The Impact of Solar Energy on the Lives of Tribal Women: With Special Reference to Sonbhadra District, Uttar Pradesh

Dr. Amarnath Paswan

Associate Professor, Centre for the Study of Social Inclusion Faculty of Social Sciences Banaras Hindu University, Varanasi

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ABSTRACT

This research paper is based on a study of the impact of solar energy on the lives of women belonging to various tribal communities residing in Sonbhadra district of Uttar Pradesh, a region with a significant tribal population. The study primarily attempts to understand how solar energy, as a form of renewable energy, is affecting the lives of tribal women. Based on questions related to important issues such as how solar energy is bringing about changes in the socio- economic status of tribal women and other aspects and activities of their lives, this research paper utilizes analytical, descriptive, and interpretive research methodologies to highlight the impacts of solar energy on the lives of tribal women, the related problems or challenges, and also presents important suggestions. These suggestions can prove helpful in the policy-making process related to the role of solar energy in tribal development.

INTRODUCTION

Scheduled Tribes constitute approximately 9% of India's total population[1], residing in dense forests, hilly regions, and rural areas. Due to the geographical complexities of these regions and varying levels of expectations, the pace of development among tribal communities remains slow. Despite the implementation of numerous development policies and schemes, these communities continue to experience socio- economic and educational backwardness, with the situation of women being particularly dire. The combined effects of social, economic, and educational backwardness, along with the influence of traditional community structures, have a profound impact on the lives of tribal women. Their lives are extremely challenging. In many tribal areas and communities, women are burdened with household chores, agricultural work, and labor in the unorganized sector. In this situation, the lack of adequate lighting further complicates their lives. Due to the absence of proper lighting, women face numerous difficulties in performing household chores at night and experience feelings of insecurity and fear when alone. In the absence of electricity, women have to rely on wood and oil lamps, the light from which is not only insufficient but also produces smoke that is harmful to their health. In this scenario, solar energy can be seen as a sustainable means of bringing about significant changes in the lives of tribal women. Solar energy has fostered the potential for widespread transformation in the lives of tribal women. The use of solar energy is not limited to providing lighting at night; it is also empowering women in the areas of education, health, safety, and social and economic activities. Now, women are able to easily perform their household chores and livelihood-related work at night. Several studies indicate that the availability of solar energy in tribal areas is bringing about positive changes in the lives of tribal women. The availability of solar energy in tribal areas is positively impacting the social, economic, cultural, health, and other important aspects of tribal women's lives. Several important studies have been conducted on the impact of solar energy on the lives of tribal women, which demonstrate positive results and transformations.

Valentina (2016)[2], in her study 'Managing Solar Energy Technology and Women Empowerment', stated that solar energy technology is not merely a source of energy. If used in the direction of women's empowerment, by providing women with training in the workings of solar energy technology, they can achieve economic and social advancement along with technical proficiency. Based on this study, it would be relevant to examine, in the context of tribal women in Sonbhadra district, whether solar energy is bringing about such a change in their lives or not. Agoramoorthy and Hsu (2009)[3], in their study, found that solar energy has qualitatively impacted

women's lives. The impact of solar energy has facilitated household chores and increased their social participation. Similarly, a study by Shiradkar, Sharma, Choudhary, Venkateswaran, Kumar, and Solanki (2023)[4], analyzing the deep connection between solar energy dissemination efforts and women's empowerment, clarified that solar energy has enabled the empowerment of tribal women. Naruka, Bansal, and Dangi (2023)[5], based on their study of knowledge and awareness regarding solar energy systems among rural women, clarified that for the empowerment of women through solar energy, it is essential to provide them with proper training related to solar energy systems so that they can effectively utilize solar energy. The study 'The Behavioral Impact of Basic Energy Access', published in Energy for Sustainable Development (2020)[6], analyzed the effects of solar energy in rural India and revealed that women feel safer with solar energy, and it is helping them with household chores and also leading to economic savings. The PM-JANMAN report presented by the Impact and Policy Research Institute (2023)[7] interprets the expansion of solar energy in tribal communities as a social change. It states that the light provided by solar energy in tribal communities is strengthening the sense of health and safety among tribal women and promoting their social participation. The study clearly demonstrates that if government schemes are implemented effectively, they can bring about significant positive changes in the lives of tribal women. Singh and Verma (2020)[8] analyzed the relationship between renewable energy and development in tribal-dominated regions of India and found that in areas lacking traditional energy sources, solar energy proves beneficial for women's education, health, and safety.

Energy availability is an essential condition for the development of modern society. Without it, progress or development is unimaginable. In a developing country like India, recognizing this necessity, special emphasis is being placed on the exploration and dissemination of renewable energy sources, so that affordable and sustainable electricity can be provided to all citizens and energy self-reliance can be achieved. In this direction, under the Indian government's solar energy policies, work has been underway since the 1970s to significantly expand solar energy in India.[9] Looking at the planned efforts, during the period 1970-2013, several important initiatives were undertaken related to the exploration of renewable energy sources, capacity building, research on utilization methods, coordination in research, results and development, promotion of investment in energy research, establishment of energy-related commissions and institutions, and planning for the dissemination of solar energy in rural and urban areas.[10] After 2013, from 2014 onwards, the Indian government further expanded these efforts in the solar energy sector, increasing the solar energy production target from 20 gigawatts set in 2010 to 100 gigawatts for the period 2015- 2022.[11] As a result of global efforts such as the establishment of the International Solar Alliance and the Panchamrit policy, India ranks fourth globally with a solar capacity of 70,000 megawatts.[12] Along with these global achievements, the Indian government's solar energy policies are playing a significant role in transforming energy availability into social progress and inclusive development. Under the planned efforts to ensure the spread of solar energy and inclusive development to the country's tribal communities, numerous schemes have been launched, the direct benefits of which are reaching rural and tribal communities. The role of schemes such as the Pradhan Mantri Janjati Adivasi Nyaya Maha Abhiyan, Pradhan Mantri Kusum Yojana, Pradhan Mantri Surya Ghar Muft Bijli Yojana, and Shyama Prasad Mukherjee Rurban Mission is particularly commendable. With the aim of improving the living standards of tribal communities and empowering them socio- economically, the Pradhan Mantri Janjatiya Nyaya Maha Abhiyan (PM JANMAN Yojana) is electrifying the homes of tribal families with solar energy, enabling them to join the mainstream of society. In this same effort, the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM Yojana) is promoting the economic development of tribal communities by providing them with solar-powered agricultural pumps. Under this scheme, 2.09 lakh agricultural pumps in tribal areas have already been connected to solar power, and a target has been set to connect a total of 35 lakh agricultural pumps to solar energy systems by 2026.[13] Considering the economic condition of the poor and backward groups in the country, the government is also providing them with financial assistance, for which the Ministry of New and Renewable Energy of the Government of India has proposed an investment of more than ₹ 75000 crore.[14]

The planned efforts by the government to promote solar energy in tribal areas and studies related to the impact of solar energy on the lives of tribal women provide the latest background for research on solar energy and tribal women. This necessitates an evaluation of solar energy and related policies from a women's perspective. While solar energy is positively impacting tribal communities overall, it is relevant to examine how it is affecting the lives of tribal women and the challenges associated with it. The impact of solar energy, aimed at providing equal energy access for all in tribal areas, needs to be viewed from a women's perspective in the context of education,

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domestic work, socio-economic empowerment, and women's safety. This is crucial because in tribal communities, where education levels are low, the status of women is particularly disadvantaged. Given the traditional social structure where tribal women do not enjoy the same freedom as men and are bound by community rules, it is essential to understand how solar energy is impacting tribal women in modern times, what new changes it is bringing to their lives, and how these changes align with inclusive development policies. Evaluating the social utility of solar energy in the context of these research questions is necessary. This study is also important from a regional perspective. Considering the limited availability of research literature focused on tribal areas like Sonbhadra, there is a need for more regional studies on this topic. Therefore, this research paper, considering the literature gap and the necessary research background arising from it, attempts to understand the impact of solar energy on the lives of tribal women in Sonbhadra district based on questions related to their technical knowledge of solar energy, the availability of local training facilities, positive changes in their socio-economic status, economic improvement, increased social participation, and the utility of solar energy from a safety perspective.

Research Objectives

1. To study the availability and usability of solar energy among tribal women.
2. To study the impact of solar energy on the social status of tribal women.
3. To study the impact of solar energy on the economic status of tribal women.
4. To study the impact of solar energy on the safety and security of tribal women.
5. To understand the problems or challenges associated with solar energy among tribal women.

Research Questions

1. What is the level of availability and usability of solar energy in the lives of tribal women?
2. How is solar energy affecting the social lives of tribal women?
3. How is solar energy affecting the economic lives of tribal women?
4. Is solar energy also impacting the lives of tribal women from a safety and security perspective?
5. What are the problems or challenges associated with solar energy among tribal women?

Study Area

For this study, Sonbhadra district of Uttar Pradesh, a district with a significant tribal population, was selected. The district is inhabited by people from the Oraon, Dhangar, Chero, Gond, Panika, Kharwar, Agariya, Baiga, Kol, and Pathari tribal communities. Their total population is 3,85,018, which is approximately 20.67 percent of the district's total population.[15] According to estimates based on local reports from 2021, women constitute 48 percent (approximately 175,000) of the total population in the district.[16]

Administratively, the district is divided into 10 development blocks: Robertsganj, Ghorawal, Chatra, Nagwa, Chopan, Babhni, Muirpur, Dudhi, Karma, and Kon. Therefore, the respondents for this study were selected from these 10 development blocks of Sonbhadra district, which was chosen as the study area.

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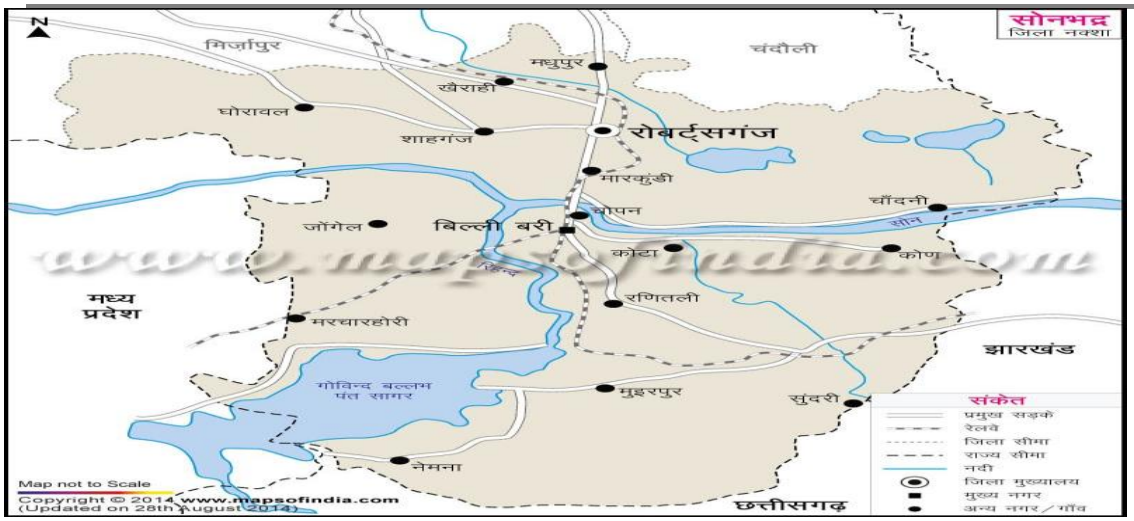


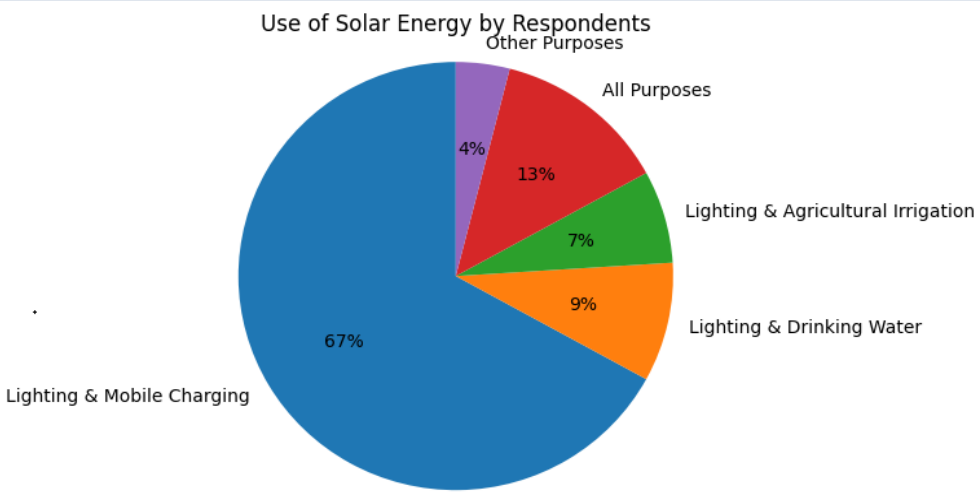
Sample Selection Process

The sample selection process ensured that only those tribal women who are beneficiaries of solar energy and are actively using it were included, as the tribal communities residing in Sonbhadra district live in remote hilly and forested areas, making direct access to them a challenging task. Considering this situation, the snowball sampling method was used to reach the respondents and the sample was expanded progressively. A total of 100 tribal women beneficiaries were selected from all 10 blocks of Sonbhadra district for the selection of respondents. Thus, 10 tribal women were selected as respondents from each block.

RESEARCH METHODOLOGY

In accordance with the nature and objectives of the study, both qualitative and quantitative methods were used in this research. Analytical, descriptive, and explanatory research methods were employed for the study. Primary data was collected using interview schedules and observation methods. For secondary data, subject-related research publications, reports from government ministries and departments, and published and unpublished research and official documents were used. The collected data was analyzed through thematic classification and frequency analysis. The analysis process attempted to understand how solar energy is affecting the lives of tribal women.

What tasks do you use solar energy for ?



Source: Primary

Regarding the use of solar energy, it was found that out of 100 percent of the respondents, 67 percent use solar energy for lighting bulbs and charging mobile phones. 9 percent of the respondents use solar energy for lighting

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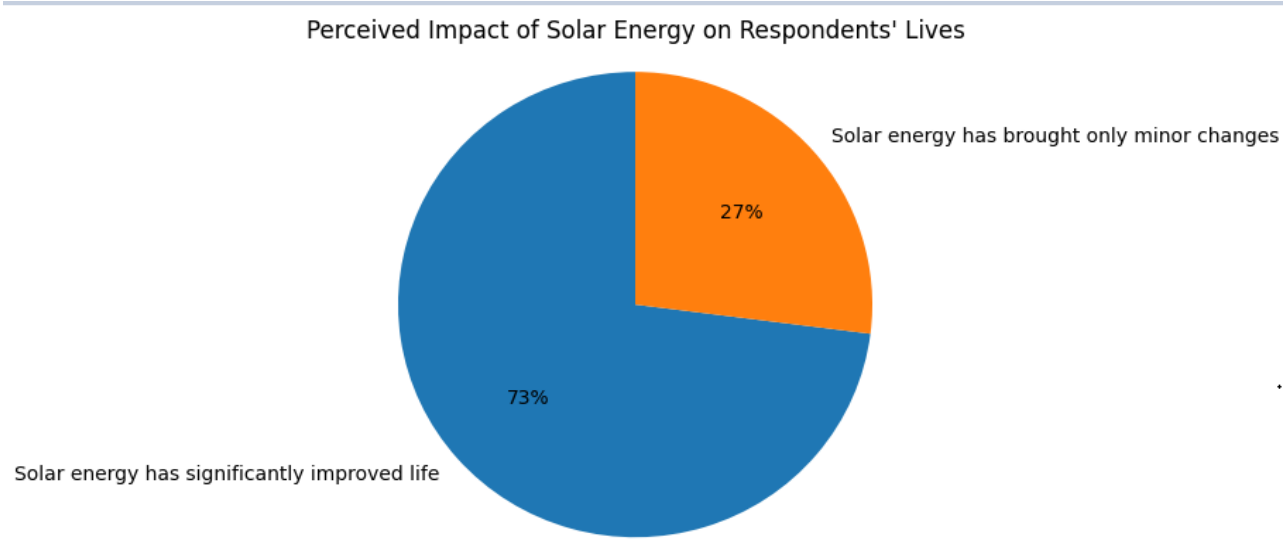
bulbs and for drinking water. 7 percent of the respondents use solar energy for lighting bulbs and for agricultural irrigation, while 13 percent of the respondents use solar energy for all purposes. 4 percent of the respondents use solar energy for other purposes such as sewing at night, running shops late at night, and for school- related work.

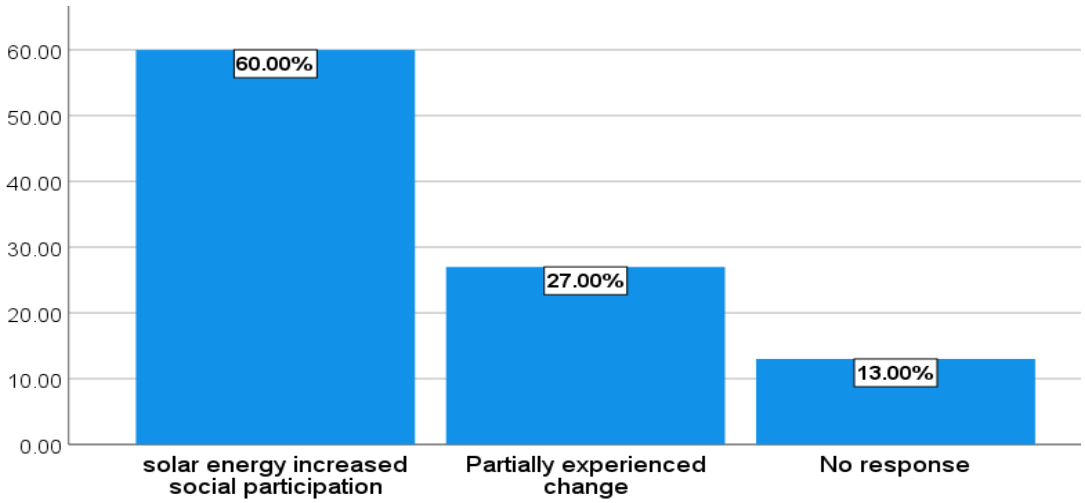
Has solar energy improved your life?



Source: Primary

In this regard, 73 percent of the total respondents believe that solar energy has improved their lives, while 27 percent believe that solar energy has brought about only minor changes in their lives.

Is solar energy helping you connect with your community or other people?



Source: Primary

In this regard, 60 percent of the total 100 percent of respondents stated that solar energy has not only facilitated their household chores but has also enabled them to communicate with people in their community, neighbors, and relatives by allowing them to charge their mobile phones. Charging their phones also allows them to connect with the outside world through the internet. Thus, it can be seen that solar energy has helped increase their social participation. Regarding this question, 27 percent of the respondents felt that this change in their lives was only partial, while 13 percent of the respondents did not provide an answer.

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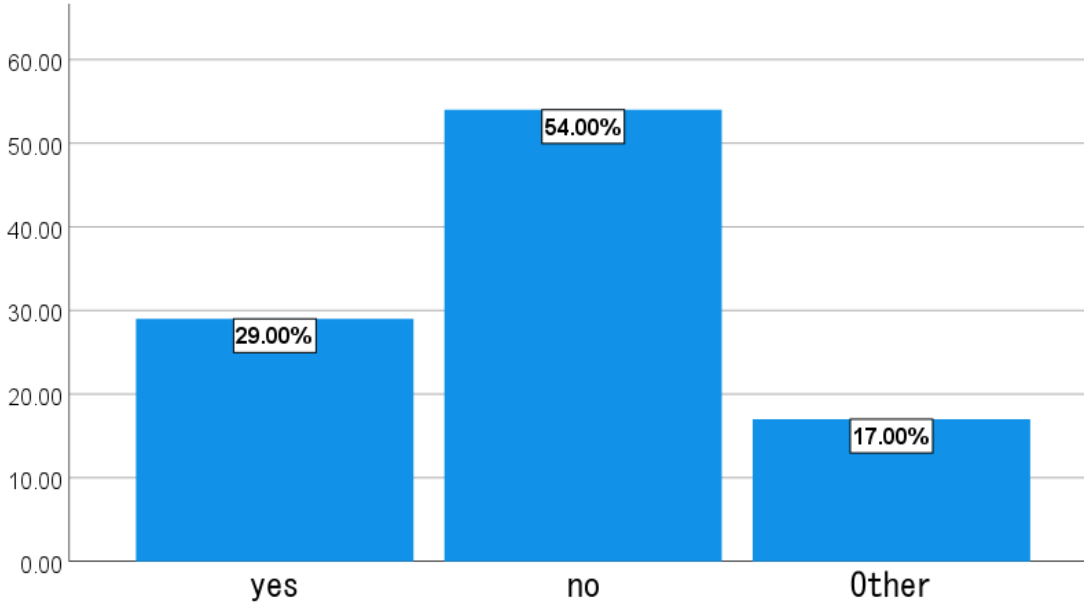
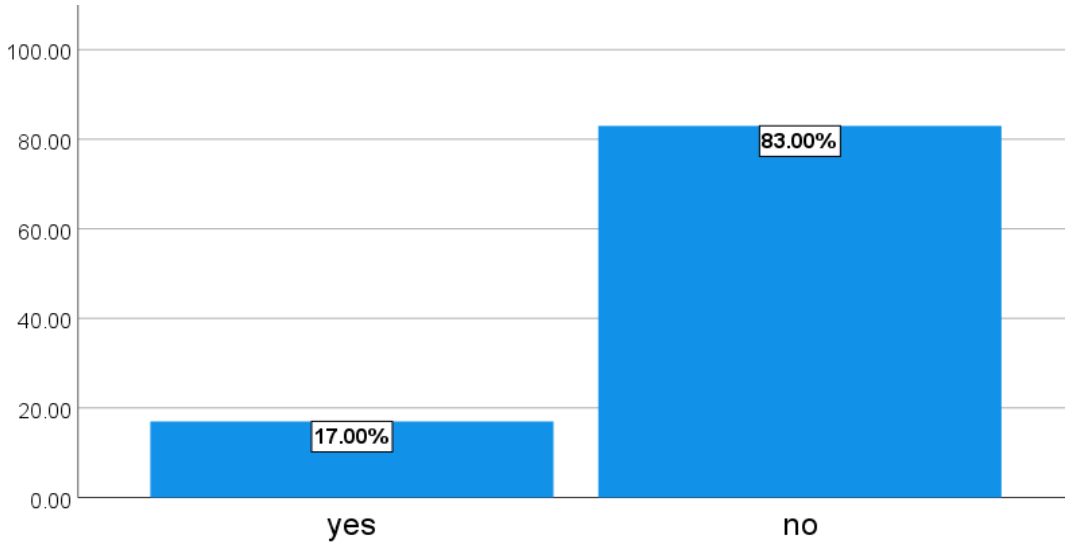
Are you getting any financial benefits from solar energy?



Source: Primary

The tribal women's perception of the economic benefits of solar energy is not limited to simply earning money, but they also associate economic benefits with a reduction in household expenses. They believe that the facilities provided by solar energy, such as lighting, irrigation and improved communication services, have reduced their household expenses, thus providing them with economic benefits. Of the total 100 percent of respondents, 29 percent acknowledged receiving economic benefits from solar energy, while 64 percent explicitly stated that they were not receiving any economic benefits from it, although they acknowledged that solar energy was making their household chores easier. The remaining 17 percent considered the economic savings resulting from solar energy as the economic benefit itself.

Have you obtained any employment through solar energy?



Source: Primary

Regarding employment opportunities, out of 100 percent of the respondents, 17 percent acknowledged that they had obtained employment in the fields of agriculture, education, and tailoring through solar energy, while 83 percent clearly stated that they had not received any employment through solar energy and only used it for domestic purposes.

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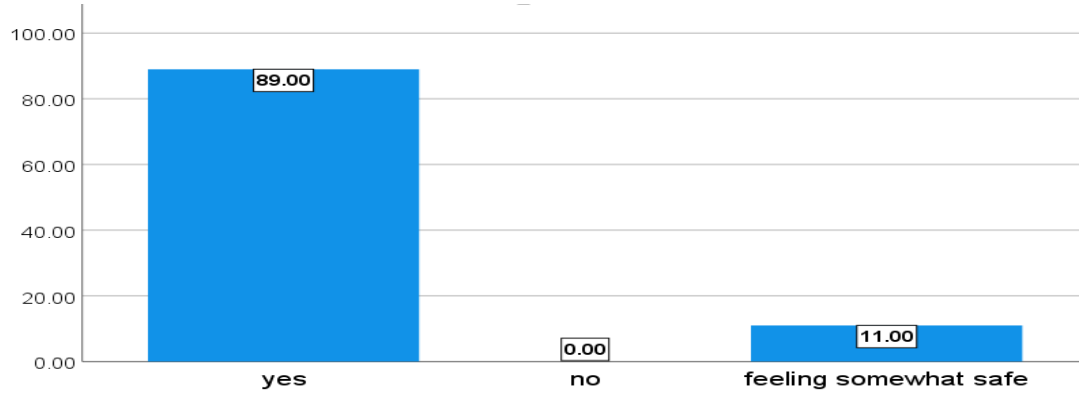
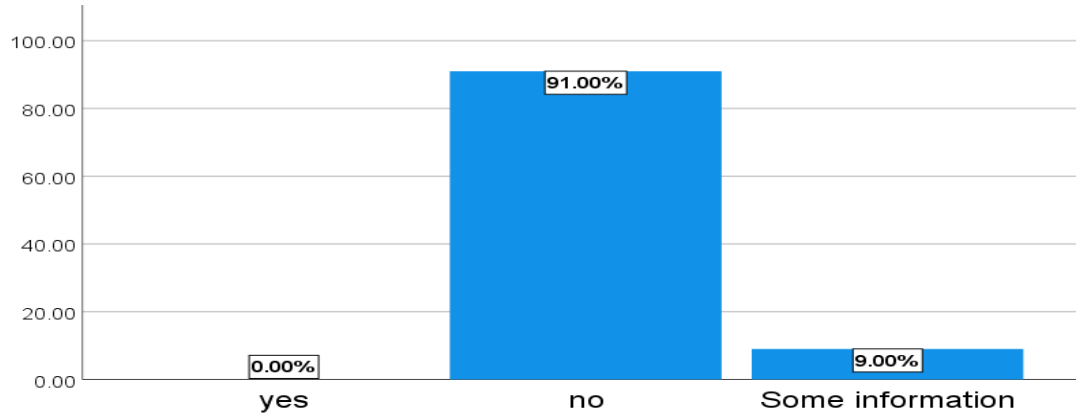
Do you feel safer now that you are using solar energy ?



Source: Primary

Regarding safety, 89 percent of the total 100 percent of respondents stated that they feel safe with solar energy, while 11 percent reported feeling somewhat safe. The majority of these 89 percent of respondents shared that, before the availability of solar energy, they faced difficulties with household chores at night and lived in fear of wild animals, venomous creatures, and thieves. Due to the lack of electricity, they were unable to charge their mobile phones, making it impossible to seek help from neighbors. However, solar energy has freed them from these difficulties and enhanced their sense of security.

Do you know the technical working system related to the use of solar energy?



Source : Primary

Regarding knowledge of the technical working principles associated with the use of solar energy, 89 percent of the total 100 percent of respondents stated that they had no knowledge in this regard, while 11 percent of respondents said they had some knowledge.

Has technical training been provided at the local level regarding the use of solar energy and the proper maintenance of the equipment?

S. No.	Response	Frequency	Percentage
1	Yes	00	00
2	No	100	100
	Total	100	100

Source: Primary

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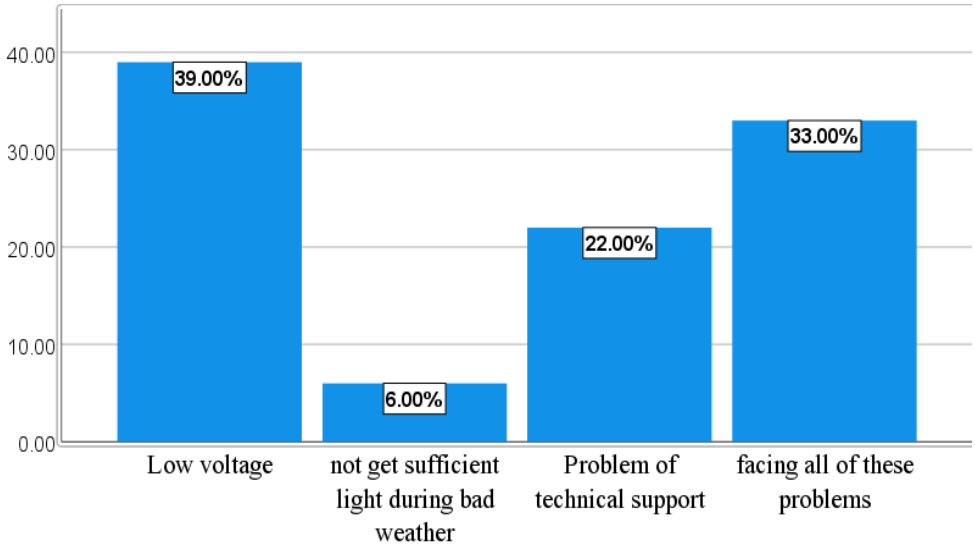
A total of 100 percent of the respondents reported a lack of technical training facilities at the local level regarding the use of solar energy and the proper maintenance of the equipment. This leads them to face technical problems.

From your perspective, what are the problems you face regarding solar energy?



Source: Primary

Regarding problems associated with solar energy, 39 percent of the total 100 percent of respondents reported experiencing low voltage issues. 6 percent of respondents stated that they do not get sufficient light during bad weather. 22 percent of respondents indicated that they do not receive any technical assistance when their solar energy equipment malfunctions, while 33 percent of respondents reported facing all of these problems.

DISCUSSION

The study clearly shows that solar energy is playing a positive and transformative role in the lives of tribal women in the Sonbhadra district. However, the pace of these changes is not uniform across the various aspects of their empowerment. The impact of solar energy on the lives of tribal women is mainly seen in terms of lighting, safety, social connectivity, and convenience in household chores, while its impact on economic empowerment and employment is limited. The study found that most tribal women use solar energy for lighting bulbs, charging mobile phones, accessing drinking water, and for household and agricultural work, which indicates that the use of solar energy in their lives is still limited to basic amenities. Despite this limited utility, 73% of the respondents felt that their lives have improved since the introduction of solar energy. From a social perspective, the availability of solar energy has provided mobile charging facilities, which has helped tribal women connect with their community and the outside world, thereby increasing their social participation. This finding corroborates the conclusions of Agoramoorthy and Hsu (2009) and Energy for Sustainable Development (2020), which linked energy availability to social participation. The economic impact on the lives of tribal women appears weak. The study found that most respondents acknowledged that they had not received any direct economic benefits or employment opportunities from solar energy. This fact clearly indicates that the productive use and impact of solar energy are still limited in tribal communities, especially among tribal women. Tribal women perceive the reduction in household expenses due to solar energy as an economic benefit, which is an indirect form of economic gain. From a safety perspective, the impact of solar energy was found to be highly positive; 89% of the women shared that they feel safer with solar energy. Thus, the lighting provided by solar energy is providing psychological and social support to women, which represents an important aspect of women's empowerment. The study found that there is a lack of technical knowledge and training in tribal areas, especially among tribal women, which limits the level of utility and benefits of solar energy. The lack of technical support for solar energy equipment malfunctions, low voltage, and weather-related problems highlight policy, structural, and systemic issues at the grassroots level.

CONCLUSION

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Based on this study, it is clear that the impact of solar energy on the lives of tribal women is positive, but this impact appears limited in several aspects of their lives. Solar energy is playing a significant role in making the lives of tribal women more convenient, safer, and socially active. However, the impact of solar energy on tribal women is still primarily limited to domestic use, although it has reduced the difficulties in their daily lives. Its impact is limited in terms of economic empowerment, employment generation, and technical knowledge. The lack of technical training and support at the local level limits the spread of solar energy and its long-term effects. Thus, it can be said that the availability of solar energy in tribal areas is significantly impacting the lives of tribal women. The use of solar energy for household chores and the availability of mobile charging facilities have promoted their social participation. In economic terms, their household expenses have decreased, enabling them to save money, although its impact on employment is limited. Nevertheless, considering all these efforts, it can be said that solar energy has expanded the possibilities for the empowerment of tribal women. To enhance these possibilities, it is essential to provide technical training related to the productive use of solar energy for tribal women, establish local technical support centers, formulate women-centric solar energy policies, promote their social participation and literacy campaigns, and strengthen policies that connect them to solar energy-based employment.

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