Measuring the Holistic Impact of Solar Home Systems (SHS) on Remote Tamil Nadu Villages: Economic, Social, and Environmental Perspectives

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Abstract

Problem: The study focuses on using SHS as a practical and eco-friendly solution for providing electricity to remote rural areas in developing nations like India. Due to the inaccessibility of electricity and impracticality of extending the national grid, SHS emerges as a low-cost alternative. The objectives of the study were to understand the socio-economic conditions of SHS users and assess the benefits of SHS in different perspectives. **Approach:** This study is based on primary data. A well-structured interview schedule was used to collect the data from sample respondents and few identified variables were set as to evaluate the benefits of SHS namely economic, social and environmentally. The study adopted the simple random technique for the selection of 300 sample respondents from among SHS users. The collected data were processed and analysed to test hypothesis using SPSS (Statistical Packages for Social Sciences), Statistical tools such as Reliability, Correlation and Regression. **Findings:** The findings highlight the advantages experienced by SHS users across economic, social, and environmental domains. Economically, SHS contributes to income generation within households. Socially, it fosters community engagement by supporting activities such as village festivals, temple processions, and local traditional events. Environmentally, SHS stands out as an eco-friendly system, offering sustainable electricity without causing harm to the environment. **Conclusion:** The study concludes that use of SHS lead to reduction of social, environmental and health cost of the rural community. The installation of SHS in a rural area is to improve the quality of life. SHS helps to achieve the sustainable development goals. It is suitable to the remote rural areas and will solve the electricity accessibility problems of remote areas.

Keywords: Economic, Electricity, Environmental, Social, Solar Home System, Rural Electrification.

1.0 Introduction

Access to electricity is crucial to the development of rural areas which is obviously raise the well-being of the people through providing a wide range of opportunities such as creation of new small businesses and jobs, agricultural and other productive activities, household income, accessing TV, radio, cell phone, Internet, etc thereby their livings conditions are socially, economically, and environmentally improved (Kabir et al, 2017 & Imai and Palit,2013). However, getting access to electricity is still a very difficult undertaking in the majority of developing nations, including India, because all the unconnected villages and hamlets are situated in inaccessible and mountainous areas. Because it would be expensive and harmful to the environment to establish changes, transforms, polls, etc. in these places, the national grid extension is not feasible. While, these remote areas are abundant availability of renewable energy

resources such as wind, solar, small hydro, biomass etc (Chauhan and Saini, 2015). Khan (2020)point out that disseminated renewable energy generation is an effective approach to ensuring access to electricity for remote areas especially where couldn't possible to extend the conventional grid. Among the renewable energy technologies, off-grid solar photovoltaic (PV), like Solar Home Systems (SHS) is becoming more popular in the developing countries in the world.

Over the past few decades, there has been a notable surge in enthusiasm and investment towards off-grid renewable energy sources. This surge aims to ensure that by 2030, everyone has access to affordable, dependable, and modern energy services. Solar power, particularly in the form of SHS and solar lanterns, has experienced remarkable growth globally. Residential electricity capacity from these sources has quadrupled between 2017 and 2021. SHS and solar lanterns serve either as primary or supplementary energy sources, catering to residential energy requirements in regions abundant in sunlight. The off-grid solar sector is estimated to cater to approximately 420 million users across energy-deficient South Asian and African countries. Moreover, it is projected to provide basic electricity access to an additional 388 million individuals by 2030 (Akter and Bagchi, 2021).

Across the world, largest SHS electricity access was found in the South Asia, in whichBangladesh, India, Nepal, Sri Lanka, Pakistan these are frontrunner countries for using the SHS for the electrification of their remote and where fail to extension the national grid. Ojong, N. (2021) study indicates that India's SHS market will grow from 18 per cent in 2018 to 42 per cent by 2023.As of December 2022 in India, the total number of installed SHS was 17,23,479. In which, the following states of Tamil Nadu, Uttar Pradesh, Rajasthan, West Bengal and Jammu Kashmir which are accounted for 298641, 235909,187968, 145332 and 144316 respectively. These states are the highest SHS installation states as compares to other states in India. (Annual Report,2022-23).

SHS provides low-cost solution to the electricity access in the remote rural areas and eco-friendly system. Many studies indicates that SHS is best method for electrification because which requires low amount of capital cost, eco-friendly and free from greenhouse gas, easy to install and maintenance, ensure to reliability and productivity benefits (Khan, 2020).Moreover, SHS is worldwide recognised, suitable, and sustainable development-based method because of its efficient technique for delivering basic access to electricity in many underdeveloped countries including India. It can be seen through various studies. In general, SHS's beneficial classified in two dimensions namely reducing energy expenditures and satisfying energy necessities (Baker and Khan, 2023).

Majority of the studies indicates that SHS provides large number of benefits to the SHSs users but this study is to evaluate the SHS's benefits in terms of economic, social and environmental in the selected remote villages of Tamil Nadu.

2.0 Objectives

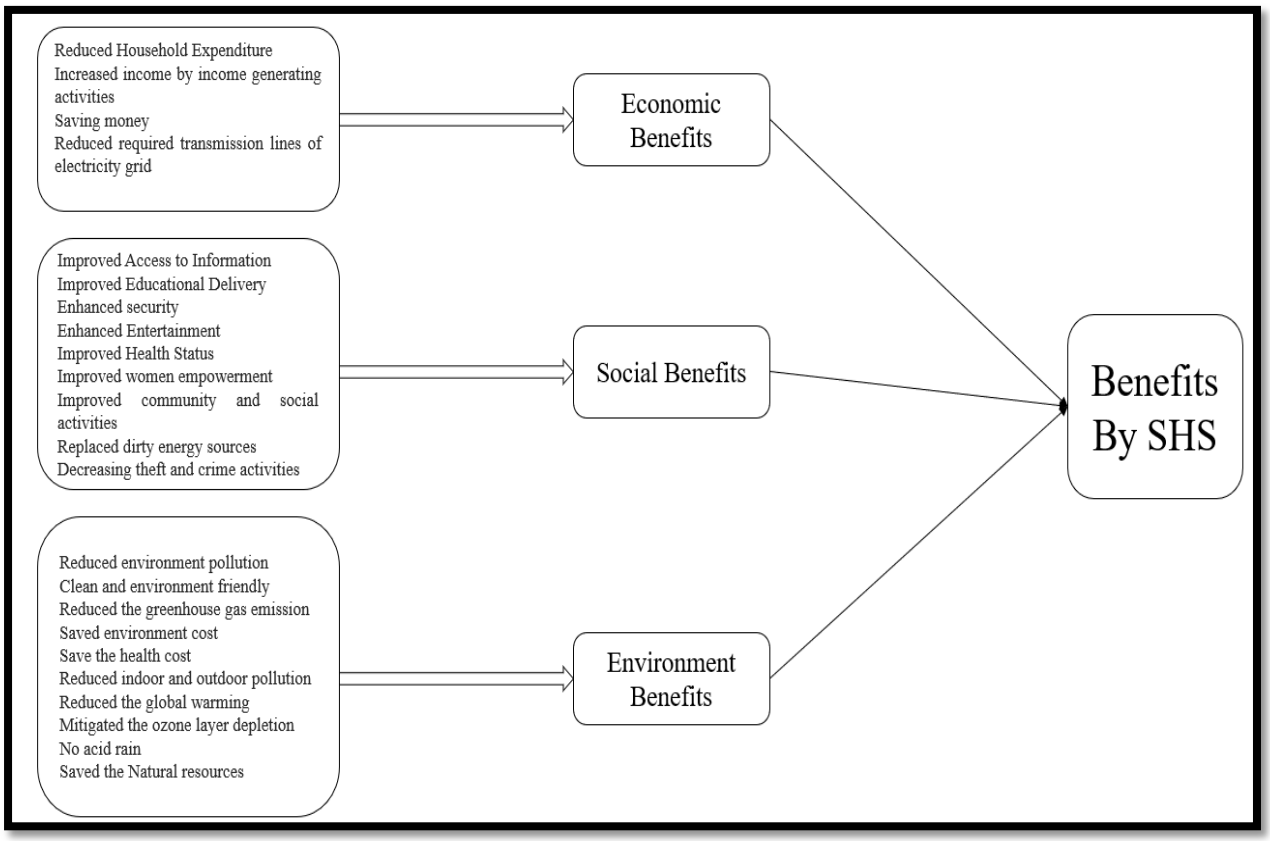
The objectives of the study are followed by

1. To understanding the socio-economic conditions of the SHS stakeholders in the study area.
2. To examine the SHS's benefits, encompassing economic, social, and environmental aspects, associated with the utilization of Solar Home Systems (SHS) during the study period.

3.0 Conceptual frame work

The present study has framed the conceptual framework to assess the benefits of SHS. SHS is not only provides lighting benefit apart from this which also delivers more benefits to the shareholders. Thus, this study proposed to investigate SHS's benefits in broadly that is economic, social and environmental benefits.

Fig.3.1
Conceptual framework



Source: Compiled by author

4. 0 Social Benefits by SHS

SHS provides more benefits apart from the lighting, such as the use of radio, TV, communication equipment, fans, water pumps etc. About 50 per cent of the SHS households felt happy about the benefits to the children and 43 per cent are satisfied with the provision of entertainment. One third of the respondents reported that they could read and study at night after the installation of SHS. Two thirds of the stakeholders assert that SHS has changed their daily activities (Gustavsson and Ellegad, 2004)such aseducation, communication, information, health and community activities. Out of these, few benefits were extended to neighbouring households like increased information facilities through watching TV (Blunck, 2007). Buragohain (2012) discusses the solar home lighting system in the remote villages of six states, namely Assam, Meghalaya, Jharkhand, Odisha, Madhya Pradesh, and Chattisgarh in India and observes that after the installation of solar home lighting system, nearly 53 to 69 per cent of people made a positive report of improvement of their children's education, and 37 to 78 per cent about better standard of living as results of installation of SHS. While there was an increase in the time spending on income generating activities there was significantly decline in crime rate, because of solar street lighting system in the villages.

After the installation of SHS, people are free to plan their work and spend more time at night without any expenses. Besides, sleeping time in post installation period was significantly reduced compared to pre installation period. Accesses to electricity by SHS, enables the stakeholders to get

information on the happenings across the world. Respondents learnt several new ideas, such as life styles, cultures, languages and others (Pramanik, 2012).The literacy rate was increased due to SHS by 38-39 per cent compared to non-SHS villages. In addition, eye irritation, cough and bronchial diseases were rampant in un-electrified villages whereas the SHS electrified villages were absolutely from these diseases. At the same time, SHS is only used for entertainment like watching TV and to upscale the social status **(**Rahman and Ahma's,2013). SHS increased the people's quality of life, ability to generate income, get better education to children and decreased the health hazards and also the risk of fire by kerosene use. Murali etal., (2015) study highlights that SHS is a possible solution to the rural remote electrification which paves the way for additional benefits like easy to access lighting for children's study and for other purposes like cooking and it reduces environment pollution. SHS enhanced socio-economic conditions and quality of life of the households, especially women. Besides, it improved environmental standard by reducing internal pollution formerly caused by the use of traditional sources of energy such as kerosene. SHS significantly increased safety and security particularly from snakes and other poisonous insects. But the beneficiaries of the SHSs complained that there was no proper demonstration on the use of SHS by the supplying agency. In many cases, wrong handling of the system, particularly by children has caused its malfunctioning (Mishra and Behera, 2016).

Bezerraet al., (2016) study observed that the electrification was a positive influence on all dimensions of the Human Development Index, of which education factor has strongest effect and that access to electricity is the prerequisite for the improvement of standard of life. Stojanovski etal., (2017) study revealed that there was a significant reduction in the kerosene consumption after that installation of SHS which was accounted to 58 per cent and 36 per cent in Uganda and Kenya respectively. It indicates that 90 per cent of the SHS users used SHS for domestic purposes as a result of which their lifestyle was enhanced comfortably but it did not provide the opportunity to improve the family's income. It shows that small disposable batteries were declined. SHS was not used to radios and TV in most parts.

5.0 Economic Benefits of SHS

SHS raises the income-generating activities by extension of working hours. In petty shops, tailor shops, grocery shops, tea stalls and small enterprises, their closing time is changed due to adoption of SHS. Especially, women are getting more time to be engaged in income generating activities by reducing the time spent on household chores. It creates and sustains saving habit by reducing household expenditures. It reduces the fuel and health cost, fire accident and fauna attacking. Snigdha and Chakrabarti (2002) state that supply of power from solar Photovoltaic power plants within four years, remarkably increased trade and commerce, entertainment, health etc. They assert that productivity level of some agricultural activities and women's participation in different economic activities (at night) other than household work was shown definite better signs than the other conventional systems on consideration of environmental effects. Ahammed and Taufiq (2008) observed that SHS increased their income by increasing working hours and suitable environment for business. Around 90 per cent of the stakeholders were satisfied with the performance of the solar powered technology. Khan and Mahmud Khan's (2009) study revealed that the SHS was helpful in income generating activities and for better educational accomplishment of household members. There was both short term and long-term impacts on economic growth and diversification of rural economy.

Halder and Parvez (2015)investigated the impacts of SHS on social life of rural people and found that the economic analysis of 20, 40, and 42 Wp SHS shows high economic benefits. The SHSs for small income generation are more welcome than SHSs used only for lighting purpose. Moreover, the quality of light provides better opportunity for household work and increases children's study period in the night, hence leads to improve the quality of lifestyle in rural areas. According to Azimoh etal., (2015) the illumination provided by SHS electricity made profound impact on the sustenance of rural households. SHS enhanced the productivity of small entrepreneurs who utilize the light from SHS to do business at night.Kurata etal., (2018)explored the determinants of SHS adoption with due focus on households and micro enterprises.Households preferred higher generation capacities of SHSfor several purposes like

lighting, watching TV, reading and writing etc micro enterprise only preferred lower generation capacities because of utilizing lighting at night.

6.0 Environmental Benefits of SHS

SHS offer several environmental benefits, making them a sustainable and eco-friendly choice for generating electricity. Posorski etal., (2003) analyzed the spreading of SHS in off grid areas in developing countries and find that it improves the living conditions of the people in a cost–effective manner. SHS was deployed efficiently with low cost to replacement of fuels and also reduce the GHG emissions effectively. Mahapatra et al., (2009) observed that provision of the efficient electric lighting has enhanced the quality of lighting, reduced consumption of energy and also decreased the CO_2 emissions. The decentralized solar Photovoltaic and bio-energy systems offer quality lightning as different from kerosene-based lighting system in remote village areas where the grid electricity is not connected. Chaurey and Kandpal (2009) revealed that 3.63 lakhs SHS were disseminated across the country until 2007. It shows 50Wp of SHS can save 9 tonnes of CO_2 emission in 20 years. India gave up the use of kerosene, candles and battery charging for lighting purposes and used the 20-53Wp size of SHS module which reduced 373 Kg CO_2 emission in a year.

Akella et al., (2009) highlights India's trends of total emission reduction in different years which is exponentially increasing after the installation of renewable energy system in remote areas. Hoque and Das (2013) examined 40 Wp and 85Wp SHS and found their costs were 24000, 45000 Bangladeshi Taka (BDT) respectively. The total primary energy requirement for a 50Wp in its total life of 20 years is 4593 MJ^{th}. It gives around 253 kg of CO_2 emission. A 50 Wp SHS on the other hand supplies around 11773 MJ^{th} of Energy in 20 years. Energy payback for the same module was found to be 7.80 years and the total CO_2 emission reduction compared to kerosene consumption of the users was 11604 kg in 20 years. Hoque et al., (2014) study revealed that 40, 50, 65, 75 and 85 Wp SHS energy payback period was 6.94, 7.47, 7.80, 7.32 and 6.91 years respectively. It is reported that 1.4 million SHSs can virtually diminish 0.8 million tonnes of CO_2 each year of the life cycle of the SHS.Syed Ahsan Ali Shah etal., (2018) observed that the Balochistan region has best solar irradiance value across the globe and that the optimal tilt angles calculated in the respective region show a considerable increase in solar energy yield. The electricity generated using solar PV costs Rs. 7.98 per kWh which is significantly lower than conventional electricity, costing approximately Rs. 20.79 per kWh. The solar Photovoltaic systems could mitigate 126,000 metric tonnes of CO_2 annually if 100 per cent of the un-electrified households adopted solar PV systems.Sarker et al (2020) found that above 30 WP capacity of SHS could avoid 6.15 to 7.34 tonnes of CO_2 emissions during its life cycle while it gives more benefits such as lighting, entertainment, information and health care facilities.

7.0Methodology

This study is based on primary data. A well-structured interview schedule was prepared to collect the data from sample respondents which were based on the earlier studies related to socio economic status, changes of household daily activities after installation of SHS and benefits of SHS. Few identified variables were set as to evaluate the benefits of SHS namely economic, social and environmentally that was pretested and validated. The reliability of the identified variables was found and fixed the variables for hypothesis testing and analyses.

Tamil Nadu consists of 38 districts, of which, the present study purposely selected and focused on off grid electrified villages in Theni district. The study analyzes how SHS benefits to rural people, particularly economic, social and environmentally. It has more potential in terms of land area and utilization. Besides, the users of SHS are high. This study covered a few selected villages namely

Arasaradi, Bommirajapuram, Indiranagar and Notchiodai which are belong to the Mehamalai Panchayat, Mayiladumparai Block in Theni District. The identification of the study was based on installation of SHS which is inaccessible to electricity through national grid connection.

The study adopted the simple random technique for the selection of sample respondents from among SHS users. It is ensured that the selected villages contain the users depending wholly on SHS for their home lighting. Taro Yamane‟s formula used to select the sample respondent which specifies that 399 out of the 714 households are sufficient for the analysis which is considered as study sample. 300 out of 399 samples were selected for further analysis and 99 were rejected because of not functioning of SHS, refused to respond properly and incorrect answers. The collected primary data were processed and analysed by using SPSS (Statistical Packages for Social Sciences), Statistical tools such as Reliability, Correlation and Regression were used to test the hypothesis.

8. 0 Socio-Demographic Background of the SHS's Users

The socio-demographic context holds a pivotal role in the realm of social science research. It encompasses various factors such as age, gender,etc. These facets bear immense significance as they exert influence on decision-making processes and can significantly shape the lifestyle of both individuals and their families.

Table 8.1
Socio demographic background of the SHS users in the study area

Factors	Categories	Frequency	Percentage
Age	18-30 Years	24	8.00
	31-40 Years	100	33.30
	41-50 Years	99	33.00
	Above 51 Years	77	25.70
Gender	Male	233	77.7
	Female	67	22.3
Community	BC	51	17.0
	MBC	46	15.3
	SC	189	63.0
	ST	14	4.7
Educational Qualification	Illiterate	167	55.7
	Primary	80	26.7
	Secondary	26	8.7
	Higher Secondary	19	6.3
	Degree	8	2.7
Occupation	Farmer	234	78.0
	Agricultural labourers	42	14.0
	Self-employer	24	8.0
Family Size	< 3 Members	60	20.0
	4-5 Members	210	70.0
	> 5 Members	30	10.0
Monthly Income	Rs.2001 to Rs. 5000	20	6.7
	Rs.5001 to Rs.10000	72	24.0
	Rs.10001 to Rs.20000	109	36.3
	Above Rs.20000	99	33.0

Source: Primary data.

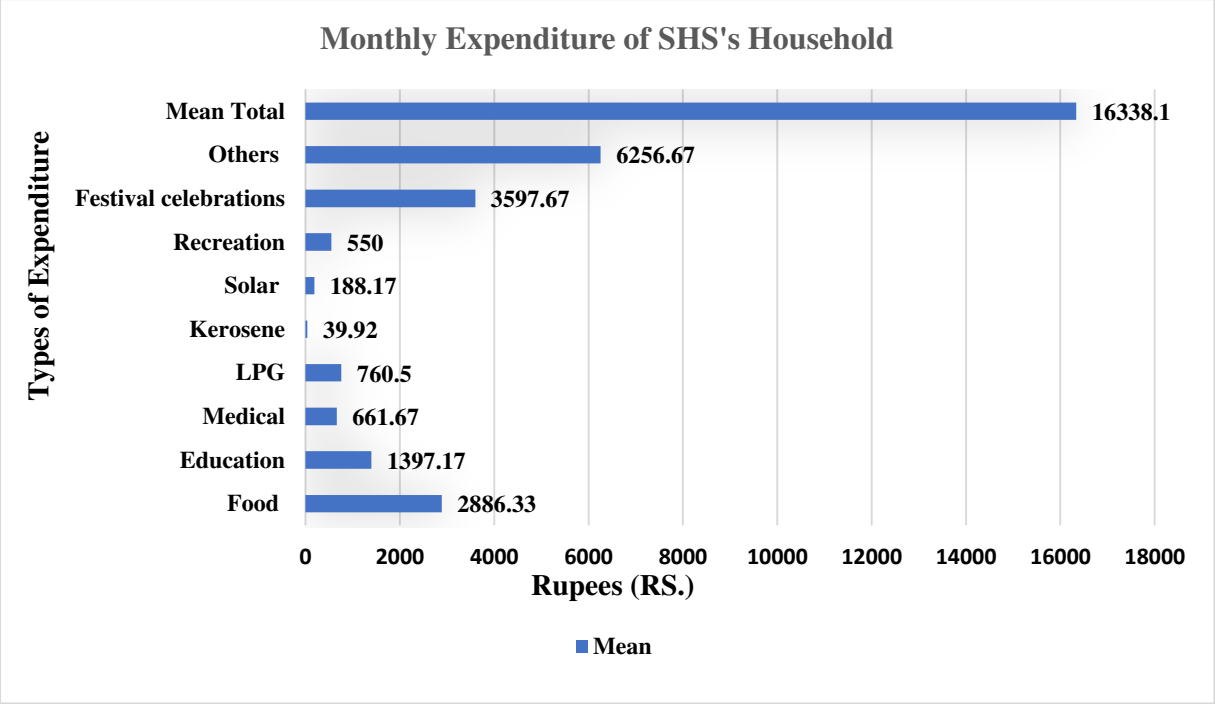
The table 8.1 represents that about 66.30 per cent of the respondents belong to middle age group (31-50 years), while 25.7 per cent and 8.0 per cent belong to above 51 years and 18-30 years groups respectively. It depicts that among the SHS users, the highest percentage of the respondents belong to 31 - 50 category whereas lowest percentage of the respondents belong to 18-30 category.In gender wise distribution of respondents, 77.7 per cent (233) of the respondents are males and 22.3 per cent (67) are females. It clearly shows that majority of the respondents are in male category. Community is a significant factor in all spheres of economic activities. According to our study, it was found that 63.0 per cent (189) of the respondents belong to SC category followed by 15.3 per cent (46) who are in the MBC category, 17.0 (51) per cent are BC's and remaining 4.7 per cent (14) of belong to ST category. Findings of our study indicates majority of the respondents belong to SC category and ST category is minority in the study area.

Around 55.7 per cent (167) of the respondents were illiterate, 26.7 per cent (80) studied upto primary education, 8.7 per cent (26) completed secondary level education and 6.3 per cent (19) studied up to higher secondary. The remaining 2.7 per cent (8)were Degree holders. It obviously shows that majority of the sample respondents were illiterates and degree holders are negligibly few.Occupation is the pillar of socio-economic profile of the sample respondents. It represents the status and the quality of life of the respondents. It reveals that 78.0 (234) of the respondents were farmers, 14.0 per cent (42) were running business and remaining 8.0 per cent (24) were agricultural labourers. The result indicates that a majority of the respondents were farmers and lowest were businesses. The size of family is one of the key factors for determining the pattern of energy consumption like lighting, cooking, usage of electronic appliances, mobile phones etc. 70 per cent (210) of the sample households have 4-5 members in their family, 20.0 per cent (60) have less than 3 members and the remaining 10.0 per cent (30) have more than 5 members. The study clearly reveals that about three fourths of the respondents have 4-5 family members. Income is an indispensable factor to determine the standard of living. Hence, an analysis of monthly income of the sample respondents is made. It clear that 36.3 per cent (109) of the sample households earned a monthly income of Rs.10001 to Rs.20000 followed by 33.0 per cent (99) who earned above Rs.20000, 24.0 per cent (72) of the households earned Rs.5001 to Rs.10000 and 6.7 per cent (20) earned only Rs.2001 to Rs. 5000. It clearly indicates that the highest percentage of the sample households earned Rs.10001 to Rs.20000 category and the lowest percentage earned to Rs.2001 to Rs. 5000.

9.1 Monthly Expenditure of the Sample Households

Expenditure is a significant factor to measure the quality. Hence, it is necessary to analyze the details of expenditure of the sample respondents.

Fig.9.1



Source: Primary Data.

10.0Installation and functioning of the SHS in the Study Area

Table 10.1 provides an overview of the installation and operation of SHS in the study area. It delves into several aspects of SHS, encompassing purchase specifics, the number of bulbs in use, lifespan of luminous bulbs, decrease in fossil fuel consumption, maintenance costs, duration of use, and the timeframe following the installation of SHS.In the case of mode of purchase, around 65.3 per cent (196) of the households received SHS from government free of cost, 29.3 per cent (88) purchased SHS from own money, remaining 5.3 per cent (16) purchased SHS through bank loan with government subsidy. Majority of the sample households got SHS through government free of cost. The number of bulbs used by SHS was based on the capacity of solar panel and storage of battery of the system.

The study observed that 61.0 per cent (183) of the sample households used two bulbs, 19.3 per cent (58) used only one bulb, 16.7 per cent (50) used three bulbs and 3.0 per cent (9) used more than three bulbs. It clearly shows that majority of the households used two bulbs during the period of study. The duration of luminousness of bulbs is determined by several factors of which availability of sunshine is the most significant factor. In the houses, the duration of luminousness of bulbs is based on the household tasks such as cooking, eating and read and writes. It is inferred that 52.7 per cent (158) of the respondents reported 4-6 hours of luminousness while for 26.3 per cent (79) it's only 2-4 hours.17.7 per cent (53) stated above 6 hours and 3.3 per cent (10) reported below 2 hours per day. Majority of the respondents found luminousness for 4-6 hours per day. The increase or decrease in the luminousness depends on the climatic and weather changes like clouds, rain, summer, winter season.

Fossil fuel sources are exhaustible and anti-environmental. The usage of fossil fuel sources was more but now it began to decrease. After adopting SHS fossil fuel consumption was changed, of the sample respondents 83.7 per cent (251) found a decrease in the fossil fuel consumption but 14.3 per cent (43) found no change and 2.0 per cent (6) found an increasing trend. The results reveal that, majority of the respondents found a decreasing trend in their fossil fuel consumption after adopting the SHS.

Table 10.1
Installation and functioning of the SHS

Factors	Categories	Frequency (300)	Percentage (100)
Mode of Purchase by SHS	Own Money	88	29.3
	Government welfare scheme	196	65.3
	Bank loan with Government Subsidy	16	5.3
Number of bulbs used by SHS	One	58	19.3
	Two	183	61.0
	Three	50	16.7
	Above three	9	3.0
Duration of luminousness per day	> 2 hours	10	3.3
	2 to 4 hours	79	26.3
	4 to 6 hours	158	52.7
	< 6 hours	53	17.7
Changes of Fossil Fuel Consumption After Adopting the SHS	Increase	6	2.0
	Decrease	251	83.7
	No effect/same	43	14.3
Details of Annual Maintenance Cost of SHS of the Sample Households	Rs. 200-400	248	82.7
	Rs. 401-600	27	9.0
	Rs. 601-800	16	5.3
	Rs. 801-1000	6	2.0
	Above Rs. 1000	3	1.0
Availability of Technician of SHS	Self	13	4.3
	Local electrician	275	91.7
	Company Technician	12	4.0

Source: Primary Data.

In the maintenance of SHS, 82.7 per cent (248) of the respondents spent Rs. 200 to Rs.400, 9.0 per cent (27) spent Rs. 401 to Rs.600, 5.3 per cent (16) spent Rs. 600 to Rs. 800 and 2.0 per cent (6) and 1.0 percent (3) spent Rs. 801 to Rs 1000 and above Rs.1000 respectively for the maintenance of SHS. Nearly every one of the respondents reported that battery got repaired within three years which was replaced with a new battery. It is observed that more than four fifths of respondents spent Rs. 200 to Rs.400. The analysis indicates that maintenance cost of SHS is low.

Generally, the availability of service centre and technician, spare parts are very important factors for adoption of any new technology like SHS. Thus, analysis on who repairs of SHS is an essential problem to be analyzed properly. 91.7 per cent (275) of the sample respondents repaired SHS with the help of local electrician 4.3 per cent (13) repaired SHS themselves and 4.0 per cent (12) repaired with the help of the Company Technician. It was noticed that a vast majority of the sample respondents repaired their SHS by local electrician.

11.0Economic, Social, and Environmental Benefits by SHS

The study analysed the benefits enjoyed by the respondents when they adopt and use the solar electric power by adopting SHS in their houses. The study evidenced the internal consistency and inter dependability of the identified benefits Economic benefits (M=, 17.00 SD=1.926, Cronbach's alpha -.583), Social benefits (M= 35.34, SD =3.392, Cronbach's alpha -.613) and environmental (M= 43.66, SD=3.99, Cronbach's alpha - .780).

The following findings exhibit the relationship between the benefits received by the respondents through adopting SHS.

11.1 Relationship between the state of economic, social, environmentally benefited on adopting SHS

The study conceived that the state economically benefited through adopting SHS and using solar electricity in the houses of sample respondents enabling to socio and environmental benefits and vice versa. The study evidenced a significant positive relationship between the benefits received by the sample respondents and found that the benefits are interdependent. This evidences a change of 1 percentage in the state of economically benefited relatively creates a change in the state of socially and environmentally benefited and vice versa.

A positive significant medium level of relationship (r =.426) between the variables of state of economically benefited (M= 4.25, SD =.481) and the state of socially benefited (M=3.92, SD =.37) by adopting SHS.

A positive significant medium level of relationship (r =.299) between the state of economically benefited (M= 4.25, SD =.481) and the state of environmentally benefited (M=3.96, SD =.36) by adopting SHS.

A positive significant strong level of relationship (r =.796) between the state of economically benefited (M= 4.25, SD =.481) and the state of overall benefits (economic, social and environmental) benefited (M=4.048, SD =.314) by adopting SHS.

A positive significant medium level of relationship (r =.457) between the state of socially benefited (M= 3.92, SD =.376) and the state of environmentally benefited (M= 3.96, SD =.36) by adopting SHS.

A positive significant strong level of relationship (r =.793) between that variable state of socially benefited (M= 3.92, SD =.37) and the state of overall benefited (economic, social and environmental) (M= 4.04, SD =.314) by adopting SHS.

A positive significant strong level of relationship (r =.720) between that variable state of environmentally benefited (M= 3.96, SD =.36) and the state of overall benefited (economic, social and environmental) (M=4.04, SD =.314) by adopting SHS.

The above correlation analysis results evidenced the chance of getting economic benefits adopting SHS significantly positively related with overall benefits explained by 79 % among other variables socio and environmental.

11.2Getting economic benefits through adopting SHS leads to overall benefits (social and environmental)

The study conceived that the respondents received benefits through adopting SHS. It reveals that getting economic benefits may lead to social and environmental benefits through adopting solar system. The study evidenced the same what the study conceived. The following findings show that getting benefits through SHS are interdependent and independent.

The assumptions for conducting the regression analysis that the collected data across the dependent (overall benefits) and independent variable (state of economically, socially, and environmentally benefited by SHS) was normally distributed, since KS Test significant p value > .05 and multi co linearity statistics VIF value is between the range 1-10.

The study evidenced the state of economically benefited adopting SHS significantly explaining the overall benefits, b= 0.796, t (298) = 18.778, P.000 <.05. Regression equation F (298) = 514.355, P.000 < 0.5 shows that adopting SHS enhancing to the state of economically benefited, significantly explaining the overall benefits by R^2 = .633.

The study evidenced the state of socially benefited through adopting SHS significantly explaining the overall benefits, b= 0.793, t (298) = 12.496, P.000 <.05. Regression equation F (298) = 504.159, P.000 < 0.5 shows that adopting SHS enhancing to the state of social benefited, significantly explaining the overall benefits by R^2 = .629.

The study evidenced the state of environmentally benefited through adopting SHS significantly explaining the overall benefits, b= 0.720, t (298) = 11.331, P.000 <.05. Regression equation F (298) = 320.775, P.000 < 0.5 shows that adopting SHS enhancing to the state of environmentally benefited significantly explaining the overall benefits by R^2 = .518.

The regression analysis results evidenced that getting economically benefited through adopting SHS significantly explaining the SHS overall benefits by 63 % among other benefits social (62 %) and environmental (51%).

12.0Conclusion

Solar power stands as a paramount solution for ensuring enduring energy sustainability and addressing the challenges of energy scarcity. The study examines SHS benefits in terms of economic benefits, socio benefits, and environment benefits perspectives. The result shows that the SHS user got benefits in the economically, socially and environmentally. It is confirmed by correlation and regression analysis. The study concludes that use of SHS lead to reduction of social, environmental and health cost of the rural community. The installation of SHS in a rural area is to improve the quality of life. The electricity generation and promote the use of solar energy at large and thereby the country's economic growth may be accelerated. SHS helps to achieve the sustainable development goals. It is suitable to the remote rural areas and will solve the electricity accessibility problems of remote areas.

13.0. References

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