middle Standard	104	20.4	27.1
	Up to Matriculation	144	28.2	55.3
	Higher Secondary	184	36.1	91.4
	Graduation	44	8.6	100.0
	Total	510	100	
Annual Income	Less than 2,00,000	1	0.2	0.2
	200001-400000	67	13.1	13.3
	400001-600000	286	56	69.3
	600001-800000	146	28.7	98
	Above 800001	10	2	100.0
	Total	510	100	
Region	DOABA	172	33.7	33.7
	MAJHA	168	33	66.7
	MALWA	170	33.3	100.0
	Total	510	100	
Occupation	Agriculture	510	100	100.00

Source: Compiled from Survey

As per income of the respondents' concerned, Table describes that 56% of the respondents belong in the income category of Rs.400001-600000 followed by 28.7% respondents belong to income segment of Rs.600001-800000. Only 13.1% of the respondents belong to income group Rs.200001-400000. 2% lies in the income category of above Rs.800000. However, only one respondent is falling in the income category of less than Rs.200000 annually. As per region of the respondent concerned, data was collected from three different regions of Punjab state where 172 (33.7 percent) respondents have been taken from Doaba region followed by 168 (33 percent) respondents were taken from Majha region. Moreover, 170 (33.3 percent) respondents belonged to Malwa region of Punjab. As far as, the profession is concerned, all the respondents are engaged in the agriculture sector.

IV. DATA ANALYSIS

This section represents a descriptive analysis of the collected data. A descriptive statistic is distinguished from inferential statistics and it aims to summarize a sample, rather than use the data to learn about the population that the sample of data is thought to represent. The statistical technique has been used on the basis of data characteristics, (Best & Kahn, 2003). The descriptive analysis of data provides estimation and summarization of data; arrange data in tables and graphs; give information about the variability and uncertainty; and indicate unexpected patterns, (Best,

1981). Collected data were examined descriptively in terms of central tendency and measure includes mean, percentage, and rank order, (Krishnaswamy & Ranganathan, 2006).

4.1 Farmers' Awareness Level towards the Solar Energy Products

The table 2 represents respondents' awareness level about solar energy products, subsidy schemes, solar panel warranty period, photovoltaic technology, and their willingness to buy solar energy products. A large number of incentives and subsidy schemes have been implemented by the government to increase the adoption of solar products. Especially, to promote solar pumps, Ministry of New & Renewable Energy (MNRE) provided 30% as a subsidy for solar pumps, (MNRE, 2014). However, this subsidy scheme was not able to achieve the solar pump set target. The Ministry also launched credit-linked capital subsidy scheme, under this scheme customers have to contribute only 20 percent of the total cost, the government contributes 40 percent of the cost as a subsidy, while remaining 40 percent availed to the customers as debt (loan) from the designated banks, which they can reimburse in 10 years, (NABARD, 2017). However, despite several efforts by the Indian government only 1,744 solar pumps were installed under this scheme until 2016, as target was of 30,000 solar pumps by 2016, (MNRE, 2017). Moreover as per standard, manufacturers provide 25 years of warranty to the customers on solar panel systems. However, some solar companies are seeking to expand solar panel warranty periods up to 30 years, (Energy Sage Inc, 2015). But very few people know about solar panel warranty period and about their subsidy schemes. Therefore, this study conducted a survey to know whether farmers' are aware about the warranty period and subsidy schemes.

Table 2: Farmers' Awareness Relating to Solar Energy Products

<i>Particulars</i>		<i>Frequency</i>	<i>Percentage</i>
Awareness about Solar Energy Products	Aware	510	100%
	Not aware	00	00%
	Total	510	100.00
Awareness about Solar Products Subsidy Schemes.	Aware	147	28.8%
	Not aware	363	71.2%
	Total	510	100.00
Awareness about Solar product warranty period	Aware	120	23.5%
	Not aware	390	76.5%
	Total	510	100.00
Awareness about Photovoltaic (PV) Technology.	Aware	46	9%
	Not aware	464	91%
	Total	510	100.00
Willingness to buy Solar energy Products.	Willing	510	100%
	Not willing	00	00%
	Total	510	100.00

(Source: Compiled from IBM SPSS version 20 output)

Results of the study depict that all respondents are aware of solar energy products, wherein among 510 respondents, only (28.8 percent) 147 respondents are aware of solar products subsidy schemes, remaining 363 (71.2 percent) respondents are not aware of the solar subsidy schemes provided by the government. Further among 510 respondents, only (23.5 percent) 120 of the respondents are aware of the solar products warranty period, while remaining 390 (76.5 percent) respondents are not aware of the solar product warranty period. Additionally very few (9 percent) 46 of the respondents among 510 respondents are aware of photovoltaic technology, while majority 464

(91 percent) of them are not aware of photovoltaic technology. All of them are willing to buy solar energy products because of its eco-friendly nature.

4.2 Sources of Information about Solar Energy Products

Table 3 describes the source of information about solar energy products. The majority 370 (72.5 percent) of the respondents acknowledged that they got awareness about solar products through friends and families, followed by newspaper & magazines which got second rank (71.4 percent) 364 respondents said that they got awareness through newspaper and magazines.

While (52.5 percent) 268 respondents described that they have got information regarding solar energy products through television and radio which got the third position in the ranking, the Internet got the fourth rank as a source of information of solar energy products, (44.5 percent) 227 respondents explored that they got information about solar energy products from the internet.

Table 3: Sources of Information about Solar Energy Products

Rank	Particulars	Frequency	Percentage
1.	Friends and Families	Yes	370 72.5%
		No	140 27.5%
		Total	510 100.00
2.	Newspaper and Magazines	Yes	364 71.4%
		No	146 28.6%
		Total	510 100.00
3.	Television and Radio	Yes	268 52.5%
		No	242 47.5%
		Total	510 100.00
4.	Internet	Yes	227 44.5%
		No	283 55.5%
		Total	510 100.00
5.	Books and Encyclopedias	Yes	125 24.5%
		No	385 75.5%
		Total	510 100.00
6.	Environmental Organizations & NGO's	Yes	86 16.9%
		No	424 83.1%
		Total	510 100.00

(Source: Compiled from IBM SPSS version 20 output)

Books and encyclopaedias got the fifth rank and out of 510 respondents, very few (24.5 percent), 125 from them revealed that they got awareness through books and encyclopedias. Environmental organizations & NGO's are last in the ranking and only (16.9 percent) 86 respondents considered environmental organizations & NGO's as a source of information for solar energy products.

4.3 Reasons for not using Solar Energy Products

As far as the adoption of solar energy products is concerned, table 4 describes that out of 510 respondents, majority 453 (88.8 percent) of the respondents acknowledged that the investment cost is the first and foremost reason for not buying solar products, whereas (87.8 percent) 448 respondents have considered maintenance cost for not purchasing solar energy products, so maintenance cost got's second rank. While seasonal attribute of the solar

product got the third rank and out of 510 respondents (87.6 percent) 447 respondents revealed that they have not adapted solar technology because they think the performance and electricity output of the solar panel is based on weather.

Table 4: Reasons for not Using Solar Energy Products

<i>Rank</i>	<i>Particulars</i>		<i>Frequency</i>	<i>Percentage</i>
1.	Investment Cost	Yes	453	88.8
		No	57	11.2
		Total	510	100
2.	Maintenance Cost	Yes	448	87.8
		No	62	12.2
		Total	510	100
3.	Seasonal	Yes	447	87.6
		No	63	12.4
		Total	510	100
4.	Long Loan Procedure	Yes	420	82.4
		No	90	17.6
		Total	510	100
5.	Long Payback Period	Yes	333	65.3
		No	177	34.7
		Total	510	100
6.	Low Voltage Application	Yes	243	47.6
		No	267	52.4
		Total	510	100
7.	Non-availability	Yes	202	39.6
		No	308	60.4
		Total	510	100
8.	Unattractive	Yes	185	36.3
		No	325	63.7
		Total	510	100
9.	Lack of Guidance	Yes	177	34.7
		No	333	65.3
		Total	510	100

(Source: Compiled from IBM SPSS version 20 output)

Further, long loan procedure attribute is fourth in the ranking and (82.4 percent) 420 respondents out of 510 respondents stated that because of long loan procedure they have not availed loan to purchase solar products. Long payback period attribute is fifth in the ranking and out of 510 respondents, (65.3 percent) 333 respondents explored that because of long payback period they avoid to purchase solar energy products.

However, low voltage application attribute got sixth rank and (47.6 percent) 243 respondents reported that solar energy technology is low voltage application, furthermore products are not easily available in the market seventh in the ranking and (39.6 percent) 202 respondents described that they have not found solar energy product outlet or store in the market.

Solar products are unattractive attribute got the eighth position in the ranking and (36.3 percent) 185 respondents consider that solar panel systems are bulky, huge, and unattractive. Lastly, there is no information available to buy these products are the principal reasons for not buying solar energy products acknowledged by (34.7 percent) 177 respondents.

4.4 Influencing Attributes for Solar Energy Products

Table 5 describes there are various influencing attributes for solar energy products such as media, financial support & subsidies, public opinion, solar companies, state government, and environmental organization which influence public attitude towards solar energy products.

Table 5: Influencing Attributes for Solar Energy Products

Rank	Influencing Attributes	No Influence		Little Influence		Some Influence		Strong Influence		Very Strong Influence	
		Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
1	Media	11	2.2	2	0.4	13	2.5	177	34.7	307	60.2
2	Financial Support & Subsidies	8	1.6	5	1	25	4.9	189	37.1	283	55.5
3	Public Opinion	21	4.1	33	6.5	102	20	197	38.6	157	30.8
4	Solar Companies	6	1.2	4	0.8	293	57.5	155	30.4	52	10.2
5	State Government	114	22.4	121	23.7	163	32	63	12.4	49	9.6
6	Environmental Organization & NGO's	114	22.4	191	37.5	159	31.2	27	5.3	19	3.7

(Source: Compiled from IBM SPSS version 20 output)

Wherein media has got the first rank and (60.2 percent) 307 respondents revealed that Media has a very strong influence regarding awareness and adoption of solar energy products. Financial support & subsidies are second in ranking and (55.5 percent) 283 respondents reported that financial subsidies provided by banks and government have a very strong influence on their purchasing intention.

The third rank owned by public opinion and (30.8 percent) 157 respondents described that the opinion of society, peers, friends, and family have a strong influence on solar products adoption. Solar companies got fourth rank and very less (10.2 percent) 52 respondents explored that the solar company's promotional and their eco-friendly initiatives have an influence on their buying decision.

State government got the fifth position in the ranking and very few (9.6 percent) 49 respondents acknowledged that state government has an influence on their purchasing. Environmental organization and NGO's at the sixth rank and only (3.7 percent) 19 respondents considered these organizations as influencing attribute to adopt solar energy products.

4.5 Association between the Education Level and Awareness of the Solar Energy Product

Chi-square (χ^2) test is used to analyze the significance of the observed association in the cross tabulation. This test measures whether a systematic association exists between two variables, (Lancaster, 1969).

The null hypothesis H_0 represents that there is no association between the variables while the alternative hypothesis H_a represents that there is significant association exists between the variables.

The expected frequencies are compared with actual observed frequencies, (Malhotra & Dash, 2014). To find out the association between education level and awareness about solar energy product subsidy schemes Chi-square (χ^2) test has been applied.

Table 6: Association between Education Level and Awareness about Subsidy Schemes

Qualification of Respondents		Subsidy		Total	Chi-square	df	Sig.
		Aware	Unaware				
Primary	Observed Frequency	1	33	34	68.661	4	0.000
	Expected Frequency	9.8	24.2	34.0			
	% within Qualification of Respondents	2.9%	97.1%	100.0%			
Middle Standard	Observed Frequency	16	88	104			
	Expected Frequency	30.0	74.0	104.0			
	% within Qualification of Respondents	15.4%	84.6%	100.0%			
Matriculation	Observed Frequency	30	114	144			
	Expected Frequency	41.5	102.5	144.0			
	% within Qualification of Respondents	20.8%	79.2%	100.0%			
Higher Secondary	Observed Frequency	69	115	184			
	Expected Frequency	53.0	131.0	184.0			
	% within Qualification of Respondents	37.5%	62.5%	100.0%			
Graduation	Observed Frequency	31	13	44			
	Expected Frequency	12.7	31.3	44.0			
	% within Qualification of Respondents	70.5%	29.5%	100.0%			
Total	Count	147	363	510			
	Expected Count	147.0	363.0	510.0			
	% within Qualification of Respondents	28.8%	71.2%	100.0%			

(Source: Compiled from IBM SPSS version 20 output)

Table 6 represents that at 5% level of significance, the value of Chi-square for n-1 is (χ^2) =68.661, whereas the level is extremely significant with the p-value of 0.000 hence, the null hypothesis is rejected leading to the conclusion that there is a significant association between the education level and awareness regarding solar product subsidy schemes. Results explained that only (2.9 Percent) 1 respondent belonging to a primary class is aware of solar product subsidy schemes and the majority (97.1 Percent) 33 respondents are not aware of these schemes.

Furthermore, (15.4 Percent) 16 respondents from middle standard are aware of subsidy schemes while (84.6 Percent) 88 of them are not aware of solar product subsidy schemes. In the case of matriculation (20.8 Percent) 30 respondents are aware and the majority of the respondents (79.2 Percent) 114 are not aware. However (37.5 Percent) 69 respondents from higher secondary are aware of subsidy schemes and (62.5 Percent) 115 respondents are unaware of subsidy schemes. Moreover (70.5 Percent) 31 respondents belonging to graduation are well aware of subsidy schemes and (29.5 Percent) 13 respondents are unaware.

Therefore, results accomplished that there is a positive association between the level of education and awareness regarding solar energy product subsidy schemes.

4.6 Association between the Education Level and Awareness about Solar Product Warranty Period

To find out the association between education level and awareness about warranty of the solar energy products Chi-square (χ^2) test has been applied.

At 5% level of significance, the table value of Chi-square for n-1 is (χ^2) =52.598, whereas the level is extremely significant with the p-value of 0.000, hence the null hypothesis is rejected leading to the conclusion that there is a significant association between the education level and awareness regarding the warranty period of the solar energy products.

Table 7: Association between the Education Level and Awareness Regarding Solar Product Warranty Period

Qualification of Respondents		Warranty		Total	Chi-Square	df	Sig.
		Aware	Unaware				
Primary	Observed Frequency	0	34	34	52.598	4	0.000
	Expected Frequency	8.0	26.0	34.0			
	% within Qualification of Respondents	0.0%	100.0%	100.0%			
Middle Standard	Observed Frequency	15	89	104			
	Expected Frequency	24.5	79.5	104.0			
	% within Qualification of Respondents	14.4%	85.6%	100.0%			
Matriculation	Observed Frequency	23	121	144			
	Expected Frequency	33.9	110.1	144.0			
	% within Qualification of Respondents	16.0%	84.0%	100.0%			
Higher Secondary	Observed Frequency	57	127	184			
	Expected Frequency	43.3	140.7	184.0			
	% within Qualification of Respondents	31.0%	69.0%	100.0%			
Graduation	Observed Frequency	25	19	44			
	Expected Frequency	10.4	33.6	44.0			
	% within Qualification of Respondents	56.8%	43.2%	100.0%			
Total	Observed Frequency	120	390	510			
	Expected Frequency	120.0	390.0	510.0			
	% within Qualification of Respondents	23.5%	76.5%	100.0%			

(Source: Compiled from IBM SPSS version 20 output)

Results explained that entire respondents who belong to primary education are not aware of solar products warranty period. Furthermore, only (14.4 Percent) 15 respondents from middle standard are aware of solar product warranty period and (85.6 Percent) 89 respondents are not aware. In the case of matriculation very few (16 Percent) 23 respondents are aware and (84 Percent) 121 majorities of the respondents are not aware. However (31 Percent) 57 respondents from higher secondary are aware and (69 Percent) 127 respondents are unaware of the warranty period. Moreover (56.8 Percent) 25 out of 44 respondents belonging to graduation are well aware and (43.2 Percent) 19 respondents are unaware of solar products warranty period. Therefore results described that there is a positive relationship between the level of education and respondents' awareness regarding solar panel warranty period. Results also explained that with increasing level of education, respondents' awareness regarding solar product warranty period also increasing gradually. Where the level is extremely significant with the p-value of 0.000 hence, the null hypothesis is rejected leading to the conclusion that there is a significant association between the education level and awareness regarding solar product warranty period.

V. CONCLUSION AND RECOMMENDATIONS

The study concluded that the majority of the respondents acknowledged that they have got awareness through their friends and families, newspaper and magazines, television and radio, internet, books and encyclopedias, and through environmental organizations & NGO's. As far as the adoption of solar energy products is concerned, the majority of the respondents acknowledged that the investment cost, maintenance cost, seasonal attribute, long loan procedure, long payback period, low voltage application, unattractive, and lack of information are the principal reasons for not buying solar energy products. Most of the respondents are quite happy with getting electricity from the public electricity boards and prefer traditional services and don't want to change it. Some major reasons for not

buying the solar energy products are investment and maintenance costs, respondents even believe that solar products are seasonal. They feel there is no requirement for installation of solar products on their land as they are not aware of the functioning and performance of solar energy products. Non-availability and lack of guidance regarding availing loan from the bank for these products also has an impacts on awareness, adoption, and installation of the solar energy products. The results also concluded that the various attributes such as media, financial support and subsidies, public opinion, solar companies, state government, and environmental organization & NGO's are attributes which influence adoption of solar energy products. Results described that there is a positive association between the level of education and awareness regarding solar product subsidy schemes and warranty period.

5.1 Recommendations of the Study

Government subsidy is essential for the short-term development of solar energy products. However, heavy dependence on subsidy for the purchase of solar pump in the long term is unsustainable. So, there are lots of strategies which may be used for the solar energy products to enhance the adoption rate in the public. These strategies are as follows:

- The Indian government could develop the current solar products subsidy and incentive instrument by taking some important steps such as expediting the disbursement process, formulation of guidelines for the solar pumps, monitoring the process subsidy release, and enhancement of transparency in the loan process.
- The solar manufacturers should promote solar energy products through local advertisements, pamphlets, leaflets, banners, and yellow pages. They should encourage and promote digital advertisements of solar products through E-mails, mobile phones, and social media. They should carry out the promotional campaign for solar energy products with proper planning with a set of objectives and targets.
- The initial investment cost of the solar energy product is the key criteria for selection. Cost price of the solar submersible pump is high compared to other energy products e.g. solar water heater. The government should provide more subsidies and should reduce the initial cost.
- The procedure for availing loan from banks for purchase of solar energy products should be simple if the government wants to encourage more and more consumers to approach for subsidies loans.
- The solar product manufacturers should provide some financial incentives and discounts to encourage the dealers to sell more solar energy products.
- Buyer must be given income tax exemption on initial cost for buying the solar energy products. The government should give a rebate in property tax for the households which are installing solar energy products to motivate consumers to use solar energy products.

5.2 Limitations of the Study

This study is based on a survey, so this study suffers from some basic limitation. Following are the limitations of the study:

- Lack of respondents' awareness regarding solar energy products may affect results of the study.
- This study is restricted to Punjab state only, so the conclusions drawn cannot be generalized.

- As the sample size has been selected on the basis of convenience and judgemental sampling and has been taken from the rural area of Punjab state, so, the result may not be representative of the overall population. The perception of respondents from one part may vary from another part of India
- The responses given by respondents may suffer from personal biases because the respondents might not have intentionally provided their correct responses. So, it could affect the results of the study.

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