Indian Journal of
Modern Research and Reviews

This Journal is a member of the *'Committee on Publication Ethics'*

Online ISSN:2584-184X

Research Paper

A Study on Public Perception Towards the Adoption of Solar Energy Systems with Special Reference to Chennai, Tamil Nadu

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ABSTRACT	Manuscript Info.
This research explores the public perception, awareness, and adoption patterns of solar energy systems in Chennai, Tamil Nadu—a region with high solar potential and growing urban energy demands. As India transitions toward cleaner and more sustainable energy sources, solar energy has emerged as a critical alternative due to its renewability, environmental benefits, and long-term cost-effectiveness. The study aims to assess the general public's knowledge of solar technologies, affordability concerns, awareness of government subsidy schemes, and willingness to adopt solar systems in residential settings. Using a structured questionnaire, primary data was collected from 100 respondents across different age groups, income levels, and educational backgrounds in Chennai through random sampling. The analysis involved statistical tools such as the chi-square test to examine the relationship between awareness and adoption, and Karl Pearson's correlation to evaluate the link between income and affordability. Results indicate that while there is a moderate level of awareness about solar energy, knowledge of government incentives and technical feasibility remains low. High initial installation costs, lack of trust in service providers, and insufficient awareness of long-term benefits are key barriers to adoption. Despite these challenges, the study found a strong willingness among the public to shift to solar energy, provided financial support and policy clarity are strengthened. The findings emphasize the importance of targeted awareness campaigns, simplified subsidy processes, improved financing options, and community-based solar initiatives. This study contributes valuable insights to policymakers, solar developers, and stakeholders aiming to accelerate the diffusion of solar energy in urban India, especially in high-potential regions like Chennai.	 **How To Cite this Article** SWETHA P., G. KARUNAMOORTHI. A Study on Public Perception Towards the Adoption of Solar Energy System with special reference to Chennai, Tamil Nadu. Ind J Mod Res Rev. 2025;3(7):89-96.

1. INTRODUCTION

Solar energy is one of the most reliable and eco-friendly renewable energy sources available today. With rising electricity demands, environmental concerns, and a push for sustainable development, solar energy has become a vital alternative to conventional power sources. India, with its abundant sunlight, has significant potential to harness solar energy, and the government has introduced various policies and subsidy schemes to promote its adoption. Tamil Nadu, especially Chennai, has favorable conditions for solar energy use. However, adoption rates remain limited due to factors such as high initial costs, lack of awareness, limited understanding of government schemes, and concerns about feasibility. This study aims to assess public perception, awareness levels, affordability, and willingness to adopt solar energy systems in Chennai. It further analyzes the relationship between income and affordability and the role of government policies in influencing adoption. The findings aim to support improved policy-making and public engagement in solar energy adoption.

2. Scope of the Study

The study will focus on the Public Perception towards the adoption of Solar Energy System in Chennai, Tamil Nadu.

3. Objectives of the Study

3.1. To study the awareness about Solar energy system among the public in Chennai.
3.2. To find out the affordability of installing solar energy system among public.
3.3. To study the awareness of public towards Government policies on solar energy.

4. Limitation of the Study

4.1. Individual survey are not good at following trends in real time or over a short Period.
4.2. Individual surveys generally cannot provide strong evidence of cause and effect.
4.3. The lack of time to carry out a survey.
4.4. Due to cost concerns, the size of the sample for analysis is very limited.
4.5. Difficulty in collecting information from vulnerable groups, particularly with poor Access to technology and internet connections.

5. Hypothesis

5.1. Testing the relationship between Income of the households and affordability of installing Solar energy system.
5.2. Testing the relationship between Government policies on Solar energy system and adoption of solar energy system by the public.

6. Sample Design and Data Collection

This study used simple random sampling, a probability method where each individual in the population has an equal chance of being selected. The sample size was 100 respondents from Chennai City. Data was collected through primary sources like questionnaires and interviews, and secondary sources such as government publications, books, and industry reports. The questionnaire was designed to gather relevant, unbiased, and analyzable data in an engaging manner.

7. Tools of Analysis

7.1. Statistical tools: For the research study, the researcher used the chi-square test and correlation analysis.

7.2. Chi-square test: The χ^2 Test pronounced as (chi-square) is one of the simplest and most widely used nonparametric tests in statistical work. The symbol χ^2 is the Greek letter Chi. The χ^2 test was first used by Hard person in 1900. The quantity χ^2 describes the magnitude of the discrepancy between theory and observation.

It is defined as $\chi^2 = \Sigma\ (O - E)$

Where O refers to the observed frequencies and E refers to the expected frequencies. Steps: To determine the value of χ^2 the steps required are:

i. Calculate the expected frequencies. In general the expected frequency can be Calculated using the following equation.
E = Expected frequency
RT= the row total row containing the cell
CT = the column total for the containing the cell N = the total number of observations
ii. Take the difference between observed and expected frequencies and obtain the Square of these differences (i.e.), obtain the value of $(O - E)2$
iii. Divide the value of $(O - E)2$ Obtained in steps (ii) by the respected frequency and obtain the total E $(O - E)2$ This gives the values of χ^2 which can range from zero to Infinity. If zero it means that the observed and expected frequencies completely Coincide. The greater shall be the value χ^2
iv. The calculated value χ^2 Is compared with the table value of χ^2 for giving a degree of freedom at a certain specific level of significance. If at the stated level, the calculated value χ^2 Is more than the table value of χ^2 the difference between theory and observation is considered to be significant, i.e., it could not have arisen due to Fluctuations of simple sampling i.e., it is regarded as due to fluctuations of sample sampling and hence ignored.

1. Karl Pearson's Co-Efficient of Correlation

Karl Pearson, a great biometrician and statistician, suggested a mathematical method for Measuring the magnitude of linear relationship between two variables. It is denoted by the Symbol 'r', the formula for calculating personation r is:

$$r = \frac{\sum XY}{\sqrt{\sum X2}\ \sum Y2}$$

Thus, correlation is a statistical device which helps us in analyzing the co-variation of two More variables.
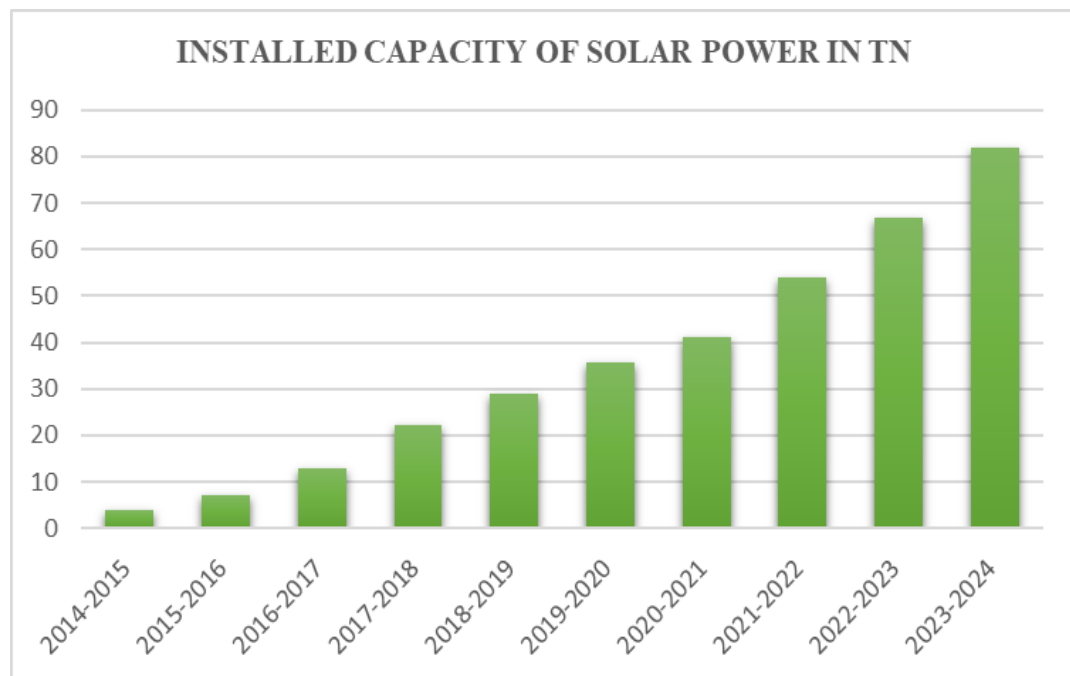
2. Solar Energy

Solar energy is the radiant light and heat from the Sun harnessed through technologies like solar power, solar thermal energy, and solar architecture, categorized as passive or active based on energy conversion methods. As a clean, renewable source, it emits no greenhouse gases and has been used since ancient times. Humans first used sunlight to light fires as early as the 7th century B.C., and by the 3rd century B.C., Greeks and Romans used mirrors to light ceremonial torches. In 1839, French physicist Edmond Becquerel discovered the photovoltaic effect, and in 1954, scientists at Bell Labs developed the first practical silicon PV cell. Today, solar energy powers everyday equipment and even satellites in space.

3. Installed Capacity of Solar Energy in Tamil Nadu

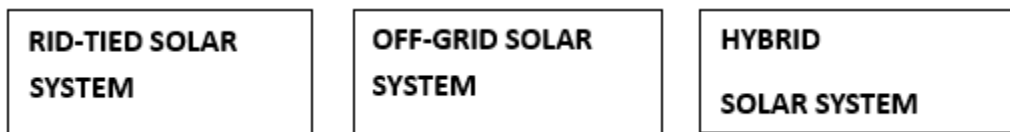| YEAR	Solar Power
2014-2015	**3.99**
2015-2016	**7.12**
2016-2017	**12.78**
2017-2018	**22.35**
2018-2019	**29.10**
2019-2020	**35.60**
2020-2021	**41.24**
2021-2022	**54.00**
2022-2023	**66.78**
2023-2024	**81.81**
Gr (2014-15 to 2023-2024)	**1950.38%**
CAGR (2014-15 to 2023- 2024)	**39.88%**

Source: MNRE (Gr-Growth %, CAGR- Compound Annual Growth Rate

Evaluating Solar Energy: Gains And Gaps

Solar energy offers numerous benefits, making it an attractive renewable energy source. It is clean and eco-friendly, producing no pollution, and relies on sunlight, which is free and abundant. It helps reduce electricity bills and dependence on the power grid, while also providing potential financial benefits through incentives like Solar Renewable Energy Credits (SRECs) and net metering. Additionally, solar installations can increase property value and require minimal maintenance, often lasting over 25 years. They are effective even in cold or snowy climates. However, solar energy also has some limitations. The initial installation cost can be high, and battery storage—necessary for nighttime or backup use—is often expensive. Not all roofs are suitable for panel installation due to their shape or orientation, and solar systems are weather- dependent, with reduced efficiency on cloudy or rainy days. They also require significant space for large panel setups, and while minimal, some pollution is generated during the manufacturing process.

Types of Solar Power Systems

RID-TIED SOLAR SYSTEM	OFF-GRID SOLAR SYSTEM	HYBRID SOLAR SYSTEM

Solar Schemes in India

India has implemented several comprehensive solar energy initiatives to accelerate renewable energy adoption and achieve its climate commitments. The Jawaharlal Nehru National Solar Mission (JNNSM), launched in 2010, serves as the flagship program targeting 100 GW of solar capacity by 2022. Complementing this, the government has introduced various targeted schemes including the Solar Energy Subsidy Scheme that provides financial incentives to promote solar installations, the Development of Solar Park Scheme focusing on large-scale solar infrastructure development, and the UDAY (Ujwal Discom Assurance Yojana) scheme that addresses power distribution challenges while promoting renewable energy integration. The Solar Energy Corporation of India (SECI) scheme facilitates competitive bidding and project implementation, while the Rooftop Solar Scheme specifically targets decentralized solar adoption in residential and commercial sectors. These interconnected policy frameworks demonstrate India's multi-pronged approach to solar energy deployment, combining large-scale infrastructure development with grassroots adoption strategies to establish the country as a global leader in solar energy transition.

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Analysis and Interpretation of Data

TEST-1: Karl Pearson's Coefficient of Correlation

Testing The Significant Relationship Between Income of Households and the Affordability of Installing Solar Energy System

INCOME OF THE HOUSEHOLDS		INSTALLING SOLAR ENERGY SYSTEM IS NOT AFFORDABLE	
VARIABLES	**NO. OF RESPONDENTS**	**VARIABLES**	**NO. OF RESPONDENTS**
BELOW ₹20,000	45	STRONGLY AGREE	59
₹21,000-₹30 000	45	AGREE	27
₹31,000-₹50 000	8	DISAGREE	9
₹51,000 and above	2	STRONGLY DISAGREE	5
TOTAL	100	TOTAL	100

x	$X = 25$ $X = x - X$	y	$Y = 25$ $Y = y - Y$	x2	y2	xy
45	20	6	-19	400	361	380
45	20	37	12	400	144	240
8	- 17	51	26	286	676	442
2	-23	6	-19	529	361	437
$\sum X = 100$		$\sum Y = 100$		$\sum X2$ $= 1,618$	$\sum Y2$ $= 1,542$	$\sum XY = 1,452$

$$\bar{X} = \frac{\sum X}{n} \qquad \bar{Y} = \frac{\sum Y}{n}$$

$$\bar{X} = \frac{100}{4} \qquad \bar{Y} = \frac{100}{4}$$

$$X = 25 \quad Y = 25$$

'n': Denotes number of items required.
Ho: There is no significant relationship between income of the households and affordability of installing solar energy system
Ha: There is significant relationship between income of the households and affordability of installing solar energy system
Ho: Denotes null Hypothesis, **Ha**: Denotes Alternative Hypothesis

Karl Pearson's Coefficient of Correlation

$$\sum X^2 = 1,618$$
$$\sum Y^2 = 1,542$$
$$\sum XY = 1,499$$

$$r = \frac{\sum XY}{\sqrt{\sum X2 \sum 2Y}}$$

$$r = \frac{1,499}{\sqrt{(1,618)(1,542)}}$$

$$r = \frac{1499}{\sqrt{2,494,956}}$$

$$r = \frac{1499}{\sqrt{1,579.5}}$$

$$r = 0.94$$

RESULT

The result shows that there is a relationship between X (income of the households) and Y (affordability of installing solar energy system) variables. Correlation analysis of variables signifies that there is a very high positive correlation between the two variables.

Inference: Hence, it was proved that there is a significant relationship between income of the households and affordability of installing solar energy system.

TEST II: Chi–Square Test Testing the Significant Relationship Between Government Policies on Solar Energy System and Adoption of Solar Energy Systems.

WILL YOU ADOPT SOLAR ENERGY SYSTEM	GOVERNMENT SCHEMES PROMOTING SOLAR ENERGY SYSTEM				
	WELL AWARE	AWARE	PARTIALLY UNAWARE	UNAWARE	TOTAL
YES	11	12	11	34	68
NO	7	5	5	15	32
TOTAL	18	17	16	49	100

Ho: There is no significant relationship between government policies on solar energy system and adoption of solar energy system by the consumers.

Ha: There is a significant relationship between government policies on solar energy system and adoption of solar energy

system.

E: Denotes expected frequency.

E = (Row total × Column total) / Grand total.

Ho: Denotes null hypothesis

Ha: Denotes alternative hypothesis

The symbol for chi – square and the formula v are as follows.

$X2 = \sum \frac{(O-E)2}{E}$

O: Denotes observed frequency.

O	E	$(O-E)$	$(O-E)2$	$(O-E)2/E$
11	12.24	-1.24	1.53	0.12
12	11.56	0.44	0.19	0.01
11	10.88	0.12	0.01	0.00
34	33.32	0.68	0.46	0.01
7	5.76	0.24	1.53	0.26
5	5.44	-0.44	0.19	0.03
5	5.12	-0.12	0.01	0.00
15	5.68	- 0.68	0.46	0.02
100				0.45

Calculated value of X2 = 0.45 Degree of freedom = (r-1) (c-1)

= (2 – 1) (4 – 1)

= (1) (3)

= 3

Value of 3 degree of freedom @ 5% level of significance = 7.81

- Ho = Accepted
- Ha = Rejected

3. Chi–Square Summary Results

X2 Caculted value	0.45
Degree of freedom	3
X2 Value @ 5 percent level of significance	7.81

RESULT

The calculated value (0.45) is lesser than the table value (7.81). Hence, Ha is rejected and Ho is accepted.

Inference

Since the calculated value (0.45) is lesser than the table value (7.81), the alternative hypothesis is rejected and the null hypothesis is accepted. So there is no significant relationship between government policies on solar energy system and adoption of solar energy system.

Findings of the Study

Based on the analysis conducted, several key findings have emerged from the study. A majority of 65% of the respondents fall within the age group of 18–28 years, and 57% are female. In terms of education, 48% of the respondents hold a Bachelor's degree, while 36% are employed. Income- wise, 45% of the respondents earn less than ₹20,000 or fall within the ₹21,000–₹30,000 range. A significant 65% of the participants are single. Regarding awareness, 73% are only partially aware of solar power generation technologies, and 52% have gained knowledge about solar energy systems through the internet. Renewable energy being environmentally friendly is a key encouraging factor for 37% of the respondents, while the high cost of installation discourages 45% of them. The electricity bill for 39% of the respondents is less than ₹1,000, and 34% expect a saving of 20%–30% on their electricity bills after adopting solar energy. Furthermore, 41% believe that solar panel companies are making efforts to promote their products, but 59% feel that installation costs are too high. An overwhelming 97% consider the shortfall in electricity a serious issue. However, 49% are unaware of government schemes supporting solar energy

adoption. A majority of 45% strongly agree that the government should offer tax benefits to users of solar energy products, while 35% strongly agree that the government should fund research related to solar products. Moreover, 54% strongly support more government initiatives to promote solar products, and 68% of the respondents expressed a willingness to adopt a solar energy system.

Findings of Statistical Analysis

The correlation analysis revealed a significant relationship between household income and the cost of installing a solar energy system, indicating that income levels influence the affordability and adoption of solar technology. However, the Chi-square test analysis showed no significant relationship between government policies on solar energy systems and their adoption, suggesting that existing policies may not effectively impact or encourage public adoption of solar energy.

CONCLUSION

This study examined the perception of public towards solar energy system. Even though many people knew about solar energy, majority of the respondents were not aware about how friendly it is to the environment. People are skeptical to adopt solar energy system because of high installation costs and space consuming nature. Therefore, in order to meet the customer need the business sectors should come with innovative yet cost-benefit and new techniques in the solar market as it not only attracts more number of customers and keeps the business intact, but also increases the consumers responsibility towards the environment and eco-friendliness for securing mother earth. From this study, it can be concluded that people are aware about solar energy but neglecting to adopt it because it is not pocket friendly and many other disadvantages. But slowly we can lead to a eco-friendly environment if business sectors and Government start to take initiatives to concentrate on Research, spreading awareness, innovation and subsidies.

Suggestion

To enhance the adoption and effectiveness of solar energy products, several suggestions can be considered. Firstly, the price of solar energy products should be reduced to make them affordable for people from low-income groups. Additionally, these products should be made available in smaller sizes, as the current systems require considerable space for setup. There is also a need to create awareness about the availability and benefits of solar energy, especially among people in rural areas and those with limited education, who may lack knowledge about its usage. Installation charges should be minimized to prevent additional financial burden on consumers. Free demonstrations and exhibition stalls can be organized to introduce solar energy products and boost their popularity in the market. Manufacturers should also diversify their product range by introducing solar-powered versions of commonly used electronics like televisions, mobile phones, and computers, in addition to water heaters, chargers, and inverters. Furthermore, solar energy products should be designed to function efficiently in all climatic conditions, and improvements must be made to enhance the power storage capacity of solar cells. The public should be informed about government subsidies available for purchasing solar devices, and the government should actively promote solar products by offering tax reductions and other incentives. Finally, technological advancements should aim to make solar energy products fully independent, eliminating reliance on traditional electricity sources to ensure complete self-sufficiency.

Summary

This study examined the perception of public towards solar energy system. The aim of this study is to determine the awareness about solar energy system among people and the attitude of people toward solar home system. The study also focuses on the factors that influence the decision for adopting and not adopting Solar energy over conventional electricity. This study suggested various factors like proper marketing, less installation charges, awareness created by the government etc., through which adoption of solar energy systems can be done by people at ease. The purposive sample technique was used to collect the data. Primary data consists of the response of individuals collected through questionnaires. The questionnaire contained twenty questions which were surveyed among 100 students and secondary data were collected from various published and unpublished sources such as the internet, journals, books and articles. Finally, data was analysed by framing the hypothesis, which are tested and proved by using statistical tools like correlation and Chi- square test. All the tables are analysed and depicted using a bar diagram and pie chart. The result showed that there is a significant relationship between income of the households and cost of installing solar energy system. The result shows that there is no significant relationship between government policies on solar energy system and adoption of solar energy system.

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