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RESEARCH ARTICLE

INVESTIGATING THE FACTORS IMPACTING THE ADOPTION OF SOLAR WATER HEATERS AMONG THE RESIDENTS OF COOPERATIVE HOUSING SOCIETIES- STUDY CONDUCTED IN CITIES OF INDIA

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Abstract

According to U. S. Energy Department, water heating accounts for about 18% to 25% of household energy consumption. World today faces energy security problems due to its demand and supply disruptions. Using solar energy for water heating becomes a good option. Solar energy is renewable, clean and green thus its usage helps in sustainable development. This research paper tries to identify the factors impacting the adoption of solar water heaters among the residents of Cooperative Housing Societies (CHSs) in six cities of India; these factors will help the manufacturers/suppliers of solar water heaters to frame marketing strategies for adoption and augmenting the sales of these products.

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Introduction:-

The current population of India exceeds 1.612 billion (Worldometer, Sept 2022). Managing the energy demand of such huge population is a herculean task. Not only India but, the entire world

today faces energy security problems due to shortage of conventional energy resources. It becomes essential to harness renewable energy options, India being a tropical nation has abundant sunlight making solar energy a great option. Using clean and green solar energy for water heating becomes a bright alternative. When it comes to domestic water heating, according to U. S. Energy Department (2016), water- heating accounts for about 18% of the entire household energy consumption. One can think of using solar energy for heating water. Solar Water Heaters (SWHs) are stand alone, off grid applications, these are sustainable technologies used to heat water in an eco-friendly manner. However, initial cost of installation for solar water heater (SWH) is high in comparison to conventional water heaters but when installed, one does not have to pay utility bills and the payback period is three to five years. Maximum use of solar water heaters can also bring down the load of grid power. It can help the usage of non conventional energy resource which is not only renewable but also green energy leading to sustainable development. The prominent conventional energy resources that are currently used are coal, petroleum and natural gas, but they lead in increase of green house gas emissions resulting in global warming and this is harmful to mankind. Therefore use of clean and green energy is an urgent necessity. Thus use of solar energy can definitely help in restricting and curbing this problem. Though Government of India is working towards using solar energy option for grid power, but solar off grid applications can also be used by individuals which can bring down the load of grid power. Solar water heater which is an off grid solar application can certainly help in reducing the burden of

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grid power. This paper tries to investigate and discover important factors affecting the use of solar water heaters among the residents of Cooperative Housing Societies (CHSs) residing in six cities of India. In this study, 'Co-operative Housing Societies are entities registered under the co-operative laws of the respective states; these are a collective body of persons, who stay in a residential society. As a collective body, they would be supplying certain services to its members, be it collecting statutory dues from its members and remitting to statutory authorities, maintenance of the building, security etc.' The significant factors identified in this study, will help the suppliers and manufacturers to identify marketing strategies for adoption and to augment the sale of solar water heaters to the residents of CHSs. It will also help the Government who is trying to enhance the use of renewable energy to reduce the load on grid power especially during peak hours.

Objectives of the Study:-

1. To identify the significant factors affecting the adoption of solar water heaters among the residents of Cooperative Housing Societies.
2. To recommend strategies for accelerating the consumer adoption of solar water heaters among the residents of Cooperative Housing Societies.

Review of Literature:-

Robinson (1962) states that, "utility is that value proposition in the goods that make consumers buy them, and the fact that consumers want to buy these goods shows that they have utility". 'Utility theory is derived from an economic concept measuring people's preferences or values over a good or service in numerically useful ways (Fishburn, 1968).' High utility of the products play a vital role in creating demand for the products. Thus demand for solar water heaters can be created if one is made to understand about its utility. The possible use of SWH was observed on several instances, especially in the context of developed countries. For example, Gadgil (2007) and Brown (2011) inveterate that SWH can be favorable for the global environment as it can reduce pressure on the national grid and mitigate environmental change. Milton & Kaufman (2005) suggested some policy recommendations for SWH as an effective tool for sustainable development. Saxena and Srivastava (2012) and Brown (2011) analyzed the implementation of the solar water heater from a global perspective.

Ramlow (2007) and Kalogirou (2004), showed a positive relation between SWH and environmental efficiency. Pandey, (2007) in the book titled, *Environmental Management* affirm in the chapter on Renewable Energy Resources, that energy potential of a nation has direct correlation with economic development and prosperity. The required transition is to shift from fossil and non – renewable sources such as petroleum, coal, and uranium to renewable energy sources. Thus solar energy will play a vital role in managing various energy related problems.

Lori and Aabakken, (2002), accentuate that greater emphasis must be laid on marketing of green energy – the act of selling energy produced wholly or in chunk from sources which are renewable in nature. In addition to it, they also affirm that customer awareness and forceful marketing, both are necessary to make these products recognized among people so that they are aware about the availability of such products. A number of marketing efforts or joint efforts- (i.e. organizations working to safeguard environment teaming with marketers) can bring about awareness in the market to a great extent.

Energy Saver, (2019) the U.S. Department of Energy (DOE) states that Rooftop solar water heaters require regular maintenance to function at peak efficiency. Solar energy systems require periodic checks and routine maintenance to keep them operating efficiently. Also, from time to time, components may need repair or replacement. One should also take steps to prevent scaling, corrosion, and freezing.

Uberoi, (2007) in his book on *Environmental Management* mentions that, Energy is an indispensable need for human existence. There is scarcity of energy due to fast exhaustion of fossil fuels and the increase in demand for energy is due to the increase in population and the growth of industry. The energy demands are escalating while traditional energy sources are diminishing at a much faster rate. The author further states that the Government at the centre and at the State level and their agencies should become proactive vis-à-vis environment. The environmental problems cannot be tackled without a sound proactive policy by the Government. Intervention of the Government is required on continuing basis and not on one-time legislation and its implementation. Consumer behavior can be regulated or altered through state policies.

Methodology:-

Literature review helped in gaining insights and ascertaining various factors, which could impact the usage of solar water heaters, these factors were considered as independent variables of study, they were Utility, High Cost, Availability of After Sales Service, Product Availability, Loan/Credit Facility, Government incentives and subsidies, Social and Environmental concerns related to sustainable development. Dependent variable being the response of users and non-users towards solar water heaters. Random sampling technique was used; primary data was collected through structured questionnaire which was administered across 284 respondents who were from CHSs. These respondents were from six cities of Southern and Western states of India which were Hyderabad, Bengaluru, Chennai, Mumbai, Jaipur, and Ahmadabad. Logistic Regression Method was used and through Likelihood ratio, Score and Wald test the significant factors influencing the use of solar water heaters were identified.

Data Analyses:-**Table No. 1:- Users & Non-Users of Solar Water Heaters.**

Cities	Respondents	Users	Non-Users
Ahmadabad	36	2	34
Bengaluru	40	9	31
Chennai	40	11	29
Hyderabad	32	5	27
Jaipur	25	1	24
Mumbai	62	11	51
Total	235	39	196

Table No. 2:- Coefficients for Co-Operative Housing Societies Using Solar Water Heaters.

Variable	DF	Estimate	SE	Wald's Test Statistic	p-value
Intercept	1	-12.7096	3.0840	16.9843	<.0001
1. UTILITY	1	2.7909	0.5904	22.3457	<.0001
2. HIGH COST	1	-0.3642	0.3061	1.4151	0.2342
3. AVAILABILITY OF AFTER SALES SERVICE	1	-0.4859	0.3977	1.4929	0.2218
4. PRODUCT AVAILABILITY	1	0.0308	0.2925	0.0111	0.9161
5. CREDIT LOAN FACILITY	1	1.3255	0.3564	13.8361	0.0002
6. GOVT SUBSIDY/INCENTIVES	1	0.1878	0.3548	0.2802	0.5966
7. SOCIAL & ENVIRONMENTAL CONCERN	1	-0.3390	0.3471	0.9541	0.3287

Out of 284 respondents, 235 responses were considered to be complete and were taken up for analyses. From Table No. 1 it can be seen that among 235 CHSs, there were 39 CHSs using solar water heaters. Chennai and Mumbai having maximum number of CHSs using solar water heaters i.e. 11 each followed by Bengaluru which had 9 users, Hyderabad having 5 users, Ahmadabad having 2 users and Jaipur having only one user. In all seven variables were tested, which were High Cost, Utility, Availability of After Sale Service, Loan/Credit Facility, Availability of Product, Government Incentives/Subsidy, Social and Environmental Concern. From the data analyses it was discovered that, in case of CHSs the significant factors affecting the use of solar water heaters were Utility and Credit/Loan facility.

Recommendations:-

From Table No. 2 one can figure out the significant factors impacting the usage of solar water heaters which were Utility of solar water heaters and Loan/Credit facility as their p-value was below 0.05. Thus the following suggestions were recommended:

Since Utility emerged as significant factor, more and more prospects should be made aware about the utility of solar water heaters. Once they are convinced that solar water heaters have good utility it will make them buy the product. Manufacturers and suppliers of solar water heaters should try to carry out promotional activities that highlight the utility of these products. Social media marketing done through Emails, Facebook, Instagram, Snapchat, and Pinterest

will help them to reach out to a large audience. BTL (Below the Line) communication strategies need to be adopted since huge promotional expenses may further add to the cost of solar water heaters therefore ATL (Above the Line) communication techniques should be avoided.

Loan /Credit facility will definitely induce more and more people to buy solar water heaters as it has turned out to be significant factor impacting the use of solar water heaters. Thus manufacturers and suppliers should tie up with Commercial banks/financial institutions to provide this facility. Personal selling can be effective in making people aware about the availability of loan /credit facility.

Limitations:-

This study is restricted to six cities of India, which are located in the Southern zone and Western zone of India as these zones receive maximum sunlight. This paper studies the influence of seven factors impacting the use of solar water heaters, which are Utility, High Cost, Availability of After Sales Service, Product Availability, Loan/Credit Facility, Government incentives and subsidies, Social and Environmental concerns, these factors were derived from literature review, there could be other factors influencing the use of solar water heaters which are not considered in this study. Solar water heaters can be used by institutional buyers, such as hotels, educational institutions, recreational centres, places of worship, large, medium and small scale industries etc. but residents of CHSs are only are considered in this study.

Conclusion:-

Significant factors impacting the adoption of solar water heaters among residents of CHSs will help the manufacturers and suppliers of SWHs to frame marketing strategies for adoption process and for augmenting its sales. Manufacturers and suppliers should very well study the consumer behavior, select the appropriate market segment which can be targeted effectively and position solar water heaters in a manner which highlights its utility and also stresses on the fact that though the initial cost of solar water heater is high but in long run they are cost effective, they should also make them aware about the availability of loan facility if required to buy the products. After learning the significant factors impacting the use of solar water heaters strategies discussed above can definitely facilitate the manufacturers and suppliers of solar water heaters to market these products in a manner which will positively increase its use and help in sustainable development.

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