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# Assessing the Socio-Economic Impacts of Solar Home Systems on Chingad, Surkhet

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*ABSTRACT*

This study assesses the multifaceted socio-economic impacts of Solar Home Systems (SHS) on the remote community of Chingad, Surkhet. Employing a comprehensive research framework, we investigate the extent to which the adoption of SHS has influenced the livelihoods, economic activities, and social dynamics within the community. Through a combination of quantitative and qualitative methodologies, we analyzed the economic benefits, social empowerment, and environmental sustainability associated with the integration of solar energy. The limitations of the study included its focus on Chindgad-5, Surkhet. This research employed a descriptive-analytic approach within an exploratory research design. In the study area, a total of 386 households were included, with 188 utilizing solar energy in December 2023 AD from field observation. The research focused on a subset of 36 purposely selected solar home system users. Energy consumption patterns varied among ethnic groups and social classes, and universal electricity access was not observed in the study area. The study integrated both descriptive and exploratory elements to comprehensively address its objectives, utilizing a combination of primary and secondary data. For policymakers, development professionals, and other stakeholders engaged in sustainable energy projects in similar circumstances, the findings offer insightful information about the complex relationships that are present between solar technology and the local socioeconomic fabric. The study provides valuable insights for policymakers, energy planners, and development organizations working towards sustainable and inclusive energy solutions in rural Nepal. The successful integration of SHS not only addresses energy needs but also contributes to economic development and improved living conditions in off-grid communities.

## 1. INTRODUCTION

Nepal is a developing country known for its ironic variety in geography and culture. It consists of more rural areas rather than cities. The context of Nepal, energy situation reflects characteristics typical of underdeveloped nations, with a per capita energy consumption of 15 GJ, aligning with similar patterns in less developed countries. The energy consumption in 2002 was as follows: 75.78 percent went towards fuel wood, 9.23 percent went towards petroleum products, 1.47 percent went towards electricity, 5.74 percent went towards animal waste, 3.75 percent went towards agricultural residue, 3.53 percent went towards coal, and 0.48 percent went towards renewable energy (Woli, 2022). Energy sources are largely common in Nepal. It stands as a crucial element for sustaining livelihoods and the continuous availability of affordable energy sources is a prerequisite for the socio-economic development of Nepal (Khanal et al., 2020). In the context of Nepal, energy consumption is very low (14.6) and most of the energy is being used for domestic purpose (Nepal, 2012). Despite the country's vast potential for hydropower generation, only 17 percent of Nepalese households currently have access to electricity (Surendra et al., 2011). Although Nepal boasts an economically feasible hydroelectricity generation capacity of 42,000 MW out of a total potential of 83,000 MW, it has thus far harnessed only a fraction of this capacity. Alarmingly, nearly 90 percent of Nepal's energy requirements are still reliant on biomass sources such as fuel wood, agricultural residues, and animal dung (Poudyal et al., 2019).

The remoteness of many hill settlements of Nepal makes these areas inaccessible from electricity grid and therefore lower access to electricity facilities (K.C et al., 2011). In a country with our kind of terrain, providing some of the basic necessities are close to impossible because of the inadequate infrastructure, scattered rural households , extremely high cost of centralized national grid power supply and poor purchasing power of the people (Agnew & Dargusch, 2015). Practically, each and every aspect of human life is associated with supply and consumption of energy item. However, the energy supply options assume the challenges from the point of view of social, economic and environmental costs, benefits and risk (Verbruggen et al., 2010). The challenging geography and remote locations of many hill settlements in Nepal contribute to their lack of access to the electricity grid, resulting in limited availability of electrical facilities (Mainali & Silveira, 2013). The country's difficult terrain, insufficient infrastructure, widely dispersed rural households, exorbitant costs associated with a centralized national grid power supply (Shrestha et al., 2020), and the low purchasing power of the population make it nearly impossible to provide essential services (Woli, 2023). Virtually, every aspect of human life is intertwined with the supply and consumption of energy, presenting challenges from social, economic, and environmental perspectives in terms of costs, benefits, and risks (Oli, 2023).

Nepal's energy sources can be broadly classified into three categories: traditional biomass energy, commercial non-biomass energy, and alternative energy (Rosillo-Calle, 2016). Traditional energy encompasses fuel wood, agricultural residue, and animal waste, while commercial energy includes electricity, petroleum products, and coal (Halder et al., 2014). Alternative energy sources consist of biomass, geothermal, micro-hydropower, biogas, solar, and wind energy (Subagyo et al., 2021). Approximately 85.27 percent of energy consumption in Nepal is derived from traditional sources, 14.24 percent from commercial sources, and a mere 0.48 percent from renewable or other sources (AEPC, 2000). By the end of the 9th Five-Year Plan, about 40 percent of the total population had access to electricity, with 33 percent from the national grid and 7 percent from alternative energy (AEPC, 2008). However, the majority of the rural population, constituting about 85 percent of the total, still faces limited access to electricity. Addressing Nepal's current energy crisis, alternative energy emerges as the optimal solution (Shaikh et al., 2015). Alternative Energy Technologies (AETs) represent innovative, renewable, and non-conventional forms of energy. In Nepal, key AETs include micro-hydropower, biomass energy, solar energy, wind energy, and geothermal energy. The use of alternative energy technologies (AETs) has been progressively increasing worldwide over the past two decades, drawing from sources such as water, sunlight, air, and biomass energy.

Solar energy is categorized as a renewable energy source, referring to forms of energy that can be replenished or regenerated within a relatively short period (Mekhilef et al., 2011). The influx of renewable solar energies on earth corresponds closely to the energy derived from solar radiation. Currently, solar sources contribute approximately 10 percent to global energy consumption, with a higher share of around 40 percent in less developed countries (Shahsavari & Akbari, 2018). The solar home system (SHS) serves as a means to harness solar energy for various purposes such as, electricity generation, water pumping, heating, and communication. SHS installations have been implemented in various regions across the country, as reported by AEPC in 2006. During the first phase of the Energy Sector Assistance Program (ESAP), the objective was to support the installation of 2500 SHS. AEPC/ESAP facilitated subsidies for SHS through the Interim Rural Energy Fund (IREF) starting in April 2001. As of the conclusion of ESAP I, the solar energy program by AEPC/ESAP successfully installed about 69,533 SHS. The subsidies were approved by REF in approximately 1855 Village Development Committees spanning 75 districts (AEPC, 2016).

Despite the significant potential of solar energy technology to contribute substantially to the nation's energy requirements, the government has yet to establish clear plans and programs for its development (Solangi et al., 2011). Key entities in the country involved in this effort include the Research Center for Applied Science and Technology (RECAST), Nepal Academy of Science and Technology (NAST), Center for Renewable Energy (CRE), and the Center for Rural Technology (CRT) (Buchy et al., 2022). Additionally, other organizations with limited engagement in this area comprise Nepal Telecommunication (NTC), Nepal Solar Energy Society (NSES), Water and Energy Commission Secretariat (WECS), Solar Energy Light Fund (SELF), and various International non-governmental organizations (Energy Commission, 2013).

## 1.1 STATEMENT OF THE PROBLEM

The study focuses on the socio-economic status for individuals who use Solar Home Systems (SHS) in Chingad-5, Surkhet, where the usage of solar technology is becoming more common in rural areas. To comprehend the effects of renewable energy efforts, it is essential to look at the social well-being, job trends, educational attainment, and economic circumstances of these inhabitants. Sustainable energy is provided by SHS, which is essential for areas with poor access to power. There is little information on how SHS influences socio-economic variables including life quality and employment prospects, despite the rising body of research in this area. By providing information to development groups and governments working on rural energy solutions, our research seeks to close such gaps.

This study may raise the following research questions in the designated areas:

- What are the primary applications of Solar Home Systems within the targeted study area?
- How does the adoption of Solar Home Systems impact the economic activities of households in the study area?
- What are the perceived benefits of Solar Home System usage on community relationships and social interactions in the study area?

## 1.2 OBJECTIVES OF THE STUDY

The general objective of the study is to explore the socio-economic status of Solar Home System user community in the Chingad-5, Surkhet.

### 1.3 SIGNIFICANCE OF THE STUDY

More than 85 percent of Nepal's population resides in rural areas, where over 3 million households lack access to electricity, relying on kerosene lamps as the main source of lighting. An ongoing initiative aims to replace these lamps with energy-efficient, cost-effective, and reliable electric lamps, particularly focusing on modern solar home system (SHS) lights. Solar lights, with their high luminous intensity, are considered for small-scale area lighting, emergency flashlights, and as plug-in replacements for incandescent lamps in electrified rural areas. The inaccessibility of many hill settlements from the electricity grid in Nepal leads to limited access to electricity facilities. The country's average isolation of 4-5 kWh per square meter per day, according to the World Meteorological Organization, signifies significant potential for large-scale solar photovoltaic (PV) home systems. Solar energy's primary application in Nepal is electricity generation from solar PV systems, supported by global technological advancements reducing solar panel costs. This, combined with Nepal's solar potential and the absence of new and renewable energy sources, creates a favorable environment for promoting solar energy, which is not only cost-effective but also easily transportable.

A specific study in Chingad- 5, Surkhet district, a representative rural settlement, highlights energy-related challenges. Although some wards are connected to the national grid, irregular electricity supply limits usage to lighting and occasional entertainment. Daily energy needs in the area mainly rely on firewood, kerosene, and dry cell batteries for cooking and lighting. The study provides insights into energy consumption patterns, influencing factors, and environmental issues, serving as a valuable resource for shaping energy-related programs and policies in the examined area. The findings emphasize the importance of addressing the existing energy crisis and planning for future technological development.

### 1.4 DELIMITATION OF THE STUDY

The study is based on and limited to the solar home system users of Chingad-5, Surkhet district.

### 1.5 REVIEW OF THE RELATED LITERATURE

Literature refers to the research and outcome of the related literature (about solar Energy) several books and publications were reviewed by the researcher while undertaking this research (Carbajo & Cabeza, 2022). The successful diffusion of rooftop solar photo voltaic (SPV) in residential sector depends on the decisions of bounded rational households to accept this technology. Alipour et al., 2020, identify "the predictors of 173 original quantitative and qualitative studies on the residential adoption behavior of SPV, solar home system (SHS) and SPV coupled with battery energy storage system (SPV-BESS) technologies". Tsukada et al., 2020 find that "over three hours per day are spent on computer by both boys and girls, and that boys spend more than 3 hours per day on game consoles" the school principal to request assessment of the school for installation of solar panels. The central question of the qualitative impact assessment was, how, if at all, has the installation of solar panels impacted individual households and the community as a whole the past year?

The importance of local participation in the design and implementation of the solar home systems (SHS) project is emphasized, and an unexpected impact on gender dynamics related to project design is explored (Spear, 2020). The objective of is to assess the caregiver(s)'ability to provide a safe home, the quality of care needed by children and an environment that is nurturing, respectful and supportive (Stevens et al., 2020). With a carefully designed home study system inclusive of predictive analytics, it is possible to reduce the amount of time an assessor uses to approve or deny a home study, saving agency time and resources. Contribution of set out to evaluate if sensors could be utilized to (1) detect changes in behavior patterns in homes of community dwelling elderly & (2) evaluate instrumental activities of daily livings (IADLs) in a smart home lab setting. Over 80% of seniors had positive feedback for the in-home system and over 95% of seniors had found the lab-based evaluation of IADLs to be acceptable (Rawtaer et al., 2020). The aim of developing an EIA system was to make decision-making affecting the environment more accountable, through the use of objective scientific evidence. Snow, 2020 explain "the apparent paradox by arguing that EIA supports neoliberal agendas by facilitating economic development". The present arguments based on a neo-Gramsci a perspective that explains how apparent advances in the practice of EIA are sanctioned because they actually maintain the political nature of the EIA system, which continues to undermine attempts to use evidence objectively. With the aim of creating a safer environment for both care recipients and caregivers connect the SPV to a communicative robot (com-robot), to function as an integrated system (Obayashi et al., 2020). Despite a few points for improvement, the results highlight multiple benefits for care recipients and professionals of using the SPV and com-robot integrated system in a residential care home.

Dapremont, 2021 examine "the feasibility of various land use policies applied to the Mars Case". This approach sufficiently addresses all assessment criteria by permitting occupation and resource rights to limited plots of land on the Martian surface, advocating for a Mars Secretariat as a conflict mediation method, implementation of a planetary park system to protect valuable lands, and designating the application of laws within and outside of land claim areas. Other influential work includes has also included the energy consumption level of the different countries and regions. The report has cited the energy consumption data of high, medium and low human development countries. The report clearly shows that the energy consumption level of developed countries, OECD and central and Eastern Europe is for higher that from Sub-Saharan, South Asian region and least developed countries (Bhattacharya et al., 2016).

Economic Survey Report, 2022 as of Mid-March of 2022, 6.9 percent of the population has access to electricity from renewable energy sources. By mid-March 2021, such population was 3.2 percent. 9.34 As of mid-March of FY 2021/22, 398 KW of electricity has been generated from micro and small hydropower projects under alternative energy. In FY 2020/21, such production was 955 KW. Similarly, out of 284 KW of electricity generated from solar and wind energy in the FY 2020/21, 200 KW of electricity has been generated till the mid-March of current fiscal year. 9.35 As of mid-March of current fiscal year, 1,733 biogas plants have been connected. Such number was 3,975 in FY 2020/21. Similarly, 11,956 solar household power systems have been connected till mid-March of current FY 2021/22. In FY 2020/21, such number was 12,567. In addition, 13,455 improved stoves were installed in the last fiscal year. 9.36 As of mid-March 2022, 40,000 jobs have been created directly / indirectly through renewable energy programs. The main reasons behind increasing energy consumption level may be growth of automobile and oil consuming industrial establishment.

## 1.6 RESEARCH METHODOLOGY

This research utilized a descriptive-analytic approach within an exploratory research design framework to investigate trends in solar energy consumption and evaluate health improvements associated with the use of solar home systems. In conclusion, the study seamlessly integrates descriptive and exploratory elements to comprehensively address its objectives. This study utilized a combination of primary and secondary data to augment its qualitative character.

The research focuses on Chingad-5, Surkhet, encompassing a total of 386 households. Among these households, 188 have adopted solar energy. A subset of 36 solar home system users in the area was purposively selected for this study. The researcher conducted fieldwork in December 2023 AD in order to gather data for the Rural Municipality profile and other relevant sources using primary and secondary sources. It's noteworthy that energy consumption patterns vary among distinct ethnic groups and social classes. Additionally, it was observed that electricity services are not universally accessible throughout the Surkhet district (Chingad Rural Municipality Profile, 2074). For the collection of primary data following data collection techniques were household survey, observation and key informant interview adopted.

## 2. RESULTS AND DISCUSSION

### 2.1 HOUSEHOLD SIZE OF RESPONDENTS IN THE STUDY AREA

Household size had a signification role in the energy consumption. It was found that higher the HH size, higher was the energy consumption and the lower the HH size, lower was the energy consumption. This means with the increase HHs size the energy demand also increased.

Table 1: *Household Size of Respondents*

| SN | Household size | No of Respondents | Percentage |
|---|---|---|---|
| 1 | 1-4 | 6 | 16.6 |
| 2 | 5-8 | 21 | 58.3 |
| 3 | 9-12 | 5 | 13.8 |
| 4 | 13-15 | 4 | 11.1 |
| Total | | 36 | 100.00 |

Source: *Field Survey, 2023*

Average Family size = no of people living in household/ total households

= 2338/386

= 6.05

Above the table shows that most of the respondent's 58.3 percent HHs had five to eight number of family members. Similarly, 16.6 percent HHs had one to four numbers of family members. The family size among nine to twelve was 13.8 percent and the 11.1 percent HHs had thirteen to fifteen numbers of family members.

### 2.2 EDUCATIONAL STATUS OF THE POPULATION

The literacy rate of study is shown by Table 2.

Table 2: *Educational Status of the Sample HHS*

| Level of education | No of Persons | Percentage |
|---|---|---|
| A. Illiterate | 39 | 14.83 |
| B. Literate | 224 | 85.17 |
| Read and Write | 38 | 14.44 |
| Basic level (1 to 8) | 103 | 39.16 |
| Secondary (9 to 12) | 74 | 28. 13 |
| Higher Education (Above 12) | 9 | 3.42 |
| Total | 263 | 100.00 |

Source: *Field Survey, 2023*

Table 2, shows that the 14.83 percent people are illiterate, and 85.17 percent people are literate of the sampling population in the study area. Out of total literate population 39.16 percent are studying in basic level, 28.13 percent in secondary level, 14.44 percent people have can read and write, and 3.42 percent in higher education (above 12) level.

### 2.3 OCCUPATIONAL STATUS OF THE SAMPLE HHS

Occupation is one of the important indicators of the economic status of the people. It also determined the household's wealth, well-being and social stigma in society and plays a vital role of energy consumption pattern. Many of the people of Chingad Rural Municipality are engaged in foreign job. Table 3 shows the occupational structure.

Table 3: *Occupational Structure of the Sample HHS*

| Occupation | No of Households | Percentage |
|---|---|---|
| Farming | 6 | 16.67 |
| Service without country | 6 | 16.67 |
| Service within country | 3 | 8.33 |
| Business | 1 | 2.78 |
| Blacksmith | 1 | 2.78 |
| Pension | 19 | 52.77 |
| Total | 36 | 100.00 |

*Source: Field survey 2023*

Table 3 shows that the 52.77 percent of HHs had pension, only about 16.67 percent people were employed in agricultural sector, 16.76 percent HHs were engaged in foreign job and 8.33 percent people were engaged in national job. The lowest number of the sample HHs was involved in business and blacksmith; i.e. 2.78 percent and 2.78 percent respectively.

The income of HHs had a great effect on their living standard. It determines the resource mobilization, education and health. Generally, it is assumed that high level of income increases the quality of life, in the study area. The annual income level of the sample HHs is shown Table 4.

## 2.4 ANNUAL INCOME LEVEL OF SAMPLE HHS

Table 4: *Distribution of Respondents by Annual Income Level*

| Income Level (in Rs. '000) | No of Respondents | Percentage |
|---|---|---|
| Less than 25 | 1 | 2.78 |
| 25 to 35 | 3 | 8.33 |
| 36 to 45 | 6 | 16.67 |
| 46 to 55 | 10 | 27.78 |
| Greater than 55 | 16 | 44.44 |
| Total | 36 | 100.00 |

Source: *Field Survey, 2023*

Table 4 states that most of the respondents (44.44 percent) had annual income level of 55000 and about 27.78 percent of sample HHs have annual income between Rs 46,000 to Rs 55,000. Similarly, 16.67 percent respondents had Rs. 36,000 to Rs 45,000. About 8.33 percent respondents had annual income level between Rs. 25000 to Rs 35000 and only 2.78 percent respondents had annual income level between Rs. 25000 and only 2.78 percent respondents have annual income less than Rs. 25,000.

## 2.5 SOLAR HOME SYSTEM INSTALLED BY ETHNIC COMPOSITION

The study states that are the most benefited by solar home system. The sampling households were installation of solar home system by ethnicity presented in Table 5.

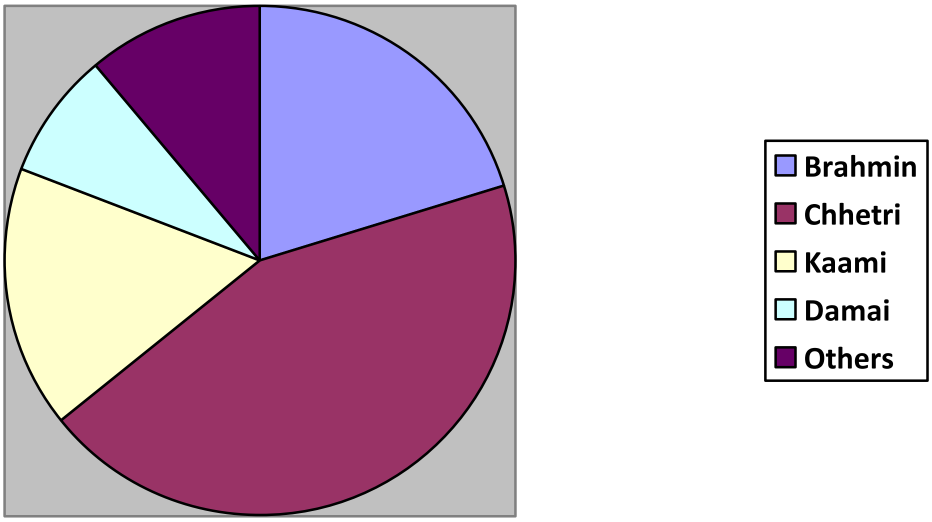
Table 5: *Distribution of Solar Home System According to Ethnicity*

| SN | Caste | No of Households | Percentage |
|---|---|---|---|
| 1 | Brahmins | 7 | 19.44 |
| 2 | Chhetris | 16 | 44.45 |
| 3 | Kamis | 6 | 16.67 |
| 4 | Damais | 3 | 8.33 |
| 5 | Others | 4 | 11.11 |
| Total | | 36 | 100.00 |

*Source: Field survey, 2023*

Table 5, indicates that the 44.45 percent Chhetris had installed the solar home system, 19.44 percent were Brahmins, 16.67 percent were Kamis, 11.11 percent were Damais, and 8.33 percent others had installed the solar home system.

Figure 1: *Distribution of Solar Home System According to Ethnicity*




Sources: *Field Survey, 2023*

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## 2.6 TOTAL COST INSTALLATION SOLAR HOME SYSTEM BY RANGES

Solar energy is related to the energy generated by the sunlight. It is a reliable and alternative free energy source for all. The initial total cost of installation Solar Home System by ranges is shown in table 6.

Table 6: *Total Installation Cost of Solar Home System by Ranges*

| SN | Cost | No of Households | Percentage |
|---|---|---|---|
| 1 | Rs. 10000 to Rs. 20000 | 10 | 27.78 |
| 2 | Rs. 21000 to Rs. 30000 | 12 | 33.33 |
| 3 | Rs. 31000 to Rs. 40000 | 11 | 30.56 |
| 4 | Rs. 41000 to Rs. 50000 | 3 | 8.33 |
| Total | | 36 | 100.00 |

Source: *Field survey, 2023*

The table shows that the most frequently installed SHS price was Rs. 21000 to Rs. 30000, then after Rs. 41000-Rs. 50000 and the lowest no of HHs but highest price was 41000-Rs. 50000. Because of the price determines according to Watts Peak (WP) capacity. Where the bigger capacity required the high price and smaller capacity needed the lower price. It is clear that the installation SHS depended on their income level. The table 6 indicates that the highest price only 8.33 percent i.e. no. of sample HHs was 3. Due to their high-income level and interest to installed the SHS.

## 2.7 DISTRIBUTION OF SHS BY SYSTEM CAPACITY

The installation SHS were various sizes ranging between 20 Watts Peak (WP) to 65 Watts Peak (WP). Considering all installations as of taken sample HHs during the field visiting are shown in the table.

Table 7: *Distribution of SHS by System Capacity*

| SN | System Capacity (WP) | No of Households | Percentage |
|---|---|---|---|
| 1 | 65 | 2 | 50.5 |
| 2 | 50 | 4 | 11.11 |
| 3 | 45 | 3 | 8.33 |
| 4 | 40 | 8 | 22.23 |
| 5 | 36 | 7 | 19.44 |
| 6 | 30 | 1 | 2.77 |
| 7 | 21 | 8 | 22.23 |
| 8 | 20 | 3 | 8.33 |
| Total | | 36 | 100.00 |

Source: *Field Survey, 2023*

The table shows that two system capacity 40 Watts Peak (WP) and 21 Watts Peak (WP) the same. 22.23 percent was the highest and these on one was 36 WP i.e. 19.44 HHs. Similarly, 11.11 percent HHs installed 50 WP, 8.33 percent HHs had 45wp and 20 WP, only 5.35 percent (2) HHs out of sampling HHs had 65 WP systems and the last one was 2.77 percent HH has 30 WP.

## 2.8 THE USES OF SHS TO OPERATE DIFFERENT EQUIPMENT

Solar Photo Voltaic (SPV) technology has been proven to be one of the best options for electrifying rural and the remote residing homes where there is no other option for lights, which can instantly have produced and used locally.

Table 8: *Distribution of Bulbs According to Connection/Operation*

| No. of Bulb | No of Households | Percentage | Operation No. of bulb | No. of Household | Percentage |
|---|---|---|---|---|---|
| 1-3 | 6 | 16.67 | 1-3 | 18 | 50.0 |
| 4-6 | 21 | 58.33 | 4-6 | 16 | 44.44 |
| 7-8 | 9 | 25.0 | 7-8 | 2 | 5.55 |
| Total | 36 | 100.0 | | 36 | 100.00 |

Source: *Field Survey, 2023*

Table 8 shows that the out of total sampling HHs 58.33 percent HHs joined 4-6 no. of bulbs in their house. Similarly, 7-8 no. of bulbs joined 25 percent HHs. And 1-3 no. of bulbs joined 16.67 percent HHs. If they join 1-8 bulbs they used according to their necessity in daily. Above no 4.9 also shows the daily operation no. of bulbs it shows 1-3 bulbs use highest 50 percent HHs, 4-6 bulbs used only 44.44 percent HHs and few (2) or 5.55 percent HHs operated 7-8 bulbs daily.

Table 9: *Operation of Bulb/Hours/Day/Households*

| Operation no. of bulb Hrs. /Day | No. of Households | Percentage |
|---|---|---|
| 2 hour | 9 | 25.0 |
| 3 hour | 13 | 36.11 |
| 4 hour | 12 | 33.33 |
| 5 hour | 1 | 2.77 |
| 6 hour | 1 | 2.77 |
| Total | 36 | 100.00 |

*Source: Field Survey, 2023*

Table 9 indicates that 36.11 percent HHs operated the bulbs for 3 hours in a day, and 33.33 percent HHs operated the bulbs for 4 hours in a day. Similarly, 25 percent HHs operated the bulbs for 2 hours in a day and only 2.77 percent HHs operated the 5 and 6 hours respectively in a day.

Table 10: *Operation of Radio Hours/Day Households*

| Operation no. of Radio Hrs./day | No of households | Percentage |
|---|---|---|
| Not Operation (no use) | 9 | 11.11 |
| 1-3 hour | 9 | 11.11 |
| 4-6 hour | 12 | 44.44 |
| 7-9 hour | 7 | 25.92 |
| 10-12 hour | 5 | 18.51 |
| Total | 27 | 100.00 |

Source: *Field survey, 2023*

Table 10 shows the 44.44 percent HHs played the radio 4-6 hrs in a day, 25.92 percent HHs played the radio 7-9 hrs in a day. Similarly, 18.51 percent HHs played the radio 10-12 hrs in a day and only 11.11 percent (3) HHs play the radio 1-3 hrs in a day.

## 2.9 SHS: INCOME GENERATOR OR KEROSENE AND BATTERY SAVEr

Once the SHS was installed, it was found that the consumption of kerosene by SHS owners significantly decreased in all SHS installed HHs in the study area, whereas the consumption of the batteries decreased only by half. The price of kerosene and batteries increase as one goes farther from the road heads due to increase in transportation cost.

Table 11: *Consumption of Kerosene and Batteries by SHS Households Before and After the Installed SHS*

| Respondents | Consumption of Kerosene (Liters/Month) | | Consumption of Battery (Pairs/Month) | |
|---|---|---|---|---|
| | Before SHS | After SHS | Before SHS | After SHS |
| Maximum per family | 7 | 2 | 5 | 2 |
| Minimum per family | 3 | 0 | 1 | 0 |
| Average per family | 5 | 1 | 3 | 1 |
| Price at local market | Rs. 161/ltr | Rs. 175/ltr | Rs 55/pair | Rs. 65/pair |
| Saving by each SHS owner/year | No saving | Rs. 10500/yr | No saving | Rs. 2340/yr |

Source: *Field survey, 2023*

Even if SHS was not directly contributing to income generation but on the other hand it was helping the families to expenses on kerosene and batteries. The families with SHS in the study area were saving Rs. 12840 per year on both kerosene and batteries at time of survey December, 2023.

Table 12: *Daily Allocation of Children's Time Before, and After SHS Installation*

| Time | Before | Time | After |
|---|---|---|---|
| 5 AM | Getup | 4 - 6 AM | Get up and study |
| 6 -7 PM | Do homework of school | 6 -7 PM | Go to play |
| 7 - 8 PM | Take meal and help to mother for sometime | 7 -8 PM | Watching TV/Listening radio |
| 8 -9 PM | Study for sometime | 8 PM | Take meal and help to mother |
| 10 PM | Sleep | 9 -11 PM | Study and sleep |

Source: *Field survey, 2023*

When respondents installed the SHS, they got many benefits from it. SHS brought some changes in their daily routine as well as increase in the study time of their children. Better lighting conditions in houses also help to ease household chores which were generally the responsibility of children for their study.

## 2.10 INVOLVEMENT ON PRODUCTIVE/ INCOME GENERATING WORK BY USING SHS

The SHS is a solar power generator designed for remote areas with small, scattered households and non-electrified villages. Its standalone and modular features make it ideal for these settings, as it can produce clean electricity from solar cells.In the study area all the SHS users agree that solar energy is a smokeless neat, clean renewable energy. SHS can only be justified if it is linked with income generating and development activities.

Table 13: *Involvement on Productive/Income Generating Work by using SHS*

| SN | Income generating / Productive work | No. of Households | Percentage |
|---|---|---|---|
| 1 | Telephone Connection | 4 | 11.12 |
| 2 | Photocopy/Fax/TV/Radio/Mobile | 0 | 00.00 |
| 3 | Repair center | 0 | 00.00 |
| 4 | Poultry farming | 0 | 00.00 |
| 5 | Knitting, weaving, handicraft | 0 | 00.00 |
| 6 | Not involvement | 32 | 88.88 |
| | Total | 36 | 100.00 |

Source: *Field Survey, 2023*

Table 13 indicates that 88.88 HHs were not involved in any productive work using SHS and only few 11.12 percent HHs were involve in income generating activity using by SHS.

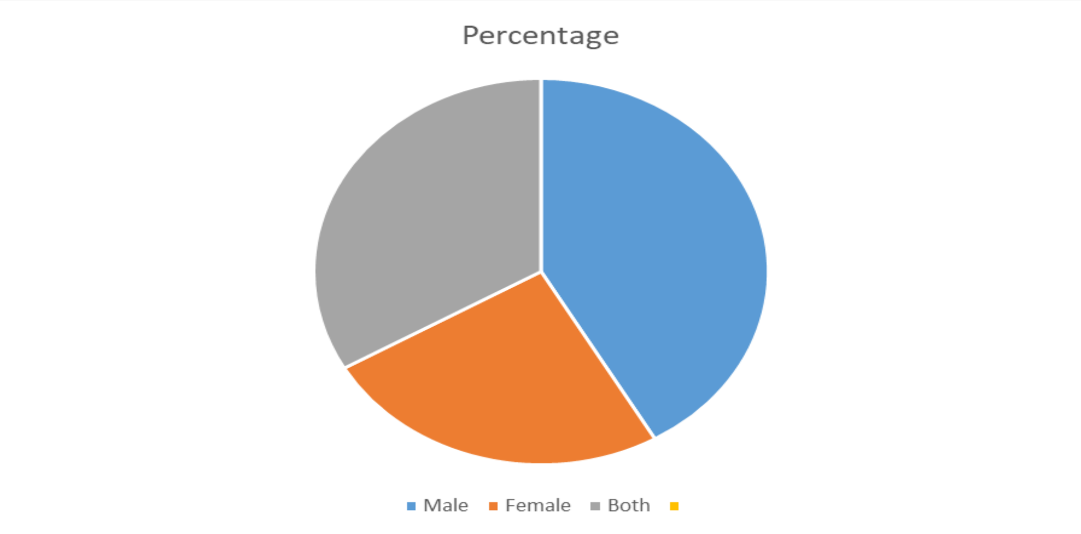
Table 14: *Decision of Respondent for Install SHS*

| SN | Decision | No. of Household | Percentage |
|---|---|---|---|
| 1 | Male | 15 | 41.66 |
| 2 | Female | 9 | 25.0 |
| 3 | Both | 12 | 33.33 |
| Total | | 36 | 100.0 |

Source: *Field Survey, 2023*

Table 14 indicates that the male decision included 41.66 percent, similarly, both (male & female) decision was 33.33 percent and female decision was 25 percent.

Figure 2: *Decision of Respondent for Install SHS*




Sources: *Field Survey, 2023*

Figure 2 indicates that the male decision held the highest position (41.66%), similarly, both (male & female) decision was 33.33 percent and female decision was 25 percent.

## 2.11 AVAILABLE OF LOCAL PROMOTER/TECHNICIAN

The available of local promoter/technician are given in the following table.

Table No. 15: *Available of Local Promoter/Technician*

| Available of local technician | No of Respondents | Percentage |
|---|---|---|
| Yes | 7 | 19.44 |
| No | 29 | 80.55 |
| Total | 36 | 100.00 |

Source: *Field Survey, 2023*

Table 15 indicates that the 80.55 percent, HHs did not get the local promoter and 19.44 percent HHs got the local promoter. It is clear that the people of that study area were suffering from the problems about SHS. Only one person was trained local promoter in the study area. He could serve only surrounding area of his home; and he was a new technician. Other remaining HHs felt that difficulty to operate the SHS.

## 2.12 THE PROBLEMATIC PART OF SHS

In this research, the problem occurs in the SHS system. In the SHS there the panel, charge controller, distilled water, battery, bulbs, and main switch wire were used. As per the respondents answered the problem occurred in the system.

Table 16: *The problematic part of SHS*

| SN | Equipments | Frequent problem | Percentage |
|---|---|---|---|
| 1 | Panel | 0 | 0.00 |
| 2 | Charge controller | 11 | 30.55 |
| 3 | Distill water | 4 | 11.11 |
| 4 | Battery | 9 | 25.00 |
| 5 | Bulbs | 5 | 13.88 |
| 6 | Main Switch | 4 | 11.00 |
| 7 | Wire | 3 | 8.33 |

Source: *Field survey, 2023*

Table 16 shows that the most frequent problematic component was battery which is 52.77 percent, second was bulb 41.66 percent, charge controller was 25 percent, similarly, distill water was 11.11 percent, wire was 8.33 percent and the lowest percent was main switch 5.55 percent.

## 3. CONCLUSION

The necessity of energy is fundamental for individual well-being and a nation's economic progress. In Nepal, Solar Home System (SHS) technology has become popular, especially in rural areas facing energy challenges. The government has integrated SHS installation programs into plans, recognizing the importance of rural energy. Concerns about the ecological impact of traditional fuel sources like dry cell batteries and kerosene led to the adoption of SHS in the study area. This technology not only addresses environmental concerns but also improves air quality in households, benefiting the health of women. The study serves as a foundation for future research and development, acting as a milestone and providing support for further exploration in this field. The findings are expected to aid decision-makers at various levels in understanding the implications of widespread SHS introduction for rural electrification in Nepal. Due to there are many manufacturers, it is standard component trying highly recommended. Standard quality maintenance will extend the useful life of SHSs and increase their viability for use in the future.

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