CHAPTER-ONE

INTRODUCTION

1.1 Background of the study

Nepal is a sovereign independent country situated in the foot hills of Himalayas in the central Asia. It has an area of 147,181 sq. km. The landlocked country is located between 26 ° 22' N to 30 ° 27' N latitude and 80 ° 4' to 88 ° 12' E longitude. The length of the kingdom is 885 km east west and the width varies from 145 km to 241 km North South a mean of 193 km. The country is wedged between India in the east, south and west and the Tibetan autonomous region of the people's republic of China in the north. The population was 2,66,20,809 (Census,2011). The mountains area includes of the world including Mount Everest (Sagarmatha upto 8848 m.). Nepal is divided into three main ecological regions having mountainous area includes the highest mountains, hills and Terai.

Nepal is a land of multi-cultural diversity and multi ethnic groups. Nepal has a long complex and diverse history. The social and cultural life of people has unique feature. People originated in Tibet live in mountainous ecological belt and have the practice of Buddhism. The People of Indian origin live in south part and practice Hinduism. In the midland valley and Terai, there are people from different economic status and education; both in rural and urban areas.

Nepalese society is the most tolerant society in the world. It has allowed different religions to merge with one another. In Nepal there are Hindus, Buddhists, Christian and Muslims as well. It may be strange and Buddhist monasteries are found by the side of Hindu temples. There is so much tolerance that people from one religion freely take part in the festival and celebrations of others.

Nepal is rich in natural resources such as; forest, water and bio-diversity. Forest covers approximately 36% land of the total area. The number of all-season rivers touches hundreds though has not yet been fully used in generating electricity and irrigation. Administratively, the country has been divided into five development Regions, fourteen zones and seventy-five districts. Likewise, there are fifty-eight municipalities that are considered as urban and 3915 Village Development Committees (VDCs) which are predominantly rural areas. Densely populated, the capital city Kathmandu is a small valley that lies in the central hill of Nepal. (CBS, 2011)

Energy is an important development indicator, which provides vital inputs for survival and economic development. Energy supply and consumption is still in a traditional state in Nepal. At present, renewable energy generation capability of the country is still significantly very low due to technological and economical barriers. But the average efficiency of the renewable energy technologies is good in performance and also environmentally safe.

The context for the use of solar energy in Nepal is slightly different. Despite Nepal's huge potential of hydroelectricity, it has not been able to harness its full potential due to various reasons. Currently "only 56% of the Nepali population has access to the electricity from both grid and off-grid while the rest of the population still relies on traditional sources of power"(AEPC, 2010). Even in grid electrified areas, there has been an acute power shortage in recent years, with people forced to live in as much as 16 hours of daily power cuts. In light of this situation, solar energy has been identified as one of the alternative sources of energy that has the potential to reduce the deficit between demand and supply. Since power from solar energy can be used by households directly, there is no need for investment in expensive infrastructure like power lines. Solar home systems are also readily available and easy to install, so they can address the short run deficit in energy in Nepal. As such, the government of Nepal has been actively promoting the use of solar energy, especially in those areas of the country where there is no supply of grid electricity.

The first recorded use of solar energy in Nepal can be traced back to 1963 when Civil Aviation Authority of Nepal installed a solar PV system in Bharatpur Airport to run navigation equipment (ibid). Its use for domestic Electrification Project was initiated and implemented by Centre for Renewable Energy (CRE) with the financial support from Solar Electricity Light Fund (SELF), a USA based non for profit organization. The use of solar PV for domestic electrification gained momentum from 1996 when Alternative Energy Promotion Centre (AEPC), with the objective of developing and promoting renewable energy in Nepal, was established. It formulated the policy of provide subsidies to the households in rural areas willing to install Solar Home System (ibid).

With national average sunshine hours of 6.8/day and solar isolation intensity of about 4.7 kWh/m^2/day, there is huge potential for solar thermal devices such as Solar Water Heaters (SWH), Solar Dryers(SD), Solar Cookers(SC). Presently SWH have been fully commercialized and till 2009 more than 185,000 SWH have been installed

in the country. SD and SC are still in the phase of dissemination and commercialization. This shows quite significant improvement in SWH installization in the recent years. (WECS, 2010)

The sun is the largest energy source on the earth. It provides free energy, which is significantly more environmental friendly than the traditional energy sources. Radiations from the sun can produce heat, generate electricity, or cause chemical reactions. Solar collectors collect solar radiation and transfer it as heat to a photovoltaic effect. "Solar energy is inexhaustible and nonpolluting, but converting solar radiation to electricity is not yet commercially competitive, because of the high cost of producing large –scale solar cell arrays and the inherent inefficiency in converting light to electricity" (Britannica Concise Encyclopedia).

Solar energy was first conceived as a viable alternative form of power as early as in the 1860s when coal was expected to be running out of supply. However, due to abundance of coal and petroleum, no major progress was made in solar technologies until the global oil crisis of 1973. The crisis brought renewed alternation to the potential of solar power as alternative source of energy. In response, industrial countries made a concerted effort to develop solar power technologies by creating and maintaining well funded research and development agencies. As a consequence, photovoltaic installation rapidly increased in the late 1970s and 1980s. With increasing evidence of global warming in the 1990s, solar energy was seen to be one of the most viable sources of energy to replace carbon emitting fossil fuels and thus became more “mainstream”. More recently, many countries have made solar energy a central part of their energy policy and committed to fulfill a substantial portion of their energy demand from solar power.

Solar energy has been used traditionally for drying such things as crops, clothes, fuel wood, and crop residues. The Solar energy potential in Nepal is estimated to be about 26 million MW. Currently there are two types of solar energy technologies in the country: Solar Thermal Systems and Solar Photovoltaic (PV) Systems.

Solar water heaters and solar dryers are the two main types of solar thermal devices. Of these, solar water heaters are popular in Kathmandu. These heaters are suitable for use throughout the country except in those regions that have long and harsh winters where the temperature falls below freezing point. However, because of the high cost, this technology is too expensive for most people.

Solar cookers were introduced by the Research Centre for Applied Science and Technology (RECAST) in 1977 as parboiling cookers. The Centre for Rural Technology, Nepal (CRT/N) took further initiative to promote solar cookers since early 1990's with the government subsidy channeled through Alternative Energy Promotion Centre (AEPC). Because of their high cost, this technology has not become popular in the rural areas. Although various types of solar cookers have been developed to reduce cost, efforts to improve the efficiency of solar cookers have yet to be undertaken.

Solar energy is the renewable energy. Renewable energy is the terms used for forms of energy that can be regenerated, or renewed, in a relatively short amount of time. The flow of renewable solar energies on earth is essentially equal to the flow of energy due to the solar radiation. Today, solar resources provide around 10% of the energy used worldwide but in least development countries their share is still of the order of 40%. (Pradhan & Pradhan, 2006)

Energy is one of the vital inputs to livelihood and consistent availability of affordable energy sources of the prerequisites of the socio-economic development of Nepal. Population Census of 2001 shows the total population to have access to electricity is 40%. Access to electricity in rural areas where only 5% people have electricity facilities is still lower. It is estimated that more than 85% people live in the rural area. Nepal has 42,000 MW of economically feasible hydroelectricity generation capacity out of the potential of 83,000 MW. It has been able to produce only the fraction of it. Still almost 85% of the energy needs in Nepal are met through biomass such as firewood, agriculture residues, animal dung etc.

The Earth receives 174 Pet Watts (PW) of solar radiation at the upper atmosphere. 30% of that is reflected back to space and the rest is absorbed by clouds, oceans and land masses. Land surfaces, oceans, and atmosphere absorb solar radiation, which increases their temperature. Warm air containing evaporated water from the oceans rises, causing convection. When the air reaches a high altitude, where the temperature is low and water vapor condenses into clouds and causes rain. The latent heat of water condensation increases convection, producing wind. Energy absorbed by the oceans and land masses keeps the surface at an average temperature of 14°C. Green plants convert solar energy into chemical energy through photosynthesis. Our food supply is completely dependent on solar energy. After plants die, they decay in the Earth, so solar energy can be said to

provide the biomass that has created the fossil fuels that we are dependent on. (Online Wikipedia, 2011)

Energy sources in Nepal can be broadly categorized into three groups such as; traditional bio-mass energy, commercial non-biomass and alternative energy. Traditional energy includes fuel wood, agriculture residue and animal waste. Commercial energy comprises electricity, petroleum products and coal. Alternatives energy sources includes micro-hydro, geo-thermal, biomass, bio-gas, wind energy and solar energy. The overall energy consumptions of Nepal are largely dominated by the use of traditional non-commercial forms of energy such as fuelwood, agriculture residues and animal waste. The share of traditional biomass resources, commercial energy resources and renewable energy resources are 87%, 12% and 1% respectively. The share of traditional fuel is decreased from 91% in 1995/96, 88% in 2004/5 and 87% in 2008/9. The remaining 13% of the energy consumed is through commercial sources (Petroleum fuels, coal and Electricity) and renewable. There is a slow pace of energy shift from traditional to modern one. The share of commercial has increase from about 9% in 1995 to about 12% in 2008/9. Similarly there is a growing trend in the alternatives. Within the commercial sources, electricity is in the higher side in substituting other fuel (WECS, 2010 p.82).

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

The rural population, which comprises about 85% of the total population, has very limited access to electricity. Alternative energy is the ideal answer to the present energy crisis in Nepal. Alternative Energy Technology (AETs) is a synonym for new, renewable, and non-conventional forms of energy. The most important alternative energy technologies in the context of Nepal are related to solar energy, biomass energy, micro-hydropower, wind energy and geo-thermal energy.

In Nepal, Here are many institutions related working in the field of solar energy. Some of government institutions and some of I/NGOs institutions are working in this field. The main organizations working in this field in the country are

Nepal Academy of Science and Technology (NAST), Research Centre for Applied Science and Technology (RECAST), Water and Energy Commission Secretariat (WECS), Alternative Energy Promotion Center (AEPC), Renewable Energy Project (REP), Centre for Renewable Energy (CRE), Solae Energy Light Fund (SELF), Royal Nepal Academic of Science and Technology (RONAST) and certain INGOs.

1.2 Statement of the problem

Energy is the critical component of the development process. It is needed in all sphere of life which is directly connected with means survival progress as in cooking, lighting, heating etc. Many developing countries are facing the problem of energy due to price high of fossil fuel and periodical shortages and international dispute in fossil fuel. More houses in rural areas using firewood, animal dug and agricultural residue.

Renewable is a key elements of sustainable, providing clean, affordable, and reliable energy, a valuable resources in the world's energy promoting sustainable human development, which involves no negative health, environmental, and social impacts in its production and use and which can be supplies continuously to future generations . Such energy is essential for the sustainable development and to countries the potentially devastating impacts of climate change.

Almost Nepalese people depend upon traditional type of *Tuki* and *Laltin* that consumer, Kerosene & fire using causes in discriminated destruction of the forest resources. It is known that the deforestation results into natural calamities. Such as landslide, flood, soil erosion, firewood collection consumers more time, more expenditure and ultimately produces ill health of the people. Therefore, people bound to live always in poor condition-socially, culturally, economically and environmentally to reduce these problems. Alternatives sources of energy like solar energy should be utilized. Solar energy helps us live move comfortably.

There are more advantages of solar energy. Solar energy doesn't work at night very expensive to build solar power stations, although the cost is coming down as technology improves. In the mean time, solar cells cost a great deal compared to the amount of electricity they'll produce in their life time in rural areas.

Dailekh is the economically poor distinct. People are shifting from their traditional occupation cash oriented agricultural practices most people are used solar energy.

1.3 Objectives of the study

The general objective of the study is to find out socio- economic impact of solar energy to its users. The specific objectives are as following:

1. To study the solar energy as an alternative energy to other energy resources.

2. To study the socio-economic impact of solar energy.

3. To study the benefits of solar energy in development.

1.4 Importance of the study

Solar energy is an easy and suitable technology for the people living in rural areas of the developing countries like Nepal. It has been helping them get solar energy and use it for different purposes like charging mobiles, listening to the radios and using as light. It is a good contribution of solar energy in the energy sector. Solar is a renewable energy. This simple technology contributes to collect and store sunlight energy; and use it as per the need.

The study focuses on the socio- economic impact of the use of solar energy and its contribution in the development of Kharigaira VDC, Dailekh. The socio-economic changes in the village represent the changes in living conditions of people in the community.

There are not previous research works on socio- economic impact of solar energy in the development of Kharigaira VDC, Dailekh. Its significance will be for planning the micro level plans and programs to improve economic and social conditions of the residents in the village. It was useful for the researchers, planners and other related line agencies too.

1.5 Limitation of the study

The present study was limited on the study and analysis of impacts of the use of solar energy by the residents in Kharigaira VDC, Dailekh. The study were done among people, solar companies serving the people supplying solar systems, different projects and organizations working in this sector, village development committee office and were limited to the solar energy users of Kharigaira VDC, Dailekh. The study was very specific like that of case studies. So, the conclusion drawn from the study was focus on the domestic solar energy system and its socio-economic impact in the development of the village.

To complete this study, direct observations of solar energy in all the four seasons was not possible as it aimed to study the impact of solar energy in a short period of time. So, recall technique was used to get data in the past and the analysis was done on the basis of the data available during the research period using sampling, questionnaire, observation, direct interview and focus group discussion methods.

1.6. Organization of the study

Collected and recorded primary and secondary types of data and information during the study were processed using different methods of data analysis. After processing and analyzing the collected data from study area on Socio-economic Impact of Solar Energy: A Case Study of Kharigaira VDC, Dailekh, the findings were tabulated to reach to its conclusion. The organization of the thesis is divided in the as below:

1. Chapter - I : Introduction
2. Chapter - II : Literature Review
3. Chapter - III : Research Methodology
4. Chapter - IV : Data Presentation and Analysis
5. Chapter - V : Use of Solar Energy and its Socio-Economic Impact
6. Chapter - VI : Summery, Conclusion and Recommendation
7. References
8. Annexes

CHAPTER-TWO

LITERATURE REVIEW

For this research work, the literature reviews were done under two categories, the conceptual review of empirical study. For this different book, journals, previous research works, reports, acts, articles, plans, and policies, other published and unpublished documents related to the subject were reviewed.

Solar energy is the very important topic on the study of rural energy. It required a wide range of literature review during the work. Basically, this study was carryout on the articles related to the solar energy. An extensive study was carry out in various publication and report also, which provide many importance information related to the field of research work. In the context of Nepal, solar energy is the modern technology. It is still in its take off stage, so there is no adequate study in the socio-economic impact of solar energy in the rural areas. Perhaps government, non-government and private institutions carried out its some reports.

In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating climate change, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared".

As per an estimate by WECS (1995), 78% of the land area of Nepal lies in high potential solar insolation areas. The average solar radiation varies from 3.6 – 6.2 kWh/m2/day, and the sun shines for about 300 days in a year. The development of solar energy technology is thus reasonably favorable in many parts of the country. Solar energy is traditionally used for drying crops, clothes, fuel wood crop residues etc. The technological intervention started only in the sixties with the production of domestic solar water heaters. The use of solar water heaters are mainly in the urban centers and in the trekking route. Till 2005, there are around 61,000 solar heaters installed in the country. Open air drying is a traditional drying method in Nepal for storage of agricultural products such as paddy, wheat, maize, fruits, vegetable and herbal medicines. Besides natural sun drying, cabinet type, rack type

and tunnel type solar dryers are also used in some places in Nepal. A few manufacturers and NGOs have attempted to promote a few designs of solar dryers in the country. A modified rack type solar dryer developed by RECAST is also used for drying fruits and vegetables. The government has been trying to encourage the use of solar dryers by providing subsidies. A 50% subsidy on the cost of solar dryer was announced by AEPC in 1998.

The world energy outlook (2000), presents that fact same 1.6 billion people, one, quarter of the world population have not access to electricity. In the absence of vigorous new policies, 1.4 billion people will have lack of electricity in 2030. Four out of people without electricity live in the rural areas of the world mainly in South Asia and Sub-Saharan African (Khatri, 2010)

Ghimire (2004), find out that Nepal relies heavily on traditional energy resources, as no significant deposits of fossil fuel are available. Nepalese use the lowest commercial energy (around 500 kWh per capita per year) of all South Asians by far. The total energy consumption in Nepal for the year 2003/04 was 363 million GJ of which the residential sector consumed 90% and agriculture sector 1% as shown in the figure. Based on the fuel type, biomass provided 86% of the total energy consumption, petroleum 9%, which is mainly, consumed by urban areas, electricity only 2% and renewable 1% of the total energy consumption About 40% of the total population has benefited from electricity by the end of the Ninth Plan. This 40% is reported to include consumption of 33% from National grid and 7% from alternative energy. About 84% of Nepal population lives in rural areas, and agricultural work are the mainstay of the rural population. For the year 2003/04, total rural energy consumption is 288 million GJ of which the rural residential consumed 97%. From end use perspective, of the total energy consumed in rural Nepal, 63.9% was used for cooking, heating accounted for 8.5%, lighting 1.31%, agro processing 3.4%, animal feed preparation 16.5% and others such as religious occasions and ceremonies 4.3%.

WECS, Report (1995) has analyzed the economic development and living standards of the people in the country is directly proportional to per capita energy consumption, a significant increase in energy consumption will be required to meet the national goal of improved living standards and rapid economic development.

Upadhaya (2008), argued that Hydropower, solar energy, wind energy are renewable sources of energy and they have also potential to reduce the emissions of

green house gas. So to reduced effect of global warming and maintain sound environment of Nepal. Seeks help from development countries for a sustainable development of its natural resources and improvement in equality of life citizens.

Pokherel (1998), "Energy in Nepal" has stated situation of Nepal. He also describes the various energy types and shows the tables. He concludes that Nepal's energy scenario is dominated by forestry sector as it supplies more than 80% of the total energy demand in Nepal. Fuel wood will remain as the major source for the forestable future and its current use it is not sustainable. Therefore it is not necessary to explore alternative mean of supplying energy to meet the need of mainly rural people.

UNDP (2011) , report pointed that 35,000 households will be connected to energy services with generation of 1.65 MW power output in 2011 and 15,000 households connected to energy serves with generation of 1.5 MW power output in 2012. He had shows his many activities to the related of renewable energy and the picture of national energy situation.

AEPC (2009), shows that some technical requirement of solar module and recommended and definition of the part of solar system and interpretation them.

WECS (1995), Report had been carried out at alternatives energy is now accorded a greater significance that then in the past. As such, of promoted ad implemented properly, alternative energy technology has the potential to meet the major portion of the commercial energy demand from rural areas. Hence, it is becoming increasingly important to develop and promote sustainable alternative energy in Nepal wherever possible and where the supply of energy to the inaccessible parts of the country through and integrated national network is less cost-effective and more time consuming.

Nepal is the richest country in solar energy technology possibilities in the world. Though there is the potentiality of generating 26,000 MW solar electricity in Nepal, only 10 MW solar electricity is estimated to have completed. According to the AEPC data, only 5.9 MW solar electricity is produced till now. Till February 2012, about 2,20,000 solar panels are installed in Nepal. Total investment for these installations is about Rs. 1,70,00,00,000. In the urban areas, there is the demand of solar panels having 80 to 320 WT capacities because they use different utensils and equipments in their houses. Whereas, there is the demand of 5 to 80 WT panels in the rural areas. (Urja Nepal, 2068 page-42, 43)

AEPC (2010), find out rural area institution such as school, health facility and offices use solar power for lighting and to operate electronic appliances. Health facilities use institutional solar PV system (ISPS) particularly to store vaccines in refrigenerators. Similarly in schools ISPS is used to run computer class. Government and non -government offices in the rural areas use ISPS to run office equipments such as computer, printer and fax machine. In the last few year ISPS have also been used to run the equipment in Fm. stations. ISPS is being used as back of power even in urban areas with the increasing hours of daily power out.

WECS (2010), Find out that the highest growth exists in renewable energy consumption because average annual growth is even more than 15% within the alternative/renewable energy system, interestingly, solar energy consumption is being increased even more then 20% in annual basis. Average annual change in the petroleum consumption is also very low that is just about 0.7% during 2000/01 to 2008/09. Especially the consumption of kerosene, furnace oil and light diesel is annually replacing the kerosene, fuel wood and electricity as well.

History in Nepal Oil Corporation (NOC) is major product and distributor for more than 90% of the total electricity generation and Nepal Oil Corporation has a monopoly on the import and distribution of petroleum products.

Sharma (1987) concluded that the energy scene in Nepal shows a stark imbalance between energy resources endowment and current use. Hydropower which has a huge potential has largely been untapped, whereas requirements are being met though continued owe use of fatly depleting forests. The challenge for the future of the correction of the imbalance and transition to energy use pattern consistent with energy resource endowment.

Solar energy is transformed into plant material by a process known as 'photosynthesis" which has been the basis of the world's fossils fuels such as natural gas, petroleum and coal. there is now interest in producing (through photosynthesis) large supplies of fuel in the form of grass, water , plant etc. a managed production of plant tissue with more efficient use of solar energy and required nutrients carried out of sustainable land and water areas can provide these organic material. It is possible to transform these organic materials into high heat content fuel (gases, oil, solids) through well established chemical process. (Kashkari, 1975-p173)

Certain applications of solar energy are well established in developing countries i.e. solar evaporation for the salt production and direct solar drying for processing croups. Solar water heater technology is developed and can be applied on a large scale in developing countries. Solar distillation for producing portable water for human and animal consumption is in the "pilot plant" stage and on an experimental basic, is supplying a number of small communities with drinking water. Solar stills applied to developing countries could solve the water supply problem in these countries Solar energy to working in solar cooking, solar drying and heating of building. Solar energy utilization though photosynthesis. (Kashkari, 1975-p174)

Photosynthesis is a term first used in 1962 to name the process of the direct conversion of light into electricity. While the term is relatively new, the process has been known for sometimes, though it has only recently been put to practical purpose. (Skelton, 1984)

In 1995, Water and Energy Commission Secretariat (WECS) published its guideline for the incorporation of gender issues in water and energy sector. Recommendations addressing gender issues such as gender sensitization, gender disaggregated databases and commissioning of gender experts in planning and programming have also been included on the 1997 WECS commissioned study on institutional strengthening in rural energy planning and implementation. However the guideline's recommendation has not been successfully practiced in implementation.

2.1 History of Solar Energy

Magnifying glasses and mirrors are used to concentrate the sun's rays on a fuel and ignite a fire for light, warmth and cooking. As early as 212 B.C., Greek scientist Archimedes applied the reflective properties of bronze shields to focus sunlight and set fire to Rome's wooden ships, which were besieging Syracuse. Civilizations from Rome to North America begin building homes and bath houses that face the sun in order to capture its heat. *(Online Wikipedia, 2010)*

1954

Photovoltaic technology is born in the United States when Daryl Chapin, Calvin Fuller and Gerald Pearson develop the silicon photovoltaic (or PV) cell at Bell

Labs. Bell Telephone Laboratories then produced a silicon solar cell with 6 percent efficiency. The NASA Lewis Research Center starts installing the first of 83 photovoltaic power systems on every continent except Australia. They provide power for vaccine refrigeration, room lighting, medical clinic lighting, telecommunications, water pumping, grain milling and classroom television. The project takes place from 1976 to 1985 and then from 1992 to completion in 1995. *(ibid)*

1986

The world's largest solar thermal electric facility is commissioned in Kramer Junction, California. Generating 150 MW, the solar field contains rows of mirrors that concentrate the sun's energy onto a system of pipes circulating a heat transfer fluid. The heat transfer fluid is used to produce steam, which powers a conventional turbine to generate electricity. *(ibid)*

2.2 The History of Solar Energy in Nepal

The exact date of first use of solar PV in Nepal cannot be determined. However it is believed that the first PV module was used in the Bhadrapur Airport for navigational purpose in 1963. 1974 – Nepal Telecom (NTC) was the first organization to use Solar PV power to operate a high frequency transceiver located in Damauli. 1980 – NTC started massive use of solar PV power. It has remained as the largest corporate user of PV. Total installed capacity exceeding 700 kWp. 1987 – ADB/N was using solar PV power to electrify its 100 branch offices.1988 – Centralized electricity supply from PV started.1988 – Nepal Electricity Authority (NEA), with the assistance of French Government installed centralized solar PV power system in Simikot (50kWp) 1989 – NEA installed another centralized solar PV power system in Kodari/Tataopani (30kWp) and Gamgadhi (50kWp) 1991/1992 – Recorded use of solar PV power for domestic electrification. First solar PV Company was established. 1993 – Successful launching of Pulimarang Village Electrification Project. After this use of PV, for the rural electrification gained the momentum Valley 1995, – The first highly subsidized (95%) 68 SHS were installed at Chhaimale village in southern part of Kathmandu by Wisdom Light Groups Pvt. Ltd. 1996 – ADB/N provided 50% subsidy to install to 40 SHS at six VDCs in Kavrepalanchwok district, for the first time in Nepal. 2000 – Renewable energy subsidy policy, addressing the policy related to solar energy systems, was announced by the government. (Bhandari, 2011)

2.3 Renewable Energy Development Scenario in Nepal

There is a dire need to substitute as well as supplement the traditional energy supply system by modern forms of sustainable energy in terms of resources and technology. Because of the country's dependence on imported fossil fuel, high cost of grid connection and low and scattered population density, a decentralized energy supply system becomes the natural and feasible choice. Decentralized new and renewable energy systems such as micro hydro, solar photo voltaic, biogas, improved cooking stove etc provide feasible and environment friendly energy supply options in rural areas. The most important renewable energy technology in Nepal is related to Pico hydropower and micro hydropower (up to 100 kW), biomass energy (biogas, briquettes, gasifiers, improved cooking stoves), solar photovoltaic (solar home systems, solar PV water pumping, solar battery charging), solar thermal energy (solar water heater, solar dryer, solar cookers etc).

Table No. 2.1
Renewable Energy Database for Nepal

S.No	Particulars	Description
1	No. of Rivers	More than 6000 with about total length of 45,000 km
2	Theoretical potential of hydropower	83,000 MW
3	Commercial potential of hydropower	42,000 MW (not necessarily environmentally acceptable)
4	Hydropower so far generated	600 MW (1.4 % of commercial potential)
5	Average sun shine hour/day	6.8 with intensity of solar insolation of about 4.5 kWh/m2/day
6	Total Energy Consumption	8.6 million TOE; about 15 GJ per capita per year
7	Share of Energy Supply	
	Biomass	77.7%
	Petroleum	8.2%
	Coal	1.9%
	Electricity	2%
	Renewable	9.4%

8	Share of Energy Consumption	
	Residential	89.1%
	Industrial	3.3%
	Commercial	1.3%
	Transport	5.2%
	Agriculture	0.9%
9	Population Coverage by Electricity Supply	
	Central Grid	33%
	Alternative energy	7%

Source :(WECS*, 2010*)

Table No. 2.2

Renewable Energy Technology (installation up to mid 2010)

S.No	Technologies	Description
1	Biomass Based Technologies	
	ICS	4,79,991 were installed in Nepal
	Biogas plant installation	128,223 units
	Bee Hive Briquette Production (Micro enterprise)	
2	Solar Based Technologies	
	Solar pV Installation	2,17,789Watt Peak upto 2010/11
	For Public Utility (aviation, telecommunication, traffic, supply etc.)	943 units
	Solar Home system	2,29,797 units
	For Water Pumping System	76 units
	Solar Cooker (Parabolic Type)	
	Solar Dryer (Box and Cabinet Type)	

	Solar Water Heater (commercial)	
3	Hydro Based Technologies (decentral)	
	Micro-hydro Systems	2,397KW
	Pico-hydro Systems	
	Improved Water Mills	4500 unit
	Peltric Set	
4	Wind Based Technologies	
	Installation of Wind Turbine Units	Below20
	Installation of Wind Pump Units	Below 20

Source: (AEPC, 2011)

2.4 Present Energy Scenario in Nepal

Nepal relies heavily on traditional energy resources, as no significant deposits of fossil fuel are available. Nepalese use the lowest commercial energy (around 500 kWh per capita per year) of all South Asians by far. The total energy consumption in Nepal for the year 2003/04 was 363 million GJ of which the residential sector consumed 90% and agriculture sector 1% as shown in the figure. Based on the fuel type, biomass provided 86% of the total energy consumption, petroleum 9%, which is mainly consumed by urban areas, electricity only 2% and renewable 1% of the total energy consumption. About 40% of the total population has benefited from electricity by the end of the Ninth Plan. This 40% is reported to include consumption of 33% from National grid and 7% from alternative energy. (Gimire, 2004)

About 84% of Nepal population lives in rural areas, and agricultural work are the mainstay of the rural population. For the year 2003/04, total rural energy consumption is 288 million GJ of which the rural residential consumed 97%. From end use perspective, of the total energy consumed in rural Nepal, 63.9% was used for cooking, heating accounted for 8.5%, lighting 1.31%, agro processing 3.4%, animal feed preparation 16.5% and others such as religious occasions and ceremonies 4.3%.

Of the total energy consumption of 288 million GJ in rural Nepal, biomass accounts for 98% while electricity accounts for only 0.1% of the total energy consumes and petroleum products comprise 1.6% and renewable source 0.5% of the total energy consumed . (ibid)

Table No. 2.3

Summary of Installed RET Systems

RET	No.	Capacity	No. of Districts
Hydro power			
Small hydro	26	76.72 MW	
Mini hydro	40	14.95 MW	31
Micro hydro	864	14.75 MW	59
Pico hydro	1,262	2.45 MW	53
Improved water mill	7,686	-	46
Biogas			
Household	238,587	-	72
Community	61	-	20
Institutional	111	-	25
Solar PV			
Household	227,039	6.31 MWp	74
Institutional	259	-	42
Water pumping	79	-	26
Wind			
Off-grid	26	8.6 kW	11
Biomass			
Improved cooking stoves	560,167	-	48

Source*: (AEPC, 2009)*

Table No. 2.4

Composition of NEA's Installed Capacity

Source	MW	% of Total
Major Hydro (NEA) - grid connected	472.99	67.0
Small hydro (NEA) - isolated	4.54	0.7
Total hydro (NEA)	**477.53**	**67.7**

Hydro (IPP)	174.53	24.7
Total hydro (Nepal)	**652.06**	**92.4**
Thermal (NEA)	53.41	7.6
Solar (NEA)	0.10	0.0
Total capacity including private and others	**705.57**	**100.0**

Source*: (NEA, 2011)*

Table No.2.5

Solar PV Capacity in Nepal

End-Use	**Name**	**Capacity kW**	**Remarks**
Lighting	Kodari	30	Nepal Electricity Authority owned.
	Gamgadhi	50	Nepal Electricity Authority owned.
	Simikot	50	Nepal Electricity Authority owned.
	Pulimarang	2	A NGO – Private initiative
Repeaters	Civil Aviation	9	43 Stations
	Telecommunications	162	16 Stations
Water Supply	Kirtipur	40	Drinking Water Pumping
	Bhaktapur	4	Drinking Water Pumping
	Others	1	Drinking Water Pumping
Total		**348**	

Source*: (Neupane, 2008)*

2.5 Indicative Potential Energy in Nepal

Compared to other countries in the world, Nepal has made significant progress in developing and using water resources for producing power. Mostly Nepal is investing on micro hydropower over the past three decades. Currently there are over 900 micro-hydro installations in the private sector in about 59 of the 75 districts of the country

Table No. 2.6

Indicative Potential Energy in Nepal

S.N.	Energy type	Potential
1.	Solar Energy	26000 MW
2.	Wind energy	200 MW
3.	Hydropower	Theoretically 83GW, Practically 25000 MW
4.	Fuelwood	7 metric ton
5.	Biogas	About 200000 plants of 10 cu.m size at existing livestock population

Source: (Upadhaya, 2008)

2.6 Energy use in Nepal

Nepal is a developing country with very low energy consumption rate compared to other developing and developed countries. Nepal relies to a large extent on the traditional energy resources as no proven significant deposits of fossil fuel are available. While studying the use of energy sources87.71% of the total consumed energy is being fulfilled by traditional energy source like fuel wood, animal residue and agricultural residue. The share of commercial fuel type is 11.76% out of which the share of petroleum products is 8.1%, share of coal is 1.76% and share of electricity is 1.82%. And the renewable energies like biogas, micro hydro, solar and other technologies come to 0.53% (WECS, 2006, p-30). The continuous population growth of the country and unavailability of other affordable fuel supply within the region is creating an excess pressure upon the forest and agricultural products thus decreasing their sustainability and impact upon the environment.

Nepal has a high potential for harnessing solar energy. As per an estimate by WECS (1995), 78 percent lies in high potential solar insulation areas. The average insulation is around 4.5 kWh/m2/day and the sunshine for about 300 days per year is sufficient for most small scale application. The monthly daily global solar radiation varies from 120 to 260 w/m2 with the annual sun shine duration ranging from 1900 to 2500 hours *(Rijal, 1984)*

Fuelwood extraction may not be the only cause of deforestation but deforestation is definitely causing fuelwood crisis. With fuelwood crisis, the consumption of agricultural residues for energy purposes has also increased resulting

in falling production, encroachment of marginal land for farming, exposure to the risks of soil erosion and further degradation in crop productivity and biomass supply.

Table No.2.7

Status of solar energy in Nepal

S.No.	Activities	Progress	
		2009/10	2010/11
1	Solar Dryer/Cooker distribution (Nos.)	318	18
2	Global gas plants Installed (Nos.)	19,511	6,774
3	Improved (iron) cooking stoves Installed	8,000	1,537
4	Improved (clay) cocking stoves Installed	60,000	28,529
5	Solar Home Energy System Installed (Nos.)	36,135	41,884
6	Improved Water Mills Installed (Nos.)	986	243
7	Micro Hydro Electricity Production (Kilowatt)	867	3,660
8	Research Related with Alternative Energy	13	-
9	Training Related with Gobar Gas Technology	23,106	-
10	Micro Hydro Electricity Plant	828	-
11	Solar Lamp	-	4,077

Source: (MoF, 2010/11)

The overall energy consumption of Nepal is largely dominated by the use of traditional non commercial forms of energy such as fuel wood, agricultural residues and animal waste. The total energy consumption in 2008 was 6.542 million ton oil equivalent (MoF, 2008) of which traditional fuel accounted for 85.0% and the commercial fuels accounted for 14.4% and renewable 0.60%. The major supplies of energy are fuel wood (75.0%), agricultural residues (4.0%) animal dung (5.86%), Petroleum fuels (9.8%), coal (2.3%) and electricity (2.6 %). The country does not have proven and significant deposits of fossil fuel and hence relies heavily on the traditional energy sources such as fuel wood, agricultural residues and animal waste. Less than 2 % Nepal's total energy demand is being met by electricity and 9.8 % by petroleum products. This has led grave consequences on ecological and

environment degradation as well as difficulties in the balance of payment. The country has to spend about 40% of its total income generated through its overseas exports for importing commercial energy sources. Due to lack of much industry, Nepal has a very low per capita energy consumption of only 15 GJ and is one of the least energy consuming countries in the world. (Shrestha, 2010)

CHAPTER-THREE

RESEARCH METHODOLOGY

3.1 Research Design

With the view of achieving research objectives, the design of this study was based on both descriptive and exploratory ways with the help of various research tools and techniques. The study was explored and describes the socio-economic impact of solar energy: a case study of Kharigaira VDC, Dailekh. It was also explore both prospects and challenges of the strategies adopted by them. Data was taken from survey method. Primary and secondary data collected and analyze and interpreted for the final presentation. This research would yield more valid data of the solar energy of the study area.

3.2 Rationale of the study area

This study was focused in the socio-economic impact of solar energy of Kharigaira VDC, Dailekh district. The solar energy consumption just uses their people. The area has been selected due to it's describe socio-economic impact and help to development activities. This district lies on mid western development region in Bheri zone. The user population of are high in this VDC in comparison to other. So, this research study is significant to be carried out which was contribute in planning and reforming their socio-economic on development.

3.3 Sampling procedure

This study emphasizes the socio-economic impact of solar energy of Kharigaira VDC, Dailekh district. The sampling procedure was done selecting certain number of solar energy users among the solar energy using population of the VDC. Therefore sample taken has the representation of the solar energy users in the VDC. The names of the selected households are transformed into household's survey and the houses of those owners are searched randomly for concluding.

The study concerns to focus on the socio-economical impact of solar energy of Kharigaira VDC, Dailekh. The total households of Kharigaira VDC are 739. Out of them, total solar energy users households are 251. I have selected 40 samples of solar energy users out of 251 HHs, Which is 15.93% of the total consumer of solar energy users in the VDC.

3.4 Sources of data collection

This study aims to explore the socio-economic impact of solar energy on development. This primary data was collected from the solar energy user House hold survey of the study area. Similarly, the secondary data were also used for the study, which data was collected from published or unpublished written documents from individuals, experts and organization related to solar energy.

3.5 Data collection tools & technique

To generate the primary data, structured questionnaire, semi or unstructured interview, and observation as well as focus group discussion method was applied.

3.5.1 Questionnaire survey

Structured questionnaire was prepared to generate the realistic and accurate data from HHs survey of the solar energy user house hold. The responding was requested to fill up the questionnaire. In case of the respondent for who cannot feel questionnaire, the questions were asked to the respondents and answers were filled up to collect the required data.

3.5.2 Field visit and observation

Each house hold selected in sampling was visited and solar energy plant was observed. The data were recorded while observing the household impact, solar panel, lamp, charging time, lighting time, etc.

3.5.3 Key information interview

The primary data were also collected from the key informants using the semi or unstructured interview method. The interviews were taken as cross checking for data obtained from questionnaire. .This information was taken to collect solar energy users, social workers, policy makers, teachers and village development committee secretary.

3.5.4 The focus group discussion

The focus group discussion was held in separate ward with the active participation of women's, man, school children, teachers, stockholder and other. This discussion focused more women participation in solar energy, impact of solar

energy, children in their activities, the problem they were facing and on more issues.

3.6 Process of data analysis

The study was based on primary and secondary data, which were collect through the field survey, from the respondents and key informants from the selected area. Data were analyzed with the help of computer manual charts, tables, diagrams, graphs and statistical tools & many more. Descriptive method was used for qualitative data.

3.7 Presentation of data

The collected & recorded primary & secondary types of data & information during the study were processed through the different ways like validation, editing & coding at first & secondary mean, median and mode for the livelihood pattern, educational attainment demographic & so as economic information of the study area, graphs & charts for the trend analysis of the collected data. However, it is supposed that study proves to be representative.

CHAPTER-FOUR

DATA PRESENTATION AND ANALYSIS

4. DESCRIPTION OF THE STUDY AREA

4.1 Dailekh District

Dailekh district is one of the remote hilly districts of Bheri zone in mid-western development region, Nepal. This district is surrounded by Jajarkot district in the eastern part, Achham in the west, Surkhet in the south and Kalikot district in the north. The district headquarter of Dailekh is Dailekh Bazaar, that lies almost in center of the district. This district is divided into 55 village development committees and a municipality.

According to district demographic profile of Dailekh (CBS, 2011), total population of the district is 2, 71,416. Total number of households in the district is 49,647 and average household size is 5.47 whereas population density is 181 per square kilometer. The literacy rate of the district is 48 percent in which male literacy rate is 64.7 percent and female literacy rate is 32.3 percent. This district is categorized in "...the 63th number on national human index and 64th number on poverty ranking at national level"(CBS, 2011).

4.2 Kharigaira VDC

Kharigaira VDC lies ten kilometer north-west from the district headquarter of Dailekh. Narayan municipality lies in the east, Badakhola and Bansi VDCs in the west, Raniban VDC in the north and Badakhola VDC and Narayan Municipality in the south. Kharigaira VDC consists of nine small villages, which exist as separate wards. Most of the parts of the village face south. The VDC has got dry and windy climate in its northern part but the southern part is fertile. The main occupation of the villagers is agriculture. But their production is not sufficient for the whole year. So, many of the villagers go to India temporarily for works. They mostly go to India for works in the winter because they don't have works to do and return in the summer with little amount they earned working as labourer in India. But, some are job holders and a few are businessmen too. In this village, there are the people from different casts like Brahmin, Chhetri, Magar, Thakuries, Ethnic Groups and Dalit. The main crops of the village are wheat, maize, millet, rice, barley, potato, pulses, green vegetables etc.

4.2.1 Population

According to the VDC household survey Profile 2066, the total number of houses in Kharigaira VDC is 739. In the village total population is 4607. Out of them, male population is 2293 and female population is 2314. In the village there are 44 houses of Brahman, 257 houses of Chhetri, 97 houses of Thakuries, 207 houses of Dalit and 134 houses of ethnic group of people. In the village the average number of population per family is 6.23. (VDC profile, 2010)

4.2.2 Education

There are six government schools in the VDC. Among them, one is higher secondary school, two are lower secondary schools and three are primary schools. In the village there is a primary level boarding school too. Total number of students studying in all these schools is 1473 in the year. The total number of teachers working in these schools is 39 except in the boarding school. The VDC, DDC and other I/NGOs have been running some adult literacy classes too. There are some social clubs working for the welfare of the society, public awareness and educational upliftment. The literate population is 48 percent in the VDC. (ibid)

4.2.3Transportation

There is a local road to join the VDC with the district headquarter and other villages but regular bus service is lacking till now. People transport their goods by tractors and mules. In the local area, they carry the loads on their backs.

4.2.4 Energy use

Though it is the VDC that touches Narayan municipality, the municipality having the district headquarters, Kharigaira VDC has not electricity access. They use kerosene lanterns, torchlight and solar energy for lighting. Most people use firewood for cooking. Kharigaira VDC is attached with many community forests which make people easy access to firewood and the main sources of firewood are the community protected forests. Nowadays, many solar companies and I/NGOs are encouraging people to use solar energy. Due to their financial support and awareness programs in the village, many people are encouraged to use them. In the night, when they install solar energy then they are using solar lighting and working for longer hours doing different households activities. In comparison to other forms of energy, solar energy has no or less side effects. In this village out of 739 houses, there are 251 houses using solar energy. In this village solar energy is used for the purpose of lighting, playing cassette players and charging mobile batteries.

4.3 Description of the sample household's characteristics

Kharigaira VDC lies ten kilometer north-west from the district headquarter of Dailekh. The VDC has got dry and windy climate in its northern part but the southern part is fertile. The main occupation of the villagers is agriculture. But, some are job holders and a few are businessmen too. In this village, there are the people from different casts like Brahmin, Chhetri, Magar, Thakuries, ethnic groups and Dalit. The main crops of the village are wheat, maize, millet, rice, barley, potato, pulses, green vegetables etc.

This research was conducted in the research area to study the consumption of solar energy and its impacts in the lives of the people living there. The finding of socio-economic characteristics of the sample household is described below:

4.3.1 Use of solar energy

Solar energy is energy or power created by using the heat of the sun. This is done by capturing the solar rays provided with daylight via photovoltaic cells, better known as solar panels. Solar panels can be installed just about anywhere and will function best with an unobstructed view of the sun. The panels convert the energy to electricity that either powers a machine or charges a battery for later energy use.

Table No.4.1

Use of solar energy in the VDC

S. No.	Ward No.	Total Household	percentage	services by solar energy	percentage	non access of solar energy	percentage
1	1	118	15.97	61	24.3	57	11.69
2	2	98	13.37	38	14.3	62	12.72
3	3	109	14.96	43	17.2	66	13.52
4	4	66	8.45	23	9.2	43	8.81
5	5	72	9.26	29	7.4	53	10.86
6	6	63	8.64	11	4.4	52	10.65
7	7	66	8.45	11	4.4	55	11.27
8	8	79	10.9	34	13.6	45	9.21
9	9	68	9.4	13	5.2	55	11.27
	total	739	100	251	100	488	100

Source: VDC Profile, 2012

In the Kharigaira VDC of Dailekh district, there have total No. of HHs is 739. In the VDC 251 HHS have installation of solar energy out of 739. 488 HHs have not

installed of solar energy and they are used kerosene lamp, torch light, pine and etc. In Kharigaira VDC, ward Number one have high installation of solar energy which is 118 HHs. But in the ward number 3, number of 66 HHs has not installation of solar energy.

4.3.2 Main cause for installation of solar energy

Solar energy means using energy of sunlight to provide electricity, to heat water, and to heat or cool homes, businesses or industry. Sunlight is a clean, renewable source of energy. It is a sustainable resource, meaning it doesn't run out, the supply can be maintained. Coal or gas is not sustainable or renewable: once they are gone, there is none left. More and more people want to use clean, renewable energy such as solar, wind, geothermal steam, hydro-electricity and others. It is sometimes called 'Green Power'.

Now a days, solar energy is demanded by rural and some urban people. In Nepal, solar energy has been in use for domestic electrification. It is the simple energy technology. It doesn't affect of human life and environment. In the study area after analysis of the qualitative data shows that the respondents experience positive effect of solar energy due to the reduction or elimination of kerosene consumptions, improvement in their life standard, improvement in education, health, income generation(some use of electric business) activities, in-house environment , entertainment and get information. Their satisfaction can be caused by the following observation made by them.

- Saved cost on kerosene purchase
- Facilitated study particularly of children
- Reduced health problem
- Reduced eye problem
- Get healthy, clean and environment friendly atmosphere in the house
- Electric shop
- Leisure time to do work in night time
- Enjoy with radio and cassette player

- Relived from smoke of kerosene light
- More lighting then other light
- Use of mobile charging
- Not effect of on the water raining

4.3.3 Lunching company in the study area

Solar energy used mostly for lighting purpose and also for listening radio, playing cassette player, charging mobile and telephone. In the study area, there are four different companies have been lunching their program since 2066. These companies and service centre's are as follows:

1. Bio- Energy Pvt .Ltd
2. Dhaulagiri Energy Pvt .Ltd
3. Suryodaya Pvt .Ltd
4. Surya Energy Pvt .Ltd

Among these companies, most popular and frequently service-providing companies are Bio-Energy, Suryodaya and Surya Energy Pvt. Ltd. Dhaulagiri Energy Company is in less use; installed in 15-20 HHs.

4.4.4 **Family size**

Household size has significant role in the energy consumption. It is found that higher the HHs size, higher is the energy consumption and the lower the HHs size, lower is the energy consumption. This means, with the increase in HHs size, the energy demand also increases.

Table No. 4.2
Distribution of family size of sample HHs

S. No.	Family Size	No. of Households	Percentage
1	3-5	4	10
2	5-7	18	45
3	7-9	14	35
4	9-11	4	10
5	11& Above	0	0
	Total	40	100

Source: Field Survey, 2012

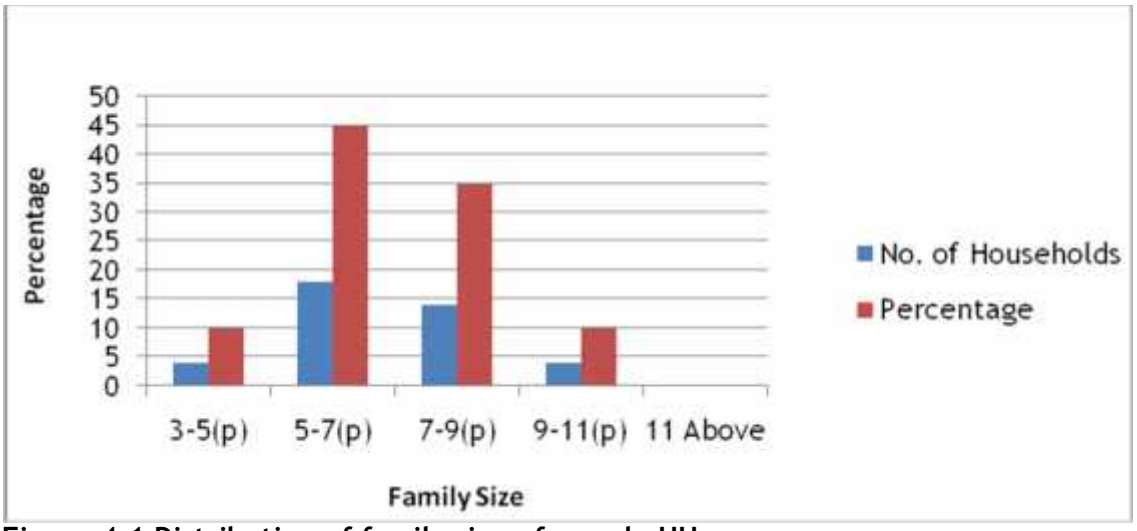

Figure-4.1 Distribution of family size of sample HHs

The table above shows that the average family size 5-7 per family is in the greatest household numbers (18 households). It's about 45% of the total households. 35% of the respondents' families have 7-9 members in their family whereas the families are having totaled family members 3-5, and 9-11 have the equal percentage i.e.; 10%. According the given table, the highest family size among the respondents is 9-11 and the smallest family size is 3-5.

4.5.5 Caste / ethnicity

In the study area, solar energy has been increasing day by day. The study states the most benefitted respondents by the solar energy. In the VDC, there are many different castes like Brahman, Chhetri, Magar, Thakuries, and Dalit etc. In this VDC, 251 households have installed SE. Among them, the sampling HHs installing solar energy by ethnicity presented in the table below:

Table No. 4.3

Caste-wise structure of sample HHs

S. No.	Caste structure	No. of household	Percentage
1	Brahman	4	10
2	Chhetri	26	65
3	Magar	4	10
4	Thakuri	2	5
5	Dalit	4	10
	Total	40	100

Source: Field Survey, 2012

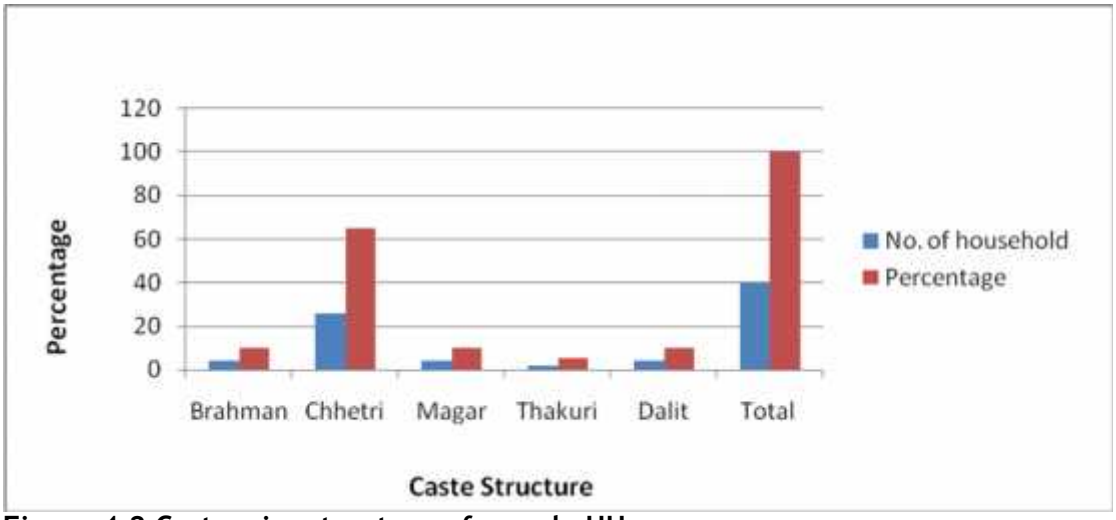

Figure-4.2 Caste wise structure of sample HHs

Table No. 2 shows that 65% of the Chhetries have installed the solar energy. Brahman, Magar and Dalit have equal number of SE consumption; 10% each and the Thakuries SE installation percentage is 5%.

The table shows that the number of Chhetries using solar energy is high. It's because most of the Chhetries and their house-heads are engaged in several economic activities like service sector, business and are getting post-service pension. When there is sound economic status, there is high demand of the modern facilities like light, furniture, better dress, and other things of luxury. Chhetries in this study area also demand and use more solar energy because they need eco-friendly light. Thakuries using solar energy are less in number due to the number of households and population in my sample HHs. Among Brahman, Magar and Dalit some of them are job holder. So they are also interested to install solar energy.

4.3.6 Sample structure

Table No. 4. 4

Structure of ward wise sample HHs

S. No.	Ward No.	No. of household	Percentage
1	1	10	25
2	2	6	15
3	3	6	15
4	4	4	10
5	5	3	7.5
6	6	2	5
7	7	2	5
8	8	5	12.5
9	9	2	5
	total	40	100

Source: Field Survey, 2012

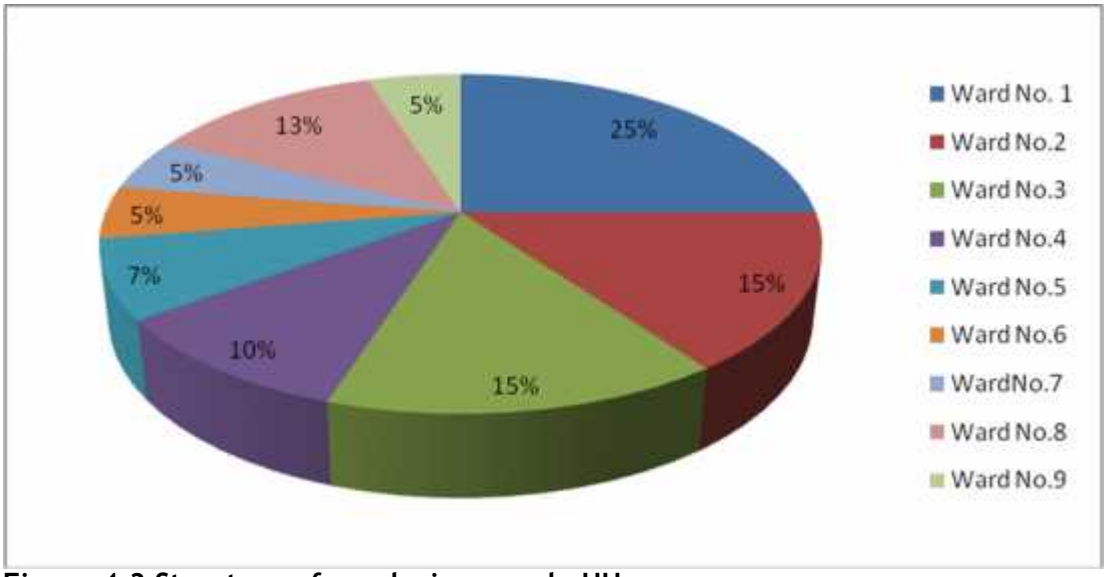

Figure-4.3 Structure of ward wise sample HHs

The table shows that Ward No. 1 is 25% of my sample method. Ward No. 2 and 3 are 15%, Ward No. 4 is 10%, Ward No. 5 is 7.5%, 6, 7, 9 are 5% and Ward No. 8 is 12.5% of my sample method.

4.3.7 House structure Table No. 4.5

House structure of sample HHs

S. No.	House structure	No. of household	Percentage
1	Stone, mud and tin	23	57.5
2	Stone, mud and straw	16	40
3	Cemented	1	2.5
4	Small huts(thatch and mud)	0	0
	Total	40	100

Source: Field Survey, 2012

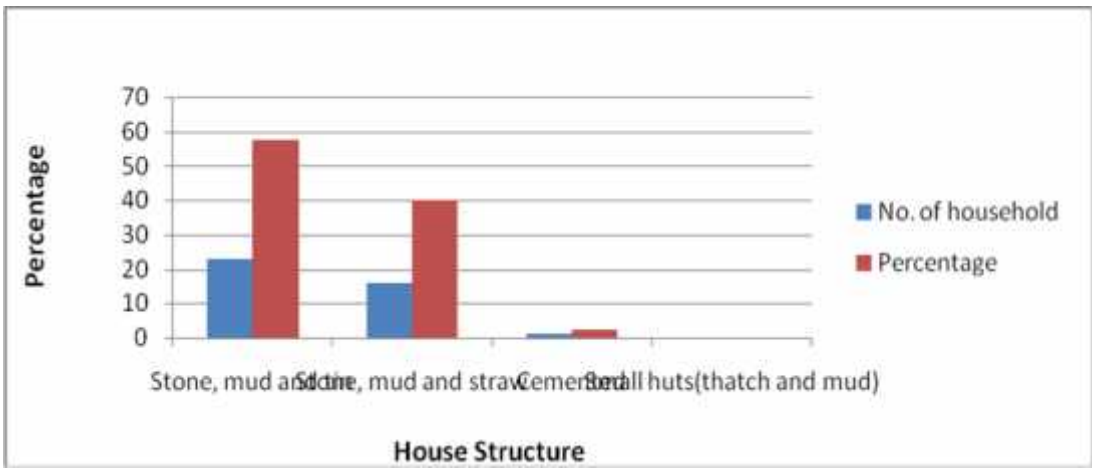

Figure-4.4 House structure of sample HHs

The table shows that 57.5 % family respondents live in stone, mud and tin house structure, 40% live in structure of stone, mud and straw and 2.5 % live in cemented house. The table says that 40% is of the high people in stone, mud and straw house structure. Many people in Nepal live in village and they live in the houses made of stone, mud and straw.

4.3.8 Reason for choosing the solar energy

Solar energy is the renewable energy. It is important in the context of Nepal. In the village, there is no access of national electricity grid neither there is any local electricity project. Therefore solar energy is the most important light of the Nepalese villages. In my study area, people reason that solar energy is easy and safe to use, it's free from smoke and pollution; and it's a renewable source of energy. That's why the villagers in Kharigaira VDC are lured towards solar energy use.

Table No. 4.6

Reason to like the solar energy

S. No.	Reason to like	No. of household	Percentage
1	More attractive	25	62.5
2	Low effective less costly	0	0
3	Solar energy has less side effect	0	0
4	Government gives the subsidy	15	37.5
	Total	40	100

Source: Field Survey, 2012

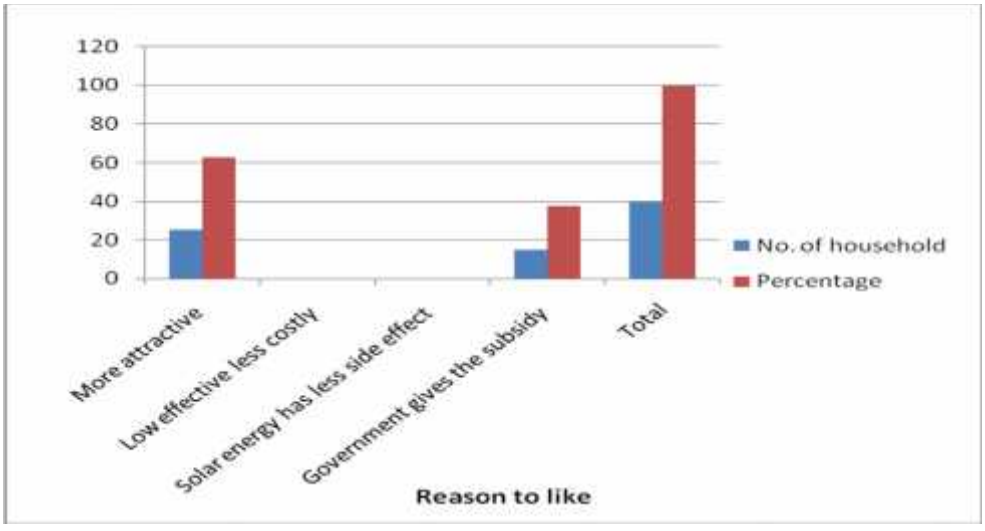

Figure-4.5 Reason to like the solar energy

The given table indicates that 62.5% or 25 samples HHs like solar energy because the solar energy is more attractive than other energy resources. 15 HHs or

37.5% respondents like the solar energy because government gives the subsidy for installing solar energy in my sample household survey in the VDC.

4.3.9 Compared light

In every country people use solar energy in their villages. Similarly in the context of Nepal, almost people in the village use solar energy. They are out of access of market and electricity because there is not good access of road infrastructure.

Table No.4.7

Compared light of HHs respondents

S. No.	Compared light	No. of household	Percentage
1	Same	0	0
2	Solar energy brighter	40	100
3	It is less brighter	0	0
	Total	40	100

Source: Field Survey, 2012

The above table indicates that all 100% household sample respondents are think that solar energy is brighter than other local energy resources to their compared light because natural energy or other energies have thrown carbon and they need to buy every day. When they have no money to invest for other energies, they do not buy energy resources. Therefore they like to use solar energy as a brighter and permanent resource.

4.3.10 Health

Health is the most important part of life. The study has shown that solar energy has positive impacts on health of the respondents. Solar energy doesn't emit harmful gases and other pollutants. Neither is throws smoke that makes breathing difficulty leading to lungs diseases. When they use solar lamp, their health problems are reduced and they enjoy healthy life.

Table No4.8

Reduced health problem of sample HHs

S. No.	Reduced health problem	No. of household	Percentage
1	Yes	32	80
2	No	8	20
	Total	40	100

Source: Field Survey, 2012

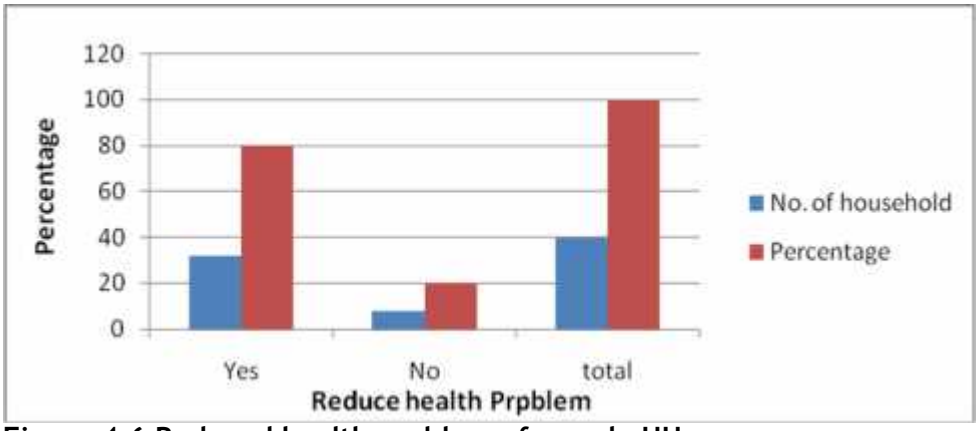

Figure-4.6 Reduced health problem of sample HHs

The table indicates that the 80% sample households think the solar energy reduced health problem and 20% think that solar energy does not reduce health problems. According to the study, the respondents giving positive answers were well educated people or literate ones whereas illiterate people responded negatively.

4.3.11 Think price of SE

Table No.4.9

Think about price of SE of sample HHs

S. No.	Think of price	No. of household	Percentage
1	Low	2	5
2	moderate	23	57.5
3	high	15	37.5
	Total	40	100

Source: Field Survey, 2012

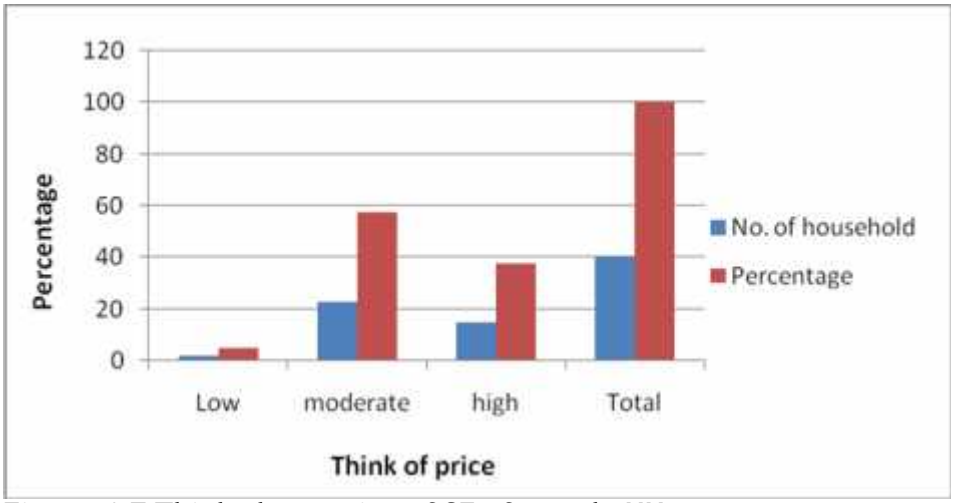

Figure-4.7 Think about price of SE of sample HHs

Above table shows that 5% respondents think that solar energy has got low price, 57.5% think that the price of solar energy is moderate and 37.5% think that the price of solar energy is high. Then we can find out most of the samples of respondents are rich. It is so because they can freely invest for the solar energy. In comparison to the respondents finding the price of solar energy low, the price of SE is moderate for few people.

4.3.12 Helping micro finance

In the context of Nepalese villages or remote area, there is not an easy access of the established micro finances. It has made the areas backward in infrastructure. Lack of infrastructure has made the villages backwards. But there are individual finances and the money lenders in the villages like Aasami, sahu etc. Though they charge high interest, they help their rural people in need.

Table No. 4.10

Helping micro finance of sample HHs respondents

s. No.	Helping micro finance	No. of household	Percentage
1	Yes	4	10
2	No	36	90
	total	40	100

Source: Field Survey, 2012

The table shows that 10% sample household respondents got the helping micro finance and 90% sample household respondents did not get the helping micro finance in the village because finance do not help them in providing necessary loan according to their demand.

4.3.13 Monthly income level

The income of HHs has a great effect on their living standard. It determines the resources mobilization, education and health. Generally, it is believed that high level of income increases the quality of life. In the study area, there are many sources of income such as economic activities like agriculture, business etc., social activities like road/building construction, social club formations and their economic activities etc., political activities like active participation of people in politics, their development plans and activities etc., government job and others. The monthly income level of sample HHs is shown in the table below.

Table No. 4.11

Distribution of respondent in monthly income level

S. No.	Income level (Rs.)	No. of respondent	Percentage
1	5,000-10,000	9	22.5
2	10,000-12,000	10	25
3	12,000-15,000	14	35
4	15,000 above	7	17.5
	Total	40	100

Source: Field Survey, 2012

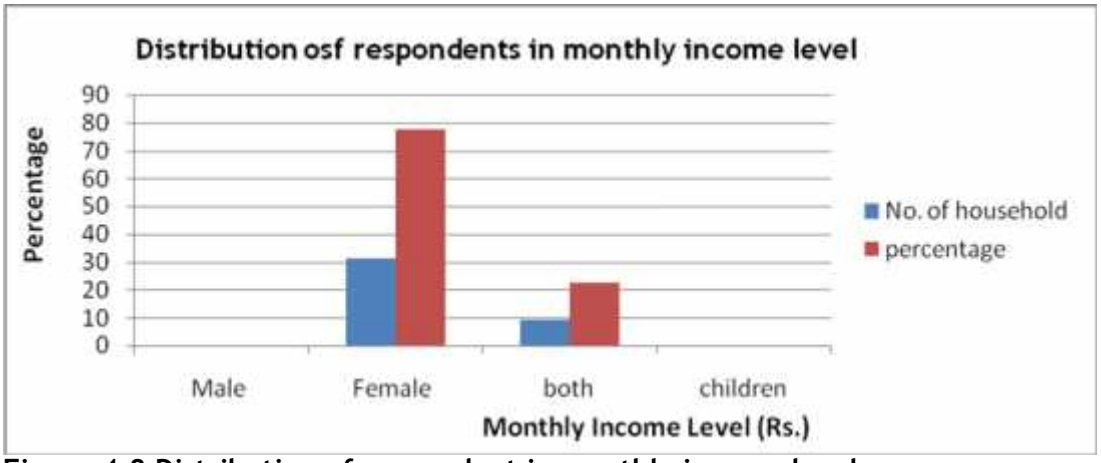

Figure-4.8 Distribution of respondent in monthly income level

The table shows that most of the respondents (35%) have monthly income level between Rs. 12,000 to Rs. 15,000 and about (25%) of the sample HHs have monthly income between Rs. 10,000 to Rs. 12,000. Similarly, 22.5% of the total respondents have Rs. 5,000- Rs. 10,000. About 17.5% of the respondents have monthly income level of Rs. 15, 000 above.

It was found that majority of survey the HHs have moderate income because mostly the household heads have moderate economic activities like small scale business, agriculture etc. It is suggested to the government to increase the subsidy amount for the installation of solar energy for economically deprived people in the area.

4.3.14 Monthly saving after installation of solar energy

Table No.4.12

Distribution of respondents in monthly saving money after installation of SE

S. No.	Saving money (Rs.)	No. of respondent	Percentage
1	300-500	29	72.5
2	500-700	11	27.5
3	700-1,200	0	0
4	1,200 above	0	0
	total	40	100

Source: Field Survey, 2012

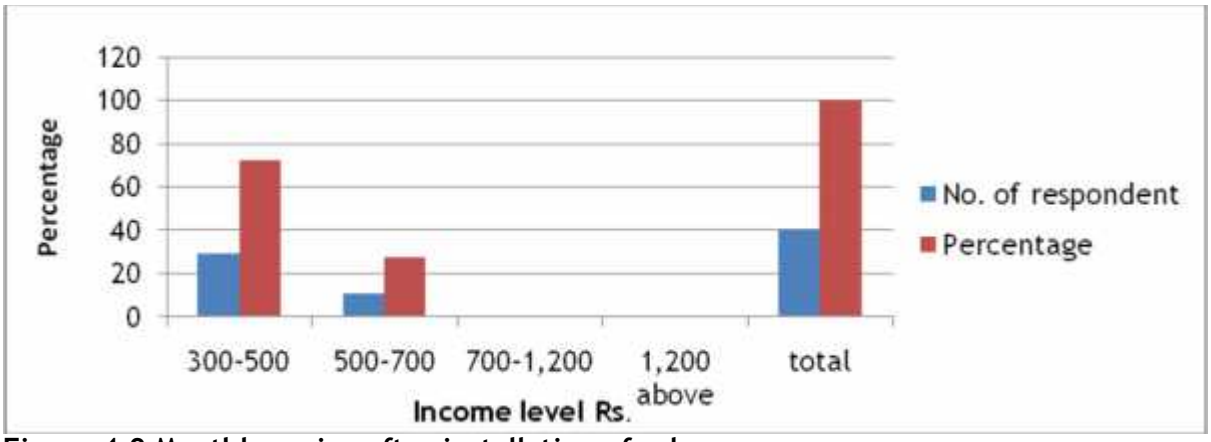

Figure-4.9 Monthly saving after installation of solar energy

The table shows that 72.5% respondents are saving Rs. 300-500 in the monthly basis and 27.5% respondents are saving Rs. 500 –700 per month after installation of solar plants. Total 29 respondents answered that they don't have much saving because they don't have better economic practices and activities. 11 respondents have somehow better saving in comparison to the others after installation of solar energy. According the table above, the highest saving per month is between Rs. 500 to 700. No one saves more than Rs. 700 per month. It shows that income level of the people in Kharigaira VDC in Dailekh is less in comparison to national income and saving of the country.

4.3.15Occupational structure

Occupation is one of the important indicators of the economic status of the people. It also determines the HHs wealth, well-being and stigma and plays vital role in energy consumption pattern. If the people are jobholders or businessmen,

they use the modern sources of energy like LP gas, solar electricity, bio-gas etc. The given below table shows the occupational structure of the respondents:

Table No. 4.13

Occupational structure of the sample HHs

S. No.	Occupation	No. of household	percentage
1	Political activities	2	5
2	Social activities	7	17.5
3	economic activities	31	77.5
	Total	40	100

Source: Field Survey, 2012

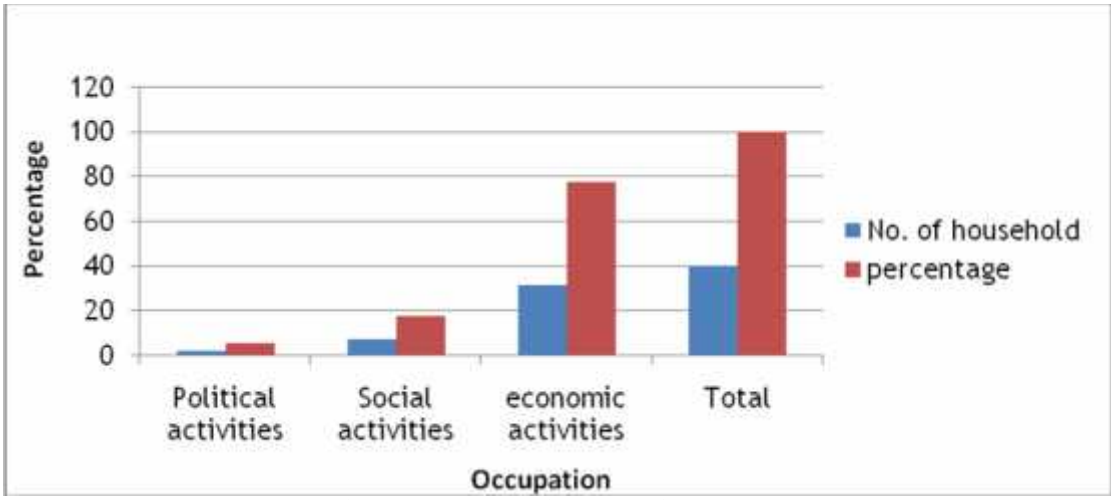

Figure-4.10 Occupational structure of the sample HHs

The table shows that 77.5% of sample HHs are involved in economic activities, 17.5% of sample HHs are involved in social activities and 5% sample HHs are involved in political activities. It indicates that in the VDC, there are almost the people involved in economic and agriculture activities.

4.3.16 Cooking purpose

Cooking purpose is very important in our daily life. We are working in energy sectors because when we income the money, we can get some materials for cooking purpose. Use of solar energy is not found for cooking purpose in my study area. Distribution of sample households by SE of cooking purpose can be studied in the following table:

Table No. 4.14

Distribution of sample household by SE of cooking purpose

S. No.	Cooking purpose	No. of household	percentage
1	Firewood	40	100
2	Croup residue	0	0
3	Dung	0	0
4	Solar energy	0	0
	Total	40	100

Source: Field Survey, 2012

The table shows that 100% respondents in the sample area use firewood for the purpose of cooking in place of solar energy. They are using solar energy only for lighting, battery charging, and radio listening and mobile charging purpose.

4.3.17 Highly benefited of solar energy

Table No.4.15

Distribution of sample household of highly benefited by SE

S. No.	Advantage group	No. of household	percentage
1	Students	17	42.5
2	Other members	1	2.5
3	both	22	55
	Total	40	100

Source: Field Survey, 2012

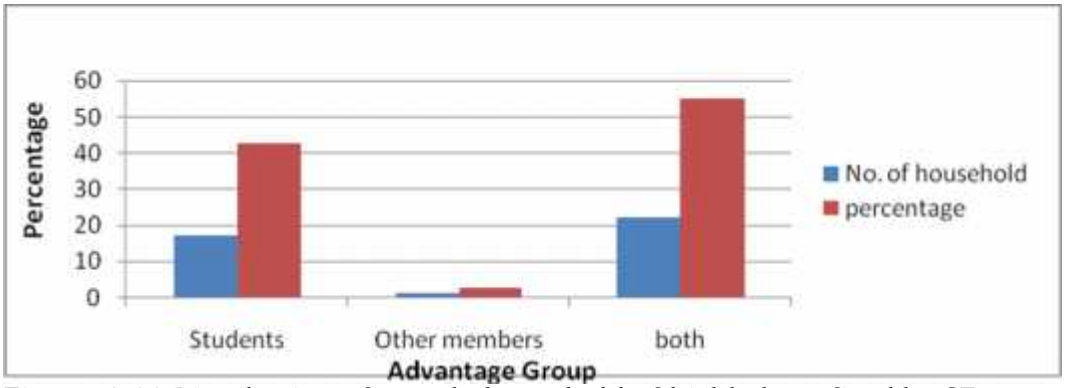

Figure-4.11 Distribution of sample household of highly benefited by SE

The table shows that 55% or, 22 sample households are highly benefited by solar energy. There are 42.5% or 17 households moderately benefited by solar energy and 2.5% or 1 household is less benefited by the solar energy.

In every house, there are many students using light in night for reading books but the respondents say that both students and other members are equally benefited in the family because they are working for every purpose in the night.

4.3.18 Purpose of solar energy

Solar energy is the radiant energy produced by the sun. It produces both light and heat. It is easily available in the environment. In comparison to other secondary solar-powered resources such as wind and wave powers, solar energy is easily available and could easily be changed into energy. There are several purposes of using solar energy in the study area. The distribution of sample household and their purposes of using solar energy are as given below:

Table No. 4.16

Distribution of sample household of purpose by SE

S. No.	Purpose	No. of household	percentage
1	Cooking	0	0
2	Lighting	40	100
3	both	0	0
	Total	40	100

Source: Field Survey, 2012

The table indicates that all 100% of the sample HHs' using solar energy purpose is lighting because they have not high watt of batteries. In the hilly regions, they use solar energy only for lighting purpose because they have not enough money to buy high powered solar panels & batteries. They have more wood and big community forest too. They are habituated in using firewood for kitchen purpose. So, they install only low watt solar panels.

4.3.19 Satisfaction with solar energy

Table No. 4.17

Distribution of sample household to satisfy by SE

S. No.	satisfaction	No. of household	percentage
1	Yes	28	70
2	No	12	30
	Total	40	100

Source: Field Survey, 2012

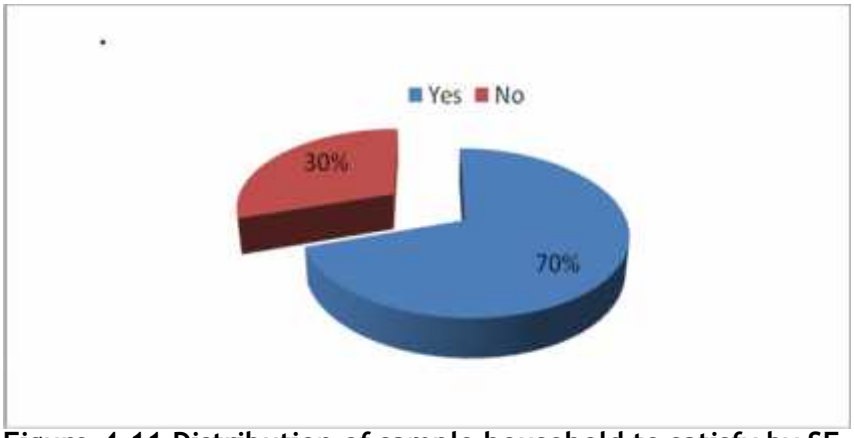

Figure-4.11 Distribution of sample household to satisfy by SE

The table above indicates that 70% sample households of the respondents are satisfied with solar energy. 30% are not satisfied from solar energy because some respondents thought that solar energy damaged fast and it was difficult for them to repair or get the technicians easily. 12 respondents are not satisfied with solar energy. They responded that solar energy was expensive to install, difficult to repair and difficult to keep protected for long. Moreover, they reacted that they could run their family business with the money they invest for solar energy.

4.3.20 Change the study time of students

Table No.4.18

Distribution of sample household to change the study time of students

S. No.	Study time	No. of household	percentage
1	1hrs	12	30
2	2hrs	26	65
3	3hrs	2	5
4	4hrs	0	0
	Total	40	100

Source: Field Survey, 2012

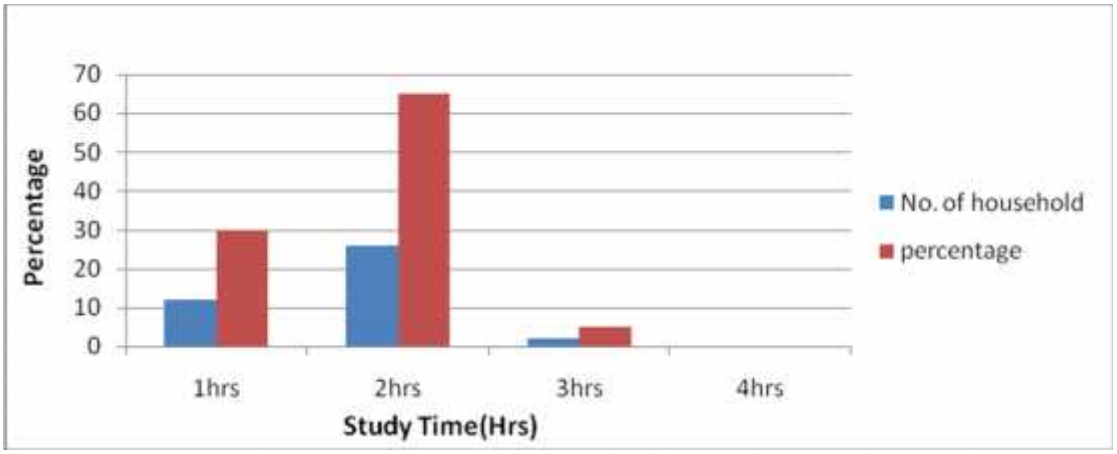

Figure-4.13 Distribution of sample household to change the study time of students

When respondents installed the SE, they get many benefits from it. SE has brought some changes in their daily routing as well increased the study time of their children. Above table shows some changes in daily study time of children as answered by the respondents.

The table shows that 65% sample household students changed the study time of 2 hours. When there solar energy, they studied two hours more at night because they got light for longer hours, solar energy didn't harm their eyes and they could lit the bulbs according to their interest. Among 2/3 of the total households 30% sample household students changed their study time only by one hour and 5% changed their study time only by three hours. So the children were highly benefited by the solar energy use.

4.3.21 Access of telephone/mobile

Telephone/mobile is the most important means of communication at present. It is more helpful to business and for establishing relationship with families and other political, social activities. Distribution of sample household to access telephone/mobile is given in the table below:

Table No.4.19

Distribution of sample household to access of telephone/mobile

S. No.	Access T.\M.	No. of household	percentage
1	Yes	32	80
2	No	8	20
	Total	40	100

Source: Field Survey, 2012

The above table shows that 80% of the sample households' access was on telephone/mobile and 20% of the sample households were found having no access of telephone/mobile service. Except private mobiles/telephones, there are some PCOs in the village too. These PCOs provide communication facilities to the villagers.

4.3.22 Impact of solar energy

Solar energy helps conserving forests, reducing pollution and increasing healthy life-style. It reduces the use of firewood. Distribution of sample household of impact of SE on use firewood after installation is given in the table below:

Table No.4.20

Distribution of sample household of impact of SE on use firewood after installation

S. No.	Impact of S.E.	No. of household	percentage
1	Conservation of forest	4	10
2	No change	26	65
3	Further deterioration	10	25
	Total	40	100

Source: Field Survey, 2012

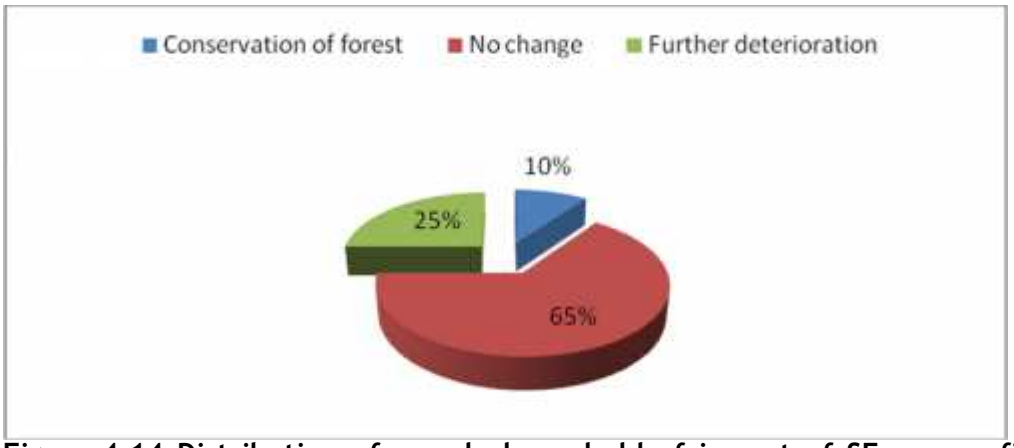

Figure-4.14 Distribution of sample household of impact of SE on use firewood after installation

The above table shows that 65% or, 26 sample households gave the views that there was no change in firewood consumption after the installation of solar energy. 25% gave the views that further deterioration of firewood after the installation of solar energy was the horrible condition. 10% or 4 sample households gave the views that conservation of the forest was possible only after the installation of solar energy. Therefore when the use of solar energy increased in the village, forest conservation got relief because many people used solar energy for the

purpose of lighting among the respondents. This use saved the consumption of firewood esp. pinewood.

4.3.23Collect firewood

Though solar energy was installed in many houses in my study area, they are still not using solar energy for cooking purpose. Rather they go to the community forest, collect firewood and use for cooking purpose. Distribution of sample household from collect sources of firewood is given in the table below:

Table No.4.21

Distribution of sample household from collect sources of firewood

S. No.	Source of firewood	No. of household	percentage
1	Government forest	0	0
2	Community forest	40	100
3	Private\ land forest	0	0
	Total	40	100

Source: Field Survey, 2012

The above table shows that 100% of the sample HHs collected firewood from their community forests. They have got a community forest near the village from where they collect firewood. They have not got government and private forest. Therefore 100% of the sample HHs' source of collecting firewood was the community forest as it is the most important part of their lives.

4.3.24 Responsible for collect firewood

Firewood collection was not only the responsibility of females in the village. Rather, both males and females used to go to the forest and collect firewood. Responsibility of collecting firewood is shown in the table below:

Table No.4.22

Responsible of collect firewood

S. No.	responsible	No. of household	percentage
1	Male	0	0
2	Female	31	77.5
3	both	9	22.5
4	children	0	0
	Total	40	100

Source: Field Survey, 2012

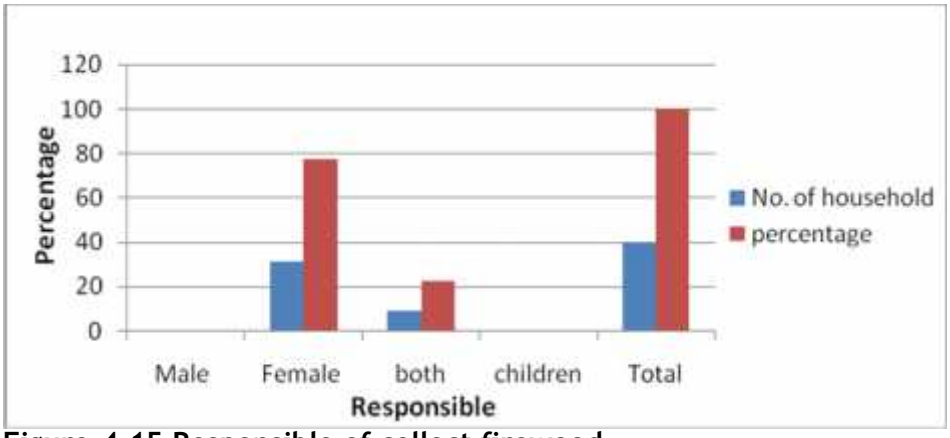

Figure-4.15 Responsible of collect firewood

Above table shows that 77.5% females were responsible for the collection of firewood and sample of 9 HHs or 22.5% of both males and females were responsible for the collection of firewood. Children are not involved to the collect firewood. Because they are small and they are students.

4.3.25 Life standard and prestige

Many of the respondents answered that installation of solar energy was the matter of prestige for them. For them, it increases life standard and prestige. Distribution of respondents of increase life standard & prestige after installation of SE in my study area is given in the table below:

Table No.4.23

Distribution of respondents of increase life standard & prestige after installation of SE

S. No.	Increase life standard and prestige	No. of household	percentage
1	Yes	30	75
2	No	10	25
	Total	40	100

Source: Field Survey, 2012

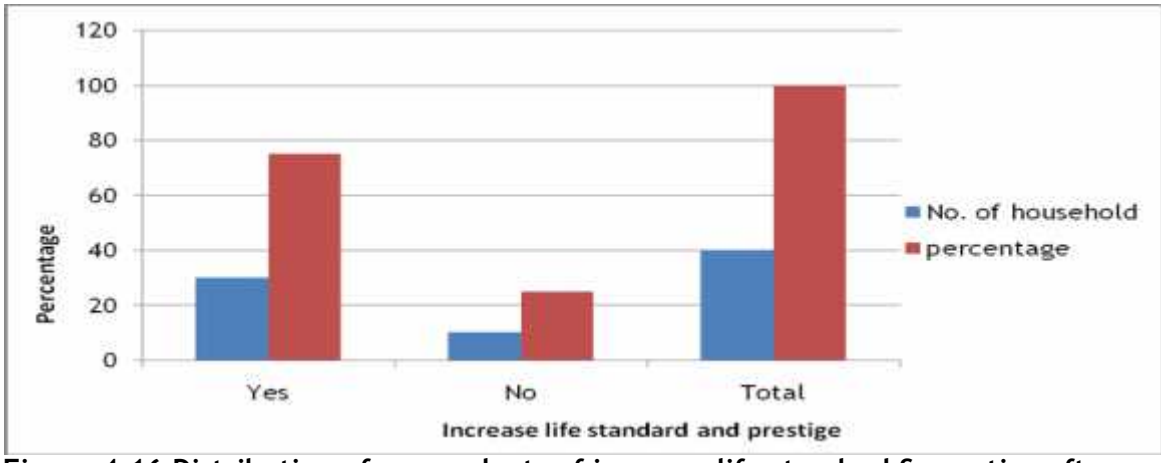

Figure-4.16 Distribution of respondents of increase life standard & prestige after installation of SE

The above table shows that 75% of respondents found installation of solar energy increasing their life standard and prestige. But 25% or 10 HHs respondents answered that it would not increase their life standard and prestige. According to the second group of respondents, they didn't mind either their life standard or prestige was increased after the installation of SE or not.

4.3.26 Environmental conservation

Environment is very important in our daily life. Solar energy helps for forest conservation when majority of the population use it. It is the renewable resource that can be reserved temporarily and used according to our need. It has not got the side effects either. The total number of respondents in my sample population answered that solar energy helps to the environment conservation. The answers of the respondents are shown in the table below:

Table No. 4.24

Help in environment conservation to use by SE

S. No.	Help in environment conservation	No. of household	percentage
1	Yes	40	100
2	No	0	0
	Total	40	100

Source: Field Survey, 2012

The table above clearly shows that 100% or all the 40 sample respondents thought that when the solar energy was used in the village, the SE helped for the environment conservation. When the SE was used, the air was not polluted.

Environment pollution decreased gradually because SE did not throw smoke while cooking. So, it helped a lot in environment conservation.

4.3.27 Solar energy use for entertainment before and after the installation

In human life entertainment is very necessary thing. Without entertainment, we can't live easily. So for the purpose of enjoyment, people use some equipments and means like Radio, cassette player, TV, memory card, mobile etc. For this purpose they purchase dry cell, battery etc. and charge them in SE for their use. In the study area, I found all of the HHs using radio and some of the households using cassette players too. Before the installation of solar energy, they used dry cell batteries for their entertainment. When they install solar energy, they are enjoying that equipment without dry cell batteries because they use solar energy for entertainment after installation of solar energy. It is clear that the purchase of dry cell battery is reduced.

UNIT-FIVE

USE OF SOLAR ENERGY AND ITS SOCIO-ECONOMIC IMPACT

In Nepal for a large part of the rural population consuming low electricity energy, there is no viable alternative to solar electricity for rural electrification. The operation and maintenance cost of diesel generators is too high, biogas technology does not work satisfactorily on the fairly cold high altitudes or in the mountains and would be difficult to achieve with roving herds of cattle. Small hydro turbines need specific topographical conditions that are only found near a small percentage of user's dwellings. Solar electricity is generating systems, which do not need fuel or extensive infrastructure, are easy and quick to install and thus could be very attractive option in many locations of the country. However, it cannot be claimed that solar electricity can solve rural electrification issues completely. Solar electricity too has limitations and problems but these can overcome with proper planning.

Photovoltaic (PV) solar cells directly convert sunlight into electricity. The simplest cells are used to operate wristwatches and calculators, and more complicated systems are used to light houses. PV cells are combined into modules called arrays, and the number of arrays used determines the amount of electricity produced. For example, a large number of arrays would be needed to generate electricity for a power plant. A power plant can also use a concentrating solar power system where sunlight is focused with mirrors to create a high-intensity heat source to produce steam or mechanical power to run a generator that creates electricity. There is no doubt that PV is an attractive source of electricity for many remote villages in Nepal, and thousands of houses are already enjoying this clean energy. In many cases, electrifying a village by PV is cheaper than extending the grid (by the way, the grid in the current situation is almost useless). But, it can be a long-term solution to the country of our Nepal.

Solar energy is energy or power created by using the heat of the sun. This is done by capturing the solar rays provided with daylight via photovoltaic cells, better known as solar panels. Solar panels can be installed just about anywhere and will function best with an unobstructed view of the sun. The panels convert the energy to electricity that either powers a machine or charges a battery for later energy use.

Silicon is mounted beneath non-reflective glass to produce photovoltaic panels. These panels collect photons from the sun, converting them into DC electric power. The power created then flows into an inverter. The inverter transforms the power into basic voltage and AC electricity.

In Kharigaira VDC of Dailekh, respondent's use of solar energy in lighting purpose, charging mobiles and playing cassette player. They have not high voltage of solar panel and batteries so their solar energy high uses purpose of lighting.

5.1 Major Users of Solar electricity of Nepal

First officially recorded use of solar electricity in Nepal is not known. But it is said that the Nepal telecommunications Corporation (NTC) was the first organization to use solar electricity to power a high frequency communication transceiver located at Damauli in 1974. Since then NTC has became one of the significant users of the solar electricity amounting to more than 1000 kWp generating about 4700kWh/day of electrical energy at more than 3000 locations, without national grid supplied electricity. 75% of all the Public call offices (PCO) in NTC are being powered by PV. (WECS, 2010)

Table No.5.1

Yearly installation of Solar Home System

S.NO.	Fiscal Year	District	Total No	Capacity(wp)	MW
1	Upto 056/57		11758	422652	0.44
2	057/58	35	6211	242064	0.24
3	058/59	63	13745	543486	0.54
4	059/60	65	18482	650669	0.65
5	060/61	71	15106	411095	0.41
6	061/62	67	17887	462679	0.46
7	062/63	67	6788	175052	0.18
8	063/64	71	6690	167113	0.17
9	064/65	68	34755	822964	0.82
10	065/66	73	53595	1249430	1.25
	Total		185017	5167204	5.17

Source: AEPC (2010)

5.2 Impact of solar energy

As the main intent of this paper is to maximize the socioeconomic impact of solar lighting, it is necessary to analyze the how the present solar lighting program has impacted the Kharigaira VDC. In the term of socio-economic indicators due to the isolation of this community from national infrastructure, politics, and to most part fiscal support my socio-economic impact was focused on the VDC level. The socio-economic area to be discussed is social and cultural, economic, education, environment and health.

5.2.1 Social and cultural impact

The people are very proud of their rich social and cultural traditions. Solar lighting provides opportunities to increase the occurrence of these social gatherings after dark. There have not been any official cultural manifestations by the solar lights but people are using the lights to socialize in their homes more. Although many families say the lights are not bright enough to read by, it fills a room with sufficient ambient light to facilitate social activities and discussion. This has given benefit to help family counsels, farmer's cooperative meetings, students and other community groups

5.2.2 Economic impact

Solar Energy is the potential long term impact is obvious but only if current use of kerosene can be reduced. That has not occurred and no financial benefits have been realized. . This had the potential to spark economic activity in the area and create other associated business opportunities. Since these commissions have not been working and have not been paid, no economic impact has been realized.

Solar electricity helps promote local enterprises. Small shops and village markets can use the systems to provide lighting to operate during the evening. Small businesses utilizing electric machines, radio, and batteries charge are also benefited by the availability of solar electric systems. Local businesses selling and servicing solar home system provide employment for local residents. Dealers, technicians, and local technicians all can be employed selling and servicing solar home systems.

5.2.3 Educational impact

Solar rural electrification improves literacy by providing high quality electric reading lights. Electric lighting is far brighter than kerosene lighting or candles. Use of solar electric light aids students in studying during evening hours. Ongoing education classes and adult literacy classes can be held during the evening in solar-lit community centers. Development of adult literacy and professional classes are possible with the introduction of solar electric lighting systems in community centers and schools in many Kharigaira VDC and many countries.

5.2.4 Environment impact

Kerosene emissions create much unwanted air pollution. The distribution method of kerosene without approved carrying devices and associated rules creates a literal environmental disaster as evidence of kerosene oil and residue is everywhere. Kerosene containers (very often empty water and pop bottles) and lamps leak frequently. With the exception of the occasional replacement of a battery, there is minimal environmental impact with the solar lights. However, like health and safety, the potential environmental impact of has not yet been realized.

5.2.5 Health impact

Reduces kerosene-induced fires: Kerosene lamps are a serious fire hazard in the developing world, killing and maiming tens of thousands of people each year. Kerosene, diesel fuel and gasoline stored for lamps and small generators are also a safety threat, whereas solar electric light is entirely safe. Improves indoor air quality: Fumes from kerosene lamps in poorly ventilated houses are serious health problem in much of the world where electric light is unavailable. The World Bank estimates that 780 million women and children breathing kerosene fumes inhale the equivalent of smoke from 2 packs of cigarettes a day. (Misra, 2004)

5.3 Benefits of solar energy in development

In rural community of Nepal, solar energy is the popular which is alternative to other energy resources. Solar energy is definitely beneficial especially for those people who would like to save money despite economic depreciation of the country. It is actually a good source of power and it is absolutely free. The equipment itself

is environmental friendly as it doesn't release any pollution unlike with other energy producing machine. The good thing about this is that, it is very cost effective. It is one-time purchasing equipment as it doesn't require maintenance and guarantees last a lifetime, usually, 30 – 40 years. The system also has full warranty for 20 – 30 years.

One of the alternative sources of energy that a person can use is the solar energy. It is the energy from which the sun is the main source. It is very useful in homes, businesses, schools and universities. However, every aspect in this world has its own advantages and disadvantages.

The rising prices of fossil fuels and political instability of their producers have encouraged the search for alternative energy sources. Nuclear plants, hydrogen cells, wind turbines and solar panels are some of the available options. Of these four, the last one offers the most benefit at the lowest cost.

1. Dependability

As long as the sun is shining, it can provide an unlimited supply of energy, which eliminates dependence on unstable, energy-producing nations.

2. Localization

Solar production is not limited to expensive, centralized power plants. Individual homes and businesses can produce their own energy.

3. Environment

Solar power is friendly to the environment because it does not pollute the air, use up natural resources or contribute to global warming.

4. Credits

To encourage research into and use of this alternative energy form, solar energy installations garner tax credits from the government.

5. Cost

Though initial installations require some expense, solar energy is free. Additionally, because they have no moving parts, solar panels require almost no maintenance.

5.4 Problems of solar energy

As for the government and the NEA, they should make suitable rules to allow the grid connection of residential PV systems. It not only eliminates the need for expensive batteries, but also effectively creates a distributed generating system. Along with a subsidy program, a large-scale adoption of PV is possible. As mentioned earlier, this is the most popular PV system in the world. For example, In Japan, out of 1.9 GW of PV installations, 1.6 GW is the grid-connected residential buildings (Matsukawa, 2007). There is no reason why we are not yet allowed to use it in Nepal.

The initial cost is very high. Means the installing costs can get costly, usually due to the high-cost semiconductor materials, which are used to build a solar energy system. Solar electricity is presently costlier than the electricity given by other sources. Naturally as energy shortages are becoming common day-by-day, solar energy is thus becoming more price-competitive. Solar electricity and heat are not available at night and also may not be accessible in case of bad weather conditions. So, a solar or complementary power station is required which may be a problem for many locations. Solar panels require a large area for installation in order to achieve a good level of efficiency. Besides the solar energy can also be influenced by the presence of water vapor, pollution etc. in the air, which may cause complexities.

Kharigaira VDC is a typical rural village which has some problems. There are not big electrical shops available but there are some small electric shops. The people have to move to district headquarter to bring their extra part of solar home system. There was no any repairing centre for the solar home system. When they damage the part of solar energy, they have to go to headquarter of Dailekh bazaar and solve their problem. In the rainy season, the river used to increase. There is no any bridge. That is the most problem of the village.

CHAPTER-SIX

MAJOR FINDINGS, CONCLUSION AND RECOMMENDATION

6.1 Major Findings

Solar energy is one of the most important renewable energies in the hilly areas in Nepal. It is becoming popular in the villages as an alternative source of energy for daily life. In this context, the present study on the socio-economic impact of solar energy was made in Kharigaira VDC of Dailekh district. The study was based on a sample of 40 households out of 251 HHs, selected by using simple random sampling technique. The study found that solar energy, not only provided energy for lighting but also helped in improving health, time saving, easy to work at night and comfortable for children's study. Some of the major findings from the study area, they are:

Kharigaira VDC lies in the middle part of Dailekh district.

Kharigaira VDC, there are 739 houses. Out of them, 25% HHs had installed solar home system. Among the solar energy installation in the research area, the total sample HHs is 15.93%.

In the village, the total population is 4607.Out of them male population is 2,293 and female population is 2,314.

In the village there are 9 wards. I was collected data from all wards of my sample method, where 26 respondents were male and 14 respondent were female person.

In the study area, there is found that the average HHs family size is 6.23.

In the VDC, 57.5% family respondents live in stone, mud and tin house structures.

62.5% or 25 sample of HHs think that solar energy is more attractive than other renewable energy resources.

All (40 HHs) respondents think that solar energy is brighter than other energy resources.

80% sample respondents think that the solar energy helps to reduced health problems and reduced their visiting hospital/ health post.

Out of 40 sample respondents, 23 HHs respondents think that price of solar energy is moderate. Therefore they are highly benefited by solar energy.

In the village, microfinance did not help to the people. It is found that 90% respondents did not get helps by microfinance.

Out of 100%, 35% or 14 number of respondents have monthly income level Rs. 12,000- Rs.15,000. It is found that majority of surveyed HHs have moderate income because mostly house heads have moderate economic activities like small scale business etc.

Out of 40 HHs, 29HHs or 72.5% respondents are saving Rs.300-500 in the monthly basis.

In Kharigaira VDC, the researcher found that all 40 respondents use firewood for the cooking purpose.

In Kharigaira VDC, 22 sample HHs respondents were highly benefited by solar energy.

In Kharigaira VDC, all respondents were using solar energy for lighting because they have not high batteries and solar panel.

In Kharigaira VDC, out of 40 samples HHs, numbers of 28 HHs were more satisfied with solar energy because it is so easy.

In Kharigaira VDC, 26 or 60% sample HHs students changed the study time of 2 hours. Where there is solar energy, they study 2 hours more at night because they get light for longer hours. Solar energy did not harm their eyes.

In VDC, 80% of the sample HHs access was on telephone/mobile and 20% of the sample HHs has no access of telephone/mobile service.

In Kharigaira VDC, the researcher found that 65% or 26 samples HHs gave the views that there was no change in firewood consumption after the installation of solar energy. 25% gave the views that further deterioration of firewood after the installation of solar energy was in horrible condition.

All 40 sample HHs collected firewood from their community forest. Other type of forest was not in Kharigaira village. 77.5% females were responsible for the collection of firewood and 22.5% of both males and females were responsible for the collection of firewood.

75% sample respondents found that when they installed solar energy they think their life standard and prestige goes too high.

In Kharigaira VDC, the researcher found that 40 or 100% sample respondents thought that when they used solar energy in the village, the solar energy helped for the environment conservation.

6.2 Conclusion

Solar energy technology, one of the clean energies is being popular in the recent years in Nepal. Especially in rural areas; where each and every household are staying in dark. Raising concern over ecology and the impact on the environment of the use of dry cell batteries and kerosene has a fuel has led to the installation of the solar energy in study area. This smoke free environment in the kitchen and study rooms improved air quality ultimately leading to improvement in health condition of women because they always have to work in kitchen and children reading in with brighter lamp.

Following conclusions were drawn from the study:

In that village, population of the female is greater than male, where the female is dominated by male population.

It found that caste of Chhetries household is greater than other caste of households but they stay and work in group.

In the village sample household survey presented that stone, mud and tin used of households are more than other houses.

It is found that 62.5% of the HHs liked solar energy. It is brighter than other energy resources and more attractive.

The sample population says that the price of solar energy is moderate because they are working in field of economics activities.

More solar energy users did not help by the microfinance. Because they have low economic income generation of the village.

Annual income level is found those 35% households have above Rs. 12,000-15,000 income monthly.

During the field visit, the researcher found that solar energy is very much popular in Kharigaira VDC. The solar energy has replaced the kerosene lamp in the VDC.

It is found that the popular end use of solar energy is basic lighting. About 1-2 liter of the kerosene consumption is reduced per month per household but the dry cell batteries are still in use to operate torch light and *tukimara*.

Solar panel has no any problem other than parts.

There is lack of training and skill development programme for the operation & repairing of basic equipment of solar energy at the local level.

In Kharigaira VDC, solar energy is highly used for the purpose of lighting, listening radio and cassette player. Some of them are charging mobile batteries too.

Students are highly benefited by the solar energy. The researcher found that in the sample of households, 42.5% students are more benefited to other.

When they use solar energy in the VDC households, they feel that the standard and prestige is going to high level after installation of solar energy.

6.3 Recommendation

Considering the general findings of the study, some recommendations have been suggested on the desired future of the implementation of solar energy related activities to get desired positive impacts.

It is suggested to the government to increase the subsidy for the installation of solar energy.

If promoted the solar energy in Kharigaira VDC, related I/NGOs, institutions, cooperatives and companies are established in the village and run its selling and business of solar activities regularly.

To provide loan at low interest rate from micro-finances to the low income level people.

In the village to make mechanics easily available when solar panel are damaged or disturbed.

In the village some people don't know about the solar energy. Therefore government gives to promote orientation to the solar energy awareness.

There is need to integrate SHS technology promotion with income generation and social development activities in order to justify the subsidy scheme.

Encouragement should be given to utilize the saved time in the economically productive activities such as income generation as well as recreational and social activities.

Interdisciplinary coordination between different organizations directly or indirectly involved in energy sector to be enhanced.

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Socio-Economic impact of Solar Energy

A case study of Kharigaira VDC, Dailekh

Questionnaire Form for HHs Respondents

A. Household Information:

1. Household head name:				
2. Ward no:			**3. Tole**	
4. Gender:	**Male**		**Female**	
5. Family size:				
6. Caste /ethnicity:			**7. Religion**	

B. Questionnaire for subject Matter:

S.No	Questions	Option No.		Code No.
1	What is the structure of your house?	A	Stone mud and tin	**1**
		B	Stone mud and straw	**2**
		C	Cemented	**3**
		D	Small huts (thatch and mud)	**4**
2	What is primary energy source of your house?	A	Solar energy	**1**
		B	Kerosene	**2**
		C	Electricity	**3**

		D	Wood	**4**
		E	Other sources	**5**
3	Do you know about <u>solar</u> energy?	A	Yes	**1**
		B	No	**2**
4	What is reason to like the solar energy?	A	More attractive	**1**
		B	Low effective less costly	**2**
		C	Solar energy has less side effect	**3**
		D	Government gives the subsidy	**4**
5	What is the intensity of solar energy compared light to other energy resources?	A	Same	**1**
		B	Solar energy brighter	**2**
		C	It is less bright	**3**
6	Which is more beneficial among the energy resources?	A	Solar energy	**1**
		B	Other energy	**2**
		a	Electricity	**1**
		b	Wood	**2**
		c	Kerosene	**3**
		d	Candle	**4**
		e	Torch	**5**
7	Do you have access of electricity facility in your village?	A	Yes	**1**
		B	No	**2**
8	Did find health improvement after uses of	A	Yes	**1**

	the solar energy?	B	No	**2**
9	What is the ration of visiting hospitals/ health posts after installation of solar energy?	A	Increased	**1**
		B	Decreased	**2**
10	What is the status of eye problems after installation of solar energy?	A	Increased	**1**
		B	Decreased	**2**
11	Lungs problems after installation of solar energy.	A	Increased	**1**
		B	Decreased	**2**
12	Has the solar energy reduced health problems created by heavy loads of carrying firewood?	A	Yes	**1**
		B	No	**2**
13	What do you think about the price of solar energy?	A	Low	**1**
		B	Moderate	**2**
		C	High	**3**
14	Is micro-finance helping to get the solar energy easily?	A	Yes	**1**
		B	No	**2**
15	Did you get subsidy from the government to install solar energy technology?	A	Yes	**1**
		B	No	**2**
16	How much is your family income per month?	A	Rs.5000-10,000	**1**
		B	Rs.10, 000-12,000	**2**
		C	Rs.12, 000-15,000	**3**
		D	Rs.15, 000 above	**4**
17	How much money do you saved think in per month after use of solar energy?	A	Rs. 300-500	**1**
		B	Rs. 500-700	**2**
		C	Rs. 700-1000	**3**

		D	Rs. 1000 above	**4**
18	How much money your family used to spend the lightening purpose before the installation of solar energy technology in per month?	A	Rs. 100-300	**1**
		B	Rs. 300-500	**2**
		C	Rs. 500-700	**3**
		D	Rs. 700 above	**4**
19	How much money your family used to spend the lightening purpose after the installation of solar energy technology in per month?	A	Rs. 100-300	**1**
		B	Rs. 300-500	**2**
		C	Rs. 500-700	**3**
		D	Rs. 700 above	**4**
20	Where are your uses of time for income generating activities for your HHs?	A	Political activities	**1**
		B	Social activities	**2**
		C	Economic activities	**3**
21	How many hours do you use for cooking purpose in the kitchen? **a) During winter**	A	1 Hrs	**1**
		B	2 Hrs	**2**
		C	3 Hrs	**3**
		D	Above 4 Hrs	**4**
	b) During summer	A	1 Hrs	**1**
		B	2 Hrs	**2**
		C	3 Hrs	**3**
		D	Above 4 Hrs	**4**
22	What is the energy sources of cooking purpose for your HHs?	A	Firewood	**1**
		B	Croup residue	**2**
		C	Dung	**3**
		D	Solar energy	**4**

23	Who are highly benefited by using the solar energy in your family?	A	Students	**1**
		B	Other members	**2**
		C	Both	**3**
24	For what purpose do you use solar energy?	A	Cooking	**1**
		B	Lighting	**2**
		C	Both	**3**
25	Are you satisfied with the installation of the solar energy?	A	Yes	**1**
		B	No	**2**
26	Have you faced any problem with solar energy?	A	Yes	**1**
		B	No	**2**
27	How much the changed in the study hours of student?	A	1 Hrs	**1**
		B	2 Hrs	**2**
		C	3 Hrs	**3**
		D	Above 4 Hrs	**4**
28	Did you changed in the timetable of sleeping used after solar energy?	A	Yes	**1**
		B	No	**2**
29	Is the time is saving of your family member after the installation of solar energy? **(If Yes)**	A	Yes	**1**
		B	No	**2**
		a	1 Hrs	**1**
		b	2 Hrs	**2**
		c	3 Hrs	**3**
		d	Above 3 Hrs	**4**
30	Use of the time saved by the solar energy for economic social activities.	A	Yes	**1**
		B	No	**2**

31	Do you have access of telephone/mobile service in your village?	A	Yes	**1**
		B	No	**2**
32	**If yes,** which energy source is used for charging these devices?	a	By battery	**1**
		b	By electricity	**2**
		c	By solar energy	**3**
33	What is the impact of solar energy on the use of firewood after the installation of solar energy?	A	Conservation of forest	**1**
		B	No change	**2**
		C	Further deterioration	**3**
34	If you use firewood, where do you collect the firewood from?	A	Government forest	**1**
		B	Community forest	**2**
		C	Private forest \ land	**3**
35	Who is responsible for collect firewood?	A	Male	**1**
		B	Female	**2**
		C	Both	**3**
		D	Children	**4**
36	Is there users committee in your area?	A	Yes	**1**
		B	No	**2**
37	Do you feel that solar energy has increased your life standard and prestige?	A	Yes	**1**
		B	No	**2**
38	Do you think that solar energy technology will help in environmental conservation and social development?	A	Yes	**1**
		B	No	**2**

39	What is your suggestion for the improvement of the solar facility at community level?	

Thank You