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A STUDY ON THE USE OF SOLAR PV SYSTEM FOR POWER GENERATION

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ABSTRACT

Energy is an important element for infrastructural development and is considered as the basic element for growth and prosperity of human civilization. The environment or the eco-system is getting affected due to pollution and so the government is focusing on the eco-friendly products like solar energy photovoltaic system to reduce this menace. The present study tries to assess the awareness among the public about the importance of solar energy generation and see how much help and assistance is provided by the government to buy the system. It is concluded that there is a lack of knowledge among the public on this issue. People in general are ignorant about the product, lack clear conception regarding the usage of the product, lack knowledge about the rebate and subsidies available for the product, and have very little idea about the incentives that can be derived by them. The product is expensive to them and the government has done little to encourage the general masses.

INTRODUCTION

The use of energy for economic growth has been an important issue of research because energy is considered to be the driving force of economic growth. Many previous studies suggest that energy consumption has a high positive correlation with economic growth. Whether economic growth takes precedence over energy consumption or energy boosts the economic growth have been examined in a number of studies yet empirical evidence is mixed and conflicting.

It is well known that the scarcity of resources had tremendously affected the economic growth and prices. So, on a sustainable basis, energy is an important element of the infrastructure sector and is considered as the basic element for growth and prosperity of human civilization. It is necessary to perform various activities leading to economic prosperity, such as heating, cooling, lighting, manufacturing, business location, family homes and transportation etc. It also has tremendous impact on the quality of life in the modern day world. In addition to this, presence of adequate amount of electricity has significant impact on issues like poverty, social services, agricultural production, food security, climate change, environmental quality and also on wide range of other economic and social issues (Kraft and Kraft, 1978).

Solar energy is the energy which is produced directly from sunlight. Solar energy from the sun can be collected and utilized for heating or cooling of buildings, heating water, distillation, providing heat for industrial and agricultural process; be transformed into electricity by solar-thermal electric by thermal conversion system; or used for bio-mass, an indirect form of solar energy, through which bio-fuels are produced such as wood, methane, alcohol, hydrogen from vegetation or bio-waste (J.R Williams, 2013). The system used to harness this energy is called solar photovoltaic system. When sun rays falls directly on the solar cells in the form of photons, it is converted into electricity. The energy is generated by nuclear fusion reaction which is inside the body of the sun that reaches the earth in the form of electromagnetic radiation i.e., photons. This radiation consists of around 56% of IR (infrared rays) 36% of visible radiation and 7% ultra-violet rays. All these radiations do not reach directly to the surface of the earth, as a large part of it is scattered by dust and molecules in the atmosphere. The amount of energy generated by solar radiation is normally expressed in the terms of solar constant. According to world energy council, the value of this constant is 1367 (W/m²) (Breeze, 2019).

There are two ways to convert sunlight into electricity: a) Concentrated Solar Power (CSP) where the sunlight is focused on an area containing water which is being heated to convert it into steam. This steam is then used to generate power as in a

thermal power plant. b) Solar PV Cells where the sunlight is converted into electricity i.e. DC (direct current) power using solar cells. This system is further connected to grid (Deolalkar, 2015).

Solar energy is the amount of radiant energy received on a given surface area per unit time (KWh/m²/day). It contains light from solar beam which is a direct component. This direct component is used to produce power. Solar energy is an intermittent source of energy as it is based on the rotation of earth (sunlight fall on the earth only during day period). Nikolay Belyakov (2019) has explained two solar technologies namely: a) Passive solar technologies which involves accumulation of solar energy without transforming directly thermal or light energy into any other form where solar energy is collected, stored and distributed for healthy purpose; and b) Active solar technologies which involve solar energy being converted directly into other forms of energy like heat or electricity which is further grouped into two categories namely i) Solar thermal technology where solar energy is collected and concentrated by special devices and further converts into electricity; and ii) Photovoltaic technology where solar energy is directly converted into electricity using semiconductor devices. Solar energy is converted into electrical energy using solar photovoltaic. Photovoltaic has a non-linear characteristic and its output varies with ambient conditions like solar irradiation, ambient temperatures etc.

OBJECTIVES OF THE STUDY

The environment or the eco-system is getting affected due to pollution and is deteriorating by each passing day. As a result, the government is focusing on the eco-friendly products like solar energy photovoltaic system to reduce this menace. The use of solar energy is among the hot topics and government is giving prime importance to the solar energy photovoltaic system. The main purpose of the study is to assess the awareness among the public about the importance of solar energy generation. The study also assesses how much help and assistance is provided by the government to buy solar energy photovoltaic system. The present paper makes an honest attempt to assess various issues through surveys conducted on a sample population who have already installed solar energy PV system and find their perspectives on the subject.

DATA AND METHODOLOGY

For the purpose of study a close ended questionnaire was designed by the researchers. It contained various questions relating to the personal, social and economic aspects of the solar photovoltaic system used for energy generation. The questions were categorized as technical aspects, cost, rebate and subsidies, and impact on health. A sample was selected to administer the questionnaire in the Gurdaspur, Amritsar,

Pathankot and Jalandhar districts of Punjab. The sample consists of 51 individuals who have already installed the solar photovoltaic system for electricity generation to obtain first hand information and share their personal experience from the system. The respondents were personally interviewed by the researchers and their responses were tabulated in excel. The data so obtained were summarized and meaningful inferences are drawn.

Findings From The Survey

Table 1: Demographic profile of the sample:

Occupation	Self-employment: 15.7% Private services: 41.2% Government services: 3% Business: 23.5% Others: 16.6%
Average monthly income	Upto Rs10000: 19.6% Rs10000 to Rs20000: 37.5% Rs20000 to Rs30000: 17.6% More than Rs30000: 25.5%
Family size	3 or less members: 9.8% 4 to 6 members: 78.4% Above 6 members: 11.8%
Education Qualification	School Education: 47% College Education: 37.3% PG or above: 15.7%

The demographic profile of the respondents who have installed the solar P.V system in their house and interviewed by the researchers are mentioned in Table 1. The occupation of the respondents shows that 41.2% of the sample is engaged in private services; 23.5% in business; 15.7% are self employed; 3% are in government services; and 16.6% are engaged in others occupations. The average annual income of the respondents show that out of the people who install solar P.V system, only 25.5% earn above Rs 30,000 per month. So, almost three-fourth of the sample earns below Rs 30,000 per month and they are capable of installing and maintaining solar P.V system. Most families interviewed (78.4%) had 4 to 6 members present in their household. Almost half of the respondents (47%) had school education and 53% had college or university education.

Table 2: Questions on Technical Issue

What is the capacity of your solar panels?	Under 500Wp: 4.5% 501Wp to 1000Wp: 29.4% 1000Wp to 1500Wp: 11.8% 1500Wp to 2000Wp: 19.6% More than 2000Wp: 25.5%
When have you started the use of solar panels?	Before 2011: 0% 2011 to 2015: 4% 2016 to 2020: 96%
What type of solar panel system have you installed in your house?	Mono-crystalline: 48% Poly-crystalline: 48% PERC solar panels: 4%
After installation of solar panels, how much units of electric consumption (approximately) has been reduced by you?	Upto 100 units: 25.5% 100 to 200 units: 49% More than 200 units: 25.5%
What was your average electricity consumption before the installation of these panels?	Upto 200 units: 35.3% 200 to 500 units: 35.3% More than 500units: 29.4%

The capacities of solar panels mostly used are 501wp to 1000wp of 29.4% and more than 2000wp of 25.5%. In the medium range, 1000wp to 1500wp was used by 11.8% and 1500wp to 2000wp by 19.6% of the respondents. From 2016 to 2020, the purchase of solar PV system scaled up and was opted by 96% of the respondents. It is also seen that two types of solar panel systems are mainly installed by the customers

namely mono-crystalline (48%) and poly-crystalline (48%). It is seen that after the installation of solar panels, much electricity is saved by the respondents and comparing this with their previous bill, it is also seen that this saving in units as substantial.

Table 3: Questions on Cost

After the installation of solar panels, how much of your electricity bill was reduced every month?	Upto Rs500: 27.5% Rs 501 to Rs1000: 27.5% More than Rs1000: 45.5%
How much electricity bill did you pay every month before installing the solar panels?	Upto Rs1000: 11.8% Rs1000 to Rs1500: 17.6% Rs1500 to Rs2000: 33.3% More than Rs2000: 37.3%
How much electricity bill are you paying after installation of the solar panels?	Upto Rs 500: 15.7% Rs 500 to Rs 1500: 41.2% More than Rs1500: 43.1%

The electricity bill is substantially reduced after the installation of solar panels. A reduction of more than Rs 1000 per month is reported by 45.5% of the respondents which is encouraging. When a detailed comparison of the expenses was done for the periods before and after installation, it is seen that people paid much lower amount after installation of the solar panels.

Table 4: Questions on Choosing Company

Which company have you chosen for purchase of solar panels?	APLAX: 2% Adani solar: 7.9% Loom solar: 10.8% Luminous solar: 6% Microtek solar: 33.5% Vikram solar: 12.5% Usha: 23.5% UTL: 4%
Why did you choose this particular company?	Best brand: 9.8% Durability: 45.1% Cost effectiveness: 27.5% Others: 17.6%

Varied producers are chosen by the respondents. In this survey people have opted the company because of durability and cost effectiveness (45.1% and 27.5% respectively) but only a few respondents are focusing on the best brand (9.8%).

Table 5: Questions on Influence and Purpose of Usage

Who influenced you to buy solar panels?	Government: 0% Suppliers: 2% Friends and relatives: 94% Others: 4%
What kind of appliances do you run on the solar panel?	Major appliances: 3.9% Minor appliances: 66.7% Both: 29.4%

Friends and relatives were the main influencers (94%) who have influenced purchase of solar panels among the respondents. It is interesting to note that the government influence is absent according to this survey. It is seen that the percentage of people using panels for their minor appliances (66.7%) and for both major and minor appliances (29.4%). There are very few people who focus only on major appliances.

Table 6: Questions on Rebate and Subsidies

Presently, are you getting any rebate on your electricity bill?	Yes: 9.8% No: 90.2%
Did you get any subsidy when you installed the solar panels?	Yes: 5.9% No: 94.1%
Why did you install the solar panels?	To save electricity bill: 90.2% Rebate scheme/ subsidy: 2.9%

	Government mandate: 0% To save the environment: 6.9%
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90.2% of the sample does not get any rebate in their electricity bill and 94% are not given any subsidy to install the solar panels. Thus, it is clear that the government does very little to promote solar panels. Most people install solar panels to save electricity bill (90.2%).

Table 7: Questions on Health

Did you develop any health problem after using the solar panels?	Yes: 0% No: 100%
Are you benefited by the solar panels?	Yes: 100% No: 0%

No health problem was reported by the respondents after installation of the solar panels. It is thus noted that the solar panels are beneficial to the environment as well as for human health.

CONCLUSION

It is clearly seen from the above findings that solar photovoltaic energy is reliable and friendly means of energy generation and greatly beneficial to the environment or ecosystem of this world. It can also boost the Indian economy and can solve various problems like power shortage which India has been facing for decades. It also reduces pollution and is seen as the best alternative to coal and other non-renewable sources of power generation. After conducting the surveys, it is concluded that there is a lack of knowledge among the public in this issue. People in general are ignorant about the product, lack clear conception regarding the usage of the product, lack knowledge about the rebate and subsidies available for the product, and have very little idea about the incentives that can be derived by them. The product is expensive to them and the government has done little to encourage the general masses.

The government, as found from the survey, is taking few initiatives to educate the masses on the use of solar panels. In case of rebates and subsidies, the government must come forward with incentives (rebates and subsidies) and also reduce the tax on the product so that the common people can install the product at a subsidized price. Much more directed initiative is also expected from the civil society to make the product reach every household in India.

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