Sustainable Energy And Social Engagement: An Analytical Study on Evaluating Surya Ghar Implementation in Rural Coimbatore

Dr. M.S. Ranjithkumar[1], Srivarsun.S[2]
[1] Professor and Head, Department of Commerce with Business Analytics, Dr. N.G.P. Arts and Science College, Coimbatore, Tamil Nadu, India
[2] B.com (Business Analytics), Dr. N.G.P. Arts and Science College, Coimbatore, Tamil Nadu, India

Abstract

This study explores the intersection of sustainable energy adoption and social engagement through an analytical evaluation of the Surya Ghar scheme in rural Coimbatore. The Surya Ghar initiative, launched to promote rooftop solar installations, aims to reduce dependence on conventional energy sources while fostering community participation in renewable energy transitions. Using a mixed-methods approach, the research investigates levels of public awareness, socio-economic factors influencing adoption, and the role of government incentives in shaping rural energy practices. Findings highlight both opportunities and challenges: while awareness campaigns have improved knowledge of solar energy benefits, barriers such as upfront costs, technical expertise, and cultural perceptions continue to affect adoption rates. The study underscores the importance of integrating social engagement strategies with policy frameworks to ensure equitable and sustainable energy transitions in rural communities.

Keywords: Renewable Energy, Solar Energy Adoption, Public Awareness, Sustainable Development, Rural Energy Access, Surya Ghar Initiative

1. Introduction

Switching to green power isn't just about new gadgets - it pulls people into change too. India's Surya Ghar plan opens doors for homes to grab sunlight through rooftop panels. In places such as Coimbatore, life off the grid dances with income levels and local beliefs. Though cleaner watts may come from this push, knowing how it works matters most. People showing up makes all the difference when light replaces smoke. This work looks at what people in Coimbatore's countryside think about the Surya Ghar program, seeing when they sign up. It checks how government plans meet real life conditions in villages through everyday involvement. Instead of just numbers, it watches who knows about the plan and who ends up using it. The goal is clarity - how clean power efforts fit rural needs across India.

In Coimbatore, farming matters just as much as factories, yet lately people have started paying closer attention to clean power options. Still, how well programs like Surya Ghar work often comes down to whether folks know about them, can easily learn more, and feel ready to try something different at home. Looking into villages across the area reveals a clearer picture of who knows what about the initiative. Because understanding shapes choices, digging into why some embrace solar while others hesitate becomes useful. What spreads knowledge best - word of mouth, local meetings, or printed material - also forms part of this look behind the scenes.

2. Literature review

2.1. Renewable Energy Adoption

One reason people pick renewable energy at home ties back to money matters, plus what they value socially. Balcombe, Rigby, and Azapagic looked into small-scale power systems in 2014, showing cash perks matter - so does caring about nature. What stands out? Long-term savings nudge choices forward. Yet confusion around how things work holds some folks back. Upfront price tags scare many away, particularly where resources are thin.

When it comes to green tech, clear info makes a difference. Rai and Robinson showed this back in 2013. Messages matter, especially if people trust where they come from. Confusion drops when facts are straightforward. Because of that, new systems feel less risky. Think solar panels or heat pumps - people warm up to them faster. Reliable details shared right

help shift hesitation into action. Households act differently once doubt fades. A neighbor's tip may work better than an ad. Information flows shape choices more than assumed. So does timing. Success often hides in how things are said.

2.2. Public awareness and how people accept renewable energy

It begins with people knowing something exists. Rogers pointed out back in 2003 how learning about new tech kicks off the whole journey - only then does attention grow. After that comes testing it, thinking it over, maybe even deciding to stick with it. Word spreads through conversations, networks, shared experiences. What users believe they gain matters more than assumed. Acceptance builds not just from facts but who shares them and how.

Painuly's 2001 work laid out a model showing what holds back renewable energy spread. Information shortages? They matter. So does low public understanding - both drag progress down. When people learn more, things shift. Education efforts help. Government messaging helps too. Local involvement nudges change along. Together, these steps speed up how fast developing nations adopt clean power.

2.3. Social and Economic Conditions Shaping Use of Renewable Energy

Starting off, how much money a family makes often shapes whether they go for renewable power at home. Education matters too - knowing about long-term gains can tip the scale. A look into solar panel use across poorer nations showed trust in the system plays a big role. Back in 2014, Islam built a model focusing on homes trying new tech and saw clear patterns. People earning more usually take up solar faster than those struggling to get by. Access to loans opens doors that stay shut otherwise. Believing the gear will work without fail? That belief spreads quicker among certain groups. Those who know what lies ahead financially tend to act sooner.

Zhang, Wang, and Zhou looked at how homes in Chinese cities start using solar power - back in 2012. Their work showed things like subsidies, how much electricity costs, and what neighbors think matter a lot. Money help from the state appears to push people toward clean energy faster than expected. When rules support it, while local efforts spread knowledge, more households begin choosing solar. This mix seems strongest where infrastructure is still growing, not just in big metropolises.

2.4. Information Sharing and Energy Learning Shape Public Understanding

How people see renewable energy usually depends on how easily they can get information - through schools, news, or official messages. According to Bhattacharyya (2012), efforts to bring power to underserved areas do more than just deliver electricity; they also teach communities about cleaner energy choices. When these educational drives team up with projects aimed at lifting villages, locals start understanding new technologies better, along with smarter ways to use energy.

Looking at energy poverty through a geographic lens, Sovacool and Ryan in 2016 pointed out how missing data and scarce chances to learn about energy dull understanding of renewables. Because people often do not get clear explanations, grasping new systems becomes harder - especially where resources run low. Instead of broad messages, efforts that speak directly to local needs tend to stick better with residents. Since trust grows person to person, neighbors sharing ideas or respected figures discussing change can shift attitudes more than distant ads. When conversations happen within familiar circles, trying something unfamiliar feels less risky.

3. Problem Statement

Lately, using clean power has grown more common in plans for lasting growth. The Indian government launched programs like the Pradhan Mantri Surya Ghar Muft Bijli Yojana to encourage homes to install rooftop solar panels, offering help through grants, funding aid, and guidance along the way. Yet many villages still stay far from taking part. A big reason? People often do not know what the program offers, how it works, or how much money they might save over time. Places such as rural Coimbatore face extra hurdles: poor outreach, missing practical skills, little contact with green tools. Even when messages are shared, it is uncertain if people really act on them inside their own homes. So this work looks at how knowing about the plan connects to actually joining it there, hoping findings will shape better ways forward for officials helping communities shift toward cleaner electricity up close.

4. Objectives of the study

- To examine the influence of socio-demographic factors (e.g., income, education, roof type) on the decision to adopt the solar system.

- To evaluate the existing levels of awareness and understanding of the scheme's benefits and application process among the target population.

5. Research methodology

Into the heart of Coimbatore's countryside, a close look unfolds through surveys tracking how rural homes see and take up the Surya Ghar push. Spread over five months, from late autumn into early spring, field interviews reached 120 villagers picked at random - each voice adding texture to the bigger picture. Instead of broad guesses, numbers speak plainly here; percentages shape meaning, charts hold answers, each table built line by line from real replies. Knowledge about rooftop solar doesn't arrive all at once - it filters through age, income level, schooling, even which village someone calls home. Official records, past studies, policy files, printed sources - they form a quiet backdrop behind every personal answer gathered door to door. What people know ties tightly to whether they act - awareness isn't just hearing a name, it's understanding what installing panels might actually mean. Some hear slogans but miss details, others grasp savings yet hesitate without trust in support structures. Information gaps show clearly - not because data is missing, but because reach falls short in uneven ways. Seeing who says yes, who stays unsure, reveals more than approval rates ever could alone. Behind every checkbox marked lies a story shaped by light, doubt, hope, and sometimes just routine disbelief in big promises. Decisions grow slowly there, rooted less in factsheets and more in lived experience shared neighbor to neighbor. So while forms collect answers fast, truth moves slower - shaped by talk under shade trees, not only print on paper. This way of digging deep avoids sweeping claims, instead letting small moments build toward clarity. No grand announcements needed - the findings stand where reality lives, spoken one reply at a time.

5. Analysis and intepretation

Chi-Square Analysis between Socio – Demographic Factors and Levels of Adoption

Socio – Demographic Factors	Values	Levels of Adoption		Total	Chi-Square Test
		Low	High		
Age	Below 25 years	0 (0.0%)	1 (100.0%)	1 (100%)	X^2 = 2.406 DF = 3 Sig. = 0.493
	25–35 years	4 (8.3%)	44 (91.7%)	48 (100%)	
	36–50 years	2 (4.0%)	48 (96.0%)	50 (100%)	
	Above 50 years	3 (14.3%)	18 (85.7%)	21 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Gender	Male	3 (7.1%)	39 (92.9%)	42 (100%)	X^2 = 0.012 DF = 1 Sig. = 0.913
	Female	6 (7.7%)	72 (92.3%)	78 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Educational Qualification	No formal education	3 (9.4%)	29 (90.6%)	32 (100%)	X^2 = 1.652 DF = 4 Sig. = 0.799
	School	3 (5.3%)	54 (94.7%)	57 (100%)	
	UG	1 (5.9%)	16 (94.1%)	17 (100%)	
	PG	1 (12.5%)	7 (87.5%)	8 (100%)	
	Others	1 (16.7%)	5 (83.3%)	6 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	

Occupation	Farmers	4 (13.8%)	25 (86.2%)	29 (100%)	X^2 = 3.973 DF = 4 Sig. = 0.410
	Daily wage worker	3 (5.5%)	52 (94.5%)	55 (100%)	
	Business	0 (0.0%)	18 (100.0%)	18 (100%)	
	Govt. employee	0 (0.0%)	1 (100.0%)	1 (100%)	
	Others	2 (11.8%)	15 (88.2%)	17 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Family Size	1–3 members	5 (11.1%)	40 (88.9%)	45 (100%)	X^2 = 2.859 DF = 2 Sig. = 0.239
	4–5 members	2 (3.4%)	57 (96.6%)	59 (100%)	
	More than 5	2 (12.5%)	14 (87.5%)	16 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Monthly Income	Below 10,000	1 (12.5%)	7 (87.5%)	8 (100%)	X^2 = 0.357 DF = 3 Sig. = 0.949
	10,000–20,000	3 (6.5%)	43 (93.5%)	46 (100%)	
	20,001–30,000	4 (7.7%)	48 (92.3%)	52 (100%)	
	30,001–50,000	1 (7.1%)	13 (92.9%)	14 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Type of House	Own	7 (7.0%)	93 (93.0%)	100 (100%)	X^2 = 0.216 DF = 1 Sig. = 0.642
	Rented	2 (10.0%)	18 (90.0%)	20 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Type of Roof	Concrete	7 (7.1%)	92 (92.9%)	99 (100%)	X^2 = 0.150 DF = 1 Sig. = 0.698
	Asbestos Sheet	2 (9.5%)	19 (90.5%)	21 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Monthly Electricity Consumption	101–200 units	1 (100.0%)	0 (0.0%)	1 (100%)	X^2 = 15.643 DF = 3 Sig. = 0.001
	201–300 units	3 (8.3%)	33 (91.7%)	36 (100%)	
	301–500 units	5 (10.2%)	44 (89.8%)	49 (100%)	
	Above 500 units	0 (0.0%)	34 (100.0%)	34 (100%)	
	Total	9 (7.5%)	111 (92.5%)	120 (100%)	
Monthly Electricity Bill	1,001–2,000	1 (33.3%)	2 (66.7%)	3 (100%)	X^2 = 5.554 DF = 3 Sig. = 0.135
	2,001–3,000	1 (2.4%)	40 (97.6%)	41 (100%)	

	3,001–5,000	5 (11.6%)	38 (88.4%)	43 (100%)
	Above 5,000	2 (6.1%)	31 (93.9%)	33 (100%)
	Total	9 (7.5%)	111 (92.5%)	120 (100%)

The table presents the relationship between socio-demographic factors and levels of satisfaction among respondents. Out of 120 respondents, a majority of 111 respondents (92.5%) fall under the high satisfaction category, while only 9 respondents (7.5%) fall under the low satisfaction category. This indicates that overall satisfaction levels among respondents are considerably high.

With respect to age, the majority of respondents across all age groups show high satisfaction levels. However, the chi-square test result (X^2 = 2.406, p = 0.493) indicates that there is no significant association between age and satisfaction level. Similarly, gender does not show any significant relationship with satisfaction (X^2 = 0.012, p = 0.913), as both male and female respondents show similar satisfaction patterns. Educational qualification and occupation also do not show statistically significant relationships with satisfaction levels, as their p-values are greater than 0.05. This suggests that satisfaction towards the scheme is not strongly influenced by education or occupational background.

Family size, monthly income, type of house, and type of roof also do not show significant associations with satisfaction levels, indicating that housing and economic conditions do not significantly affect satisfaction. However, monthly electricity consumption shows a statistically significant association with satisfaction (X^2 = 15.643, p = 0.001), suggesting that electricity usage level plays an important role in influencing satisfaction. Respondents with higher electricity consumption tend to show higher satisfaction levels, possibly due to greater benefits from the scheme. On the other hand, monthly electricity bill does not show a statistically significant association with satisfaction (X^2 = 5.554, p = 0.135).

Overall, the findings indicate that most socio-demographic factors do not significantly influence satisfaction levels, while electricity consumption level has a significant impact.

6. ANOVA Analysis between Socio-Demographic Factors and Awareness of Surya Ghar Initiative

ANOVA						
Socio-Demographic Factors and Source of Variation		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	4.146	13	.319	.547	.890
	Within Groups	61.846	106	.583		
	Total	65.992	119			
Gender	Between Groups	2.294	13	.176	.748	.712
	Within Groups	25.006	106	.236		
	Total	27.300	119			
Educational Qualification	Between Groups	15.277	13	1.175	1.067	.395
	Within Groups	116.715	106	1.101		
	Total	131.992	119			
Occupation	Between Groups	38.328	13	2.948	2.070	.022
	Within Groups	150.972	106	1.424		
	Total	189.300	119			
Family Size	Between Groups	7.112	13	.547	1.237	.264
	Within Groups	46.880	106	.442		
	Total	53.992	119			
Monthly Income	Between Groups	9.342	13	.719	1.200	.289
	Within Groups	63.458	106	.599		
	Total	72.800	119			
Type of house	Between Groups	1.151	13	.089	.605	.846
	Within Groups	15.516	106	.146		
	Total	16.667	119			
Type of roof	Between Groups	2.163	13	.166	1.164	.316
	Within Groups	15.162	106	.143		

	Total	17.325	119			
Monthly Electricity Consumption	Between Groups	4.706	13	.362	.555	.884
	Within Groups	69.161	106	.652		
	Total	73.867	119			
Monthly Bill	Between Groups	18.198	13	1.400	2.242	.012
	Within Groups	66.169	106	.624		
	Total	84.367	119			

The ANOVA analysis was conducted to examine whether there is a significant difference in awareness levels of the Surya Ghar Initiative among respondents based on their socio-demographic characteristics. The results show that most socio-demographic variables do not have a statistically significant influence on awareness levels, as their p-values are greater than the standard significance level of 0.05. Age (p = 0.890), gender (p = 0.712), educational qualification (p = 0.395), family size (p = 0.264), monthly income (p = 0.289), type of house (p = 0.846), type of roof (p = 0.316), and monthly electricity consumption (p = 0.884) do not show significant differences in awareness levels among respondents. This indicates that awareness about the Surya Ghar Initiative is relatively similar across different demographic and socio-economic groups.

Overall, the ANOVA results indicate that while most socio-demographic characteristics do not significantly affect awareness levels, economic and usage-related factors such as occupation and electricity expenditure play a significant role in influencing awareness of the Surya Ghar Initiative among rural households.

7. Major findings

Out of every ten families questioned, nine point three showed strong interest in the Surya Ghar program. Though age or how much schooling someone had didn't really shift choices, power bills did play a role. Homes using more electricity tended to sign up more often - likely because they stand to gain more. Whether people lived in small huts or bigger homes made little difference in who joined. Even income or roof shape barely changed the pattern. Still, those paying higher monthly charges leaned heavily toward installation. From town to village, knowing about the project stayed roughly the same for most. Gender hardly swayed decisions at all. What stands out is that even with varied backgrounds, nearly everyone seemed aware - and many took part. High use of current links clearly to willingness to switch. Despite differences in household size, uptake remained steady across regions. Working people know more about the program. Those who pay bigger power bills usually understand it better too. Still, income and energy costs matter most when it comes to knowing what's going on. Even so, age or gender don't weigh as heavily in practice. What you earn and how much electricity you use shapes understanding far more.

8. Suggestions

Villages might respond better when outreach happens close to home - gatherings in town squares, radio spots on regional stations, workshops run by neighborhood leaders. Households using a fair amount of power tend to show stronger interest in rooftop panels, making them natural candidates for tailored messaging. Picture farmers hearing about incentives during crop meetings, or shop owners learning details through trade circles. Clarity wins trust: break down the financial perks, trim the paperwork talk into plain terms, spell out how bills shrink over time. What sticks is what people grasp without rereading. One way to help communities use solar power is by offering clear advice and hands-on help from town officials and power providers. Village rooftops showing working solar setups give neighbors a real look at how it runs. Seeing sunlight turn into electricity where they live makes families more likely to try it themselves.

9. Conclusion

Few people expected such strong turnout, yet homes in Coimbatore's countryside are signing up fast for the Surya Ghar program. Even so, who you are - age, income, education - doesn't seem to change whether you know about it or join. That pattern hints at broad appeal, reaching villagers without favoring one group. Because of this spread, support looks steady no matter background. What stands out isn't enthusiasm alone - it's how evenly shared that interest appears.

Still, things like job type, how much power people use, and what they spend on bills shape how much they notice or choose clean energy. Households facing bigger electric loads and heavier costs tend to pay closer attention and take up solar options more often. Because of this reality, clearer outreach, easier access to details, and help tuned to local needs

could lift participation steadily. In the end, when paired with smart communication and solid follow-through, the Surya Ghar plan stands a real chance at boosting green habits and steadier power access in country homes.

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