CHAPTER ONE

INTRODUCTION

Chapter One deals with the study context, statement of the problem, objectives of the study, definitions of the key terminologies, conceptual framework, limitations of the study, rationale of the study and organisation of the study.

1.1 The Study Context

As one of the fastest growing and the biggest industries of the world, tourism is becoming a major driving force for and contributor to socio-economic development. The World Tourism Organisation (UNWTO) has predicted that the tourism industry would only continue to grow from strength to strength. Often known as a 'smokeless industry', tourism has grown rapidly in the last few decades. In 1950, the number of international tourists stood at about 25 million, while the figure increased to 808 million in 2005. A UNWTO forecast shows that the number of international visitors will be around 1.6 billion by 2020. In 2002, the tourism industry alone created well over 200 million jobs, generating an estimated US$ 3.6 trillion in economic activity and accounting for one in every 12 jobs worldwide.

With her unique and varied topographical and climatic conditions and cultural diversities, Nepal has many things to offer to foreign as well as domestic visitors having diverse tastes and interests. The year 1999 is taken as a landmark period in terms of international tourist arrivals during the five plus decades of Nepal's tourism history. In that year, the country was able to attract a record high number of 500,000 tourists from across the globe. The number of inbound tourists started to decline from 2000 due to various internal and international factors. Some of the major internal reasons for such slackness in arrivals were political unrest, internal conflict and negative portrayal of the country's image in the international arena. In Nepal, the contribution of tourism to the Gross Domestic Product (GDP) is about 4 percent.

Despite its significant contributions to the global economy, this multi-faceted industry is not free from drawbacks. The tourism industry is blamed for posing serious threats to the environment. Environmentalists and energy experts have warned that the tourism industry

could be detrimental to the environment as well as the industry itself if environmental and energy-related issues are left unattended in course of tourism development. The concept of sustainable tourism has emerged with the realization of the dynamic relationship between environment, culture and tourism. Being responsible tourism, it attempts to minimise its impacts on the natural and social environment while helping to generate income and employment and to conserve the ecosystems in the destinations concerned. The natural and social environment in any tourist destination plays an important role in its promotion. Environment is considered as a major motivating factor for tourists to visit any destination. So, sustainability of tourism in any destination is determined by the type and quality of its environment.

According to UNWTO, sustainable tourism has to fulfill three objectives: improvement in the quality of life of the host population, a high quality experience for the visitors and maintenance of the quality of environment on which both the visitors and the host community depend. Concepts such as eco-tourism, alternative tourism, greenhouse tourism, soft tourism, etc. have often been interpreted as synonymous with sustainable tourism. Like sustainable development, sustainable tourism is a multi-dimensional concept. Sustainability is a process, but it is not an end state. In ecological terms, sustainable tourism means that the level of tourism and tourist activities has to be compatible with the maintenance and enhancement of biological resources and their diversity so that the capacity of environment to regenerate itself is not impaired. In social and cultural terms, sustainable tourism development needs to ensure that it is compatible with culture and values of the people, that its benefits are broadly shared, and that it strengthens community identity, promotes wider participation in decision-making related to development and management of natural resources and enhances people's control over their own lives. In economic terms, sustainable tourism development needs to facilitate a process of development that is economically efficient, and it has positive backward and forward linkages that relieve pressure on fragile resources, and allows and promotes management of resources in which that not only supports present needs but which can also support the needs and aspirations of the future generations (WCED, 1987).

With the increased level of awareness among the stakeholders of the Nepalese tourism industry, a group of non-governmental organizations (NGOs), international non-governmental organizations (INGOs), tourism operators and government departments established the Sustainable Tourism Network (STN) in 1997. The Nepal Tourism Board

(NTB) provides administrative and other necessary supports to STN. Similarly, the National Nature Conservation Trust (NNCT), the then King Mahendra Trust for Nature Conservation (KMTNC), has played significant roles in promoting sustainable tourism with its over 100 projects on nature conservation, biodiversity as well as cultural heritage protection, natural resource management and sustainable rural development. The project areas range from the tropical plains of Chitwan district and Bardiya in the low land to the world's famous trekking destination-- the Annapurna Region, and Manaslu Region of the high Himalayas, including the trans-Himalayan region of Upper Mustang and Manang.

The tourism industry's rapid growth, however, has placed a heavy burden on local economies, cultures and environment. Uncontrolled tourism has affected many of the planet's sensitive locations, especially in Small Island Developing States where low impact energy sources such as hydroelectricity are often available only in restricted qualities, and where sea water desalination can consume significant amount of fuel. Compounding the problem, 90 per cent of the energy consumption in tourism today is spent on transportation. With current energy sources, carbon emissions are quite high. Tourism is responsible for 5-7 percent of total emissions of Europe, according to the European Environment Agency (EEA), and climate change actually threatens some of the most prized tourism destinations such as beaches, island paradises and coral reefs. Using renewable energy sources, on the other hand, can significantly decrease the environmental footprint of tourism. According to the Institut Francais del' Environment (IFEN), the Olympics swimming pool in Castres, France, is heated by a 400m^2 system of solar panels, saving the energy and carbon emissions equivalent of 100 private cars. Annually, the solar system displaces 120 MW of electricity or 12,000 m^3 of gas, reducing a considerable amount of heating cost (i.e. equivalent of 65X310 kgs of CO2). With a capital outlay of DKK (Danish Krone) 188,000 and annual operating cost of DKK 3,000, the simple payback period was less than 5 years. The solar heating system also reduces nitrous oxide emissions by 65 kilograms and carbon dioxide emissions by 32,000 Kg per year (UNEP, 2003).

The World Summit on Sustainable Development in Johannesburg 2002 acknowledged tourism as one of the major energy consuming sectors and requested the states to integrate energy efficiency into tourism related policies. In this context, the use of renewable source of energy for promoting sustainable tourism is gaining popularity day-by-day.

In Nepal, energy consumption trend is not in line with sustainability. The Economic Survey 2004/05 shows that the energy consumption of Nepal is- traditional source of energy (87%), fossil fuel (12.5%) and renewable sources of energy (0.5). Of the traditional energy consumption, the share of fuel-wood stands at 89%. Considering this fact, it can be argued that Nepal's energy consumption pattern is largely biomass oriented and the promotion of renewable sources of energy has yet to receive due attention. In Nepal, the Alternative Energy Promotion Centre (AEPC) has been effortful in the promotion of renewable sources of energy. The Rural Energy Development Programme (REDP) has been working in 25 various districts for the promotion of renewable sources of energy, especially micro-hydro projects. Similarly, the Centre for Energy Studies (CES) under the Institute of Engineering, Tribhuvan University (TU), has been successful in raising awareness among the people belonging to different organizations about the importance of the use of renewable sources of energy.

Various studies have proved that Nepal holds huge potential for the development and promotion of renewable energy. However, the country has failed to reap desired benefits from clean energy because of poor technological advancement, poverty and low level of awareness. The role of inter-linking tourism promotion and development of renewable sources of energy could be instrumental in gearing up sustainable development of mountain tourism. The mountain region is not only ecologically fragile but also frequently suffers from energy crisis. As the world's popular tourist destination, the Khumbu Region attracts thousands of visitors each year and it demands large quantity of energy. However, due attention has not been accorded for the development of alternative sources of energy to meet the growing energy demand. Consequently, deforestation rate in this region has been very acute over the years and posing threats to the entire environment of the area, jeopardizing the sustainability of tourism. Against this backdrop, it is imperative to carry out a study on inter-linkage of tourism and renewable energy promotion in order to find out the measures required for the sustainable tourism development in the area.

1.2 Statement of the Problem

Although tourism is known as a 'smokeless' and 'development' industry, it can create several environmental problems. As a tourist destination, Nepal has also witnessed some environment-related problems. This is because of lack of proper attention towards environmental aspects. Despite having realised the fact that the use of renewable sources

of energy and sustainable development of tourism are inter-related to each other and reinforcing factors, the promotion of this type of energy has been neglected in Nepal. Such a kind of negligence has severely posed threats to the environment resulting in rampant deforestation. Ultimately, the destination is sure to lose its attractions. In addition to this, degradation of the health of ecology, energy, economic and environmental securities are the most prominent issues and problems created by the excessive use of non-renewable sources of energy. Moreover, the use of renewable sources of energy is not free from its limitations and constraints. The purchasing capacity of the people, the installation charge, operation and maintenance costs, nature of its use, etc. could also be relevant aspects. Hence, the research study was confined to analyzing:

- Whether the use of renewable sources of energy (solar and micro-hydro) was heading towards sustainability or not;
- The constraints for the use of solar and micro-hydro for tourism promotion and
- The problems and prospects for sustainable tourism promotion and commercialization of solar energy and micro-hydro.

1.3 Objectives of the Study

Analysing the problems and prospects of renewable sources of energy for sustainable tourism promotion along the tourist hotels and lodges along the Lukla-Monjo trekking route in Chaurikharka VDC of Solukhumbu district is the general objective of the study.

Other specific objectives include:

a) Examining the status of renewable sources of energy (solar PV, peltric sets and micro-hydro) in the study area and

b) Exploring other viable renewable sources of energy for sustainable tourism practice.

1.4 Definition of Key Concepts & Variables

Energy: Capacity to do work

Energy source: The source from where energy can be exploited

Renewable sources of energy: The sources of energy whose natural stocks are not exhausted when they are used once and can be used again with the help of technological application.

Non-renewable sources of energy: The sources of energy whose natural stocks are exhausted when they are used once.

Eco-tourism: Responsible travel to natural areas, where the environment and culture are conserved and both tourists and host communities benefit from it.

Sustainable development: Development that meets the needs and aspirations of the present generations without compromising the ability of the future generations to meet their own needs.

Ecosystem: A dynamic complex of plant, animal, fungal, microorganism communities, and their association with non-living environment interacting as an ecological unit.

Biomass: The total quantity or weight of plants and animals in a particular area or volume.

Solar thermal energy: It is energy radiated by the sun in the form of heat energy. Solar thermal energy technology is used for harnessing the energy with the help of certain devices like solar water heater, solar cooker, solar dryer, etc.

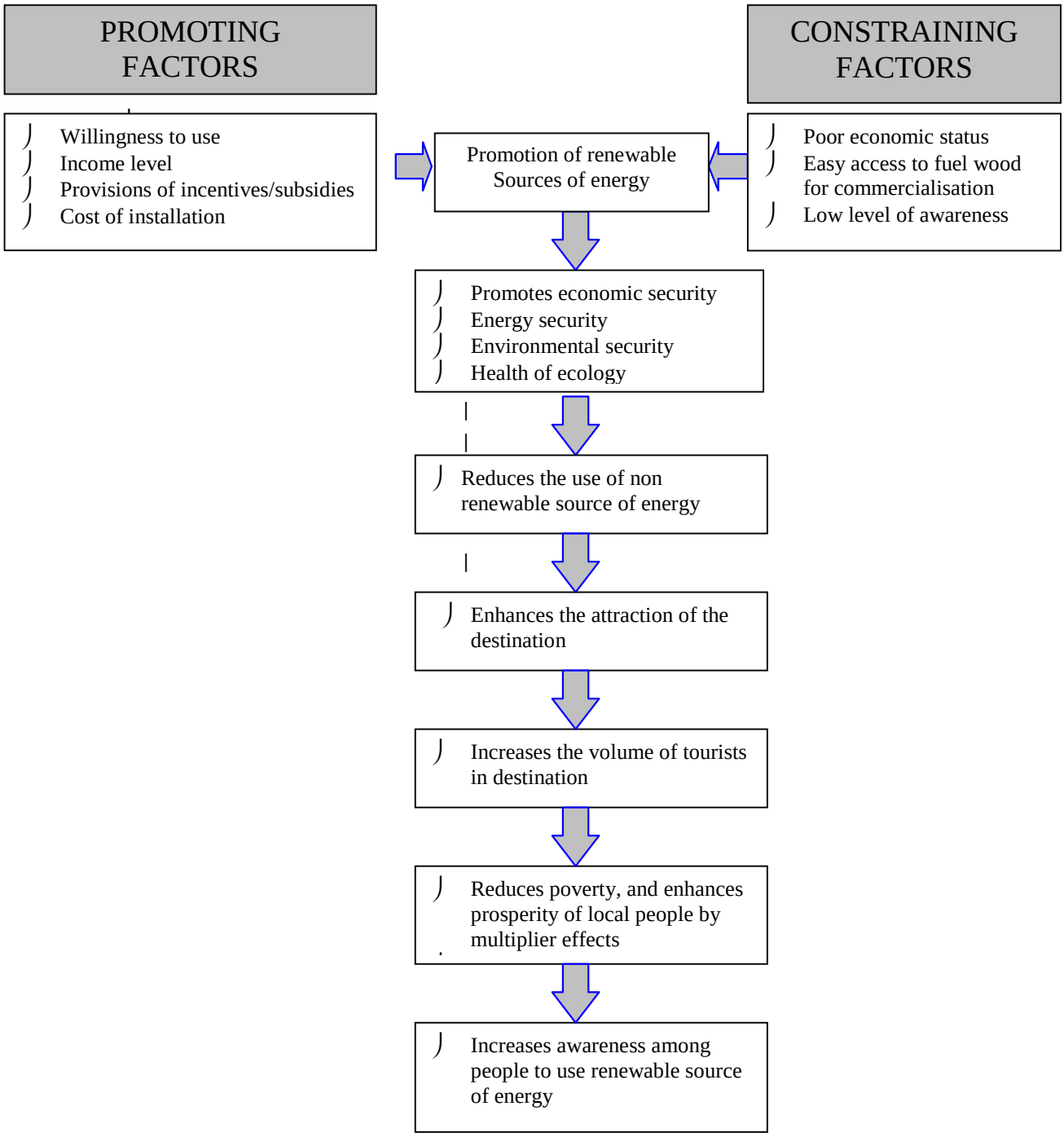
Photovoltaic: The device that converts the sunlight into electricity.

1.5 Conceptual Framework of the Study

By placing due focus on the use of renewable sources of energy and promotion of sustainable tourism, mainly the promoting and constraining factors have been developed in order to analyse them in depth. The local hotel and lodge owners' willingness to use the Renewable Energy Technologies (RETs), their income level, provision of incentives and subsidies and cost of installation are some of the motivating factors. On the other hand, poor economic status, easy access to fuel-wood for commercial purpose and low level of awareness among the local people are taken as the constraining factors for the use of renewable sources of energy and sustainable tourism promotion. It is assumed that the promotion of RETs could help ensure economic and energy security and ecological preservation. This certainly contributes to the reduction of the consumption of fossil fuel and fuel-wood. There is no doubt that the reduction of non-renewable sources of energy helps in the protection of the scenic beauty and other attractions of the destination. This, in turn, leads to increase the flow of tourists in the area. As a result, poverty in the area could be reduced through tourism. The local residents, especially hotel and lodge entrepreneurs,

would be motivated to use renewable sources of energy. Only then, the concept of sustainable tourism could gain a much-desired momentum in the area.

Figure 1.1 Conceptual Framework



1.6 Rationale of the Study

There is no denying the fact that energy consumption pattern determines whether tourism in a destination is sustainable or not. The higher the use of renewable sources of energy, the greater the sustainability of tourism is. The price of energy should not be measured only in monetary terms. Its environmental cost must be taken into consideration. Therefore, necessary attention should be paid toward reducing the use of forest resources and fossil. Nepal has to import fossil fuels from other countries to meet the growing demand. Despite the availability of vast renewable energy resources, Nepal has not tapped them properly. Rather the country has invested a substantial amount of its budget in importing fossil fuels. In the fiscal year 2003/04, the country spent Rs. 22.60 billion in the import of the petroleum products, including LPG. During the period, Nepal imported 7,55,413 Kilo Litres (KL) of petroleum products, a 3.7 percent decrease over the previous year, and 66142 Metric Tons (MT) of LPG. The quantity is an increase of 17.9 percent as compared to the import of the previous year. (Economic Survey FY 2004/05).

The Nepal Oil Corporation (NOC) suffers a deficit of huge amount every year. In October, 2006, NOC faced a loss of Rs. 250 million. With the decrease of oil prices in the international market, the loss for NOC declined to Rs. 150 million in November. The state-owned agency is expected to bear a loss of about Rs. 50 million in December, 2006. Despite such a loss, the government has not been ready to invest much in the promotion of renewable sources of energy.

Most of the researches on tourism and the use of renewable energy are conducted at the macro level. Although micro level studies are the major foundations for the macro ones, the former are often found neglected and undermined. Being one of the sensitive sectors, tourism needs micro level studies and researches so as to lead it to sustainability. Until now, no research on problems and prospects of renewable energy for sustainable tourism promotion has been carried out in the Khumbu Region. In this context, the research could be of great significance. Furthermore, this research will be an important basis for the future researches on tourism and renewable energy. The research could give some useful inputs to the planners and policy-makers in formulating more effective plans and policies and implementing them at the national as well as local levels.

1.7 Limitations of the Study

The present research deals only with Lukla-Monjo trekking route in the Khumbu Region of Solukhumbu district. The study was completed within the timeframe of six months. As the sample size was small, it may not represent the problems and prospects of renewable energy for sustainable tourism promotion in other regions of the country. Similarly, limited resource was another constraint of the study. The research has been prepared for the partial fulfillment of the requirements of the Master's Degree of Arts in Rural Development. Apart from this, the research was descriptive in nature.

1.8 Organisation of the Study

This study has been organised in five chapters, namely; introduction, literature review, research methodology, data analysis and interpretation, and findings, conclusion and recommendations.

Chapter One deals with the study context, statement of the problem, objectives of the study, definitions of the key terminologies, conceptual framework, limitations of the study, rationale of the study and organisation of the study.

Similarly, Chapter Two deals with literature review defining terminologies such as tourism and tourist, emergence, development and principles of sustainable tourism along with definitions, history, tourism and energy, opportunity for energy and tourism, energy pyramid based on efficiency and pollution, the Kyoto protocol, objectives of the Kyoto protocol, principles of Kyoto protocol, various sources of renewable energy used in tourism sector, tourism and its impact on forest resources, energy and poverty reduction, renewable energy and tourism in the tenth plan, the government's policy on renewable energy technologies, targets of the tenth plan on renewable energy technologies, subsidy policy on renewable energy technologies and criteria for subsidy on renewable energy technologies

Chapter Three offers research methodology applied for carrying out the research work. The methodology includes the rationale for the selection of the study area, research design, nature and sources of data, sampling procedure, variables and their operationalisation, data collection techniques, reliability and methods of data analysis.

Chapter Four presents an analysis and interpretation of data collected during the field survey. It has also described Solukhumbu district at a glance, tourism potentiality in Khumbu region, description of the study area, major attractions of the study area, accessibility, accommodation, tourist flow trend, energy use scenario in Solukhumbu, district energy resources and technologies, energy consumption scenario, total energy consumption in commercial sector, socio-economic profile of the respondents, ethnic composition, education, level of awareness of the respondents on renewable sources of energy, amenities in hotels/lodges, sources of investment in renewable sources of energy, sources of investment in renewable sources of energy, sources of credit, awareness level of the respondents on the provision of subsidy, type and quantity of energy used in hotels and lodges, reasons behind the use of renewable sources of energy, energy use pattern, energy types used in hotels and lodges, types of energy resources used before installation of renewable sources of energy, major factors responsible for deciding to install renewable sources of energy, major application areas of renewable sources, major areas of using renewable energy, impact of energy use, satisfaction level of hotel entrepreneurs towards the use of renewable sources of energy, respondents' views on the promotion of quality hotel management by use of renewable sources of energy, reduction of use of non-renewable sources of energy, use of renewable sources of energy and forest conservation, sustainable tourism promotion and use of renewable sources of energy, satisfaction level of the respondents on subsidy policy and the challenges of using renewable sources of energy.

Chapter Five concludes with findings and conclusion of the study. It also offers some vital recommendations for the development of sustainable tourism through promoting renewable sources of energy.

CHAPTER TWO

LITERATURE REVIEW

Reviewing literature is an integral part of a research undertaken to enrich the knowledge. It is worthwhile to review available literatures on tourism, sustainable tourism and interrelationship between sustainable tourism and renewable sources of energy for better understanding the subject matter. Different scholars and institutions have defined tourism, sustainable tourism and renewable sources of energy in their own ways.

The review of literature has been organised as follows:

2.1 Tourism and Tourist

Having derived from a French term '*tourisme*', tourism is a socio-economic phenomenon that comprises the activities and experiences of tourists away from their home environment. Swiss professors Hunziker and Krafts have defined tourism as the totality of relationship and phenomenon arising from the travel and stay of strangers provided their stay does not imply the establishment of a permanent residence and is not concerned with a remunerated activity.

As a service industry, travel and tour operators and host destinations operate tourism. However, it is not easy to define tourism as an industry. This is because tourism has very broad nature. It contains many other trades and industries such as the aviation sector, accommodation, rail, cruise and food service industries, etc.

Similarly, a tourist is a person, who travels to a place away from his/her home and stays there at least 24 hours for leisure, holiday, recreation, etc. According to UNWTO, a person becomes a tourist if he/she stays at a place or country other than his own place of stay for a minimum of one night for leisure, recreation, holiday, medical treatment, study and business, and family mission or meeting.

Austrian economist Herman Van Scheullard gave the first definition of tourism in 1910 A.D. According to him, "the sum total of operations mainly of economic nature, which directly related to the entry, stay and movement of foreigners inside and outside a certain country, city or region". Ramesh Raj Kunwar defines tourism, in his book entitled ***Tourism and Development***, as the result of temporary movement of people to destinations

outside their normal places of work and residence, the activities undertaken during their stay in those destinations, and the facilities created to cater to their needs. The international conference on leisure, recreation and tourism held by IAEST (Association of International Scientific Experts in Tourism 1981) states: "Tourism may be defined in terms of particular activities selected by choice and undertaken outside the home environment. Tourism may or may not involve overnight stay away from home". In 1976, Tourism Society of England (TSE) defined tourism as the temporary short-term movement of people to destinations, outside the places where they normally live and work and their activities during the stay at these destinations. It includes movement for all purposes as well as day visits or excursions". UNWTO in 1993, defined tourism as an activity of persons travelling to and staying in places outside their usual environment for not more than one consecutive day for leisure, business or any other purpose.

2.2 Emergence of Sustainable Tourism

A high quality of environment is the foundation for tourism development in any destination. When hundreds of thousands of tourists visit a destination, the host destination is bound to face its impact. Nevertheless, the recognition that protection of the environment, which is at the very basic of development of tourism, has often been a neglected aspect since past. Mass movement of tourists may be responsible for both protecting as well as destroying environment of a destination area. Tourism development brings in special ecological problems not encountered in other types of economic activity. Tourists are attracted toward a destination because of its scenic view, recreational possibilities and other amenities. The over-exploitation of forest resources for tourism could be detrimental to the industry itself in the long-run. The most paradoxical trait of modern tourism is that it can destroy all such attributes, which lured the visitors in the first place. Renowned economic analyst and futurologist Herman has described the rapidly expanding tourism as "next only to atomic power in its potential for environmental destruction". Tourism causes many types of pollution such air pollution (inside air pollution and outside air pollution), land and water pollution. Mass tourism has brought in its wake certain ecological and environmental problems posing threat to tourism development. In this context, the growing awareness about the relationship between tourism and environment has ultimately led to the emergence of the concept of sustainable tourism.

2.3 Sustainable Tourism Development

The notion of sustainable development is highly associated with environmental concern. The phrase 'sustainable development' has been defined and explained in a number of ways. The definition of sustainable development as defined by the World Conference on Environment and Development (WCED) may be relevant to quote: Sustainable development is development that meets the needs of the present, without compromising the ability of future generation to meet their needs stressing the 'inter-generation nature of sustainability.

The UNWTO has also applied the same definition. It states that sustainable tourism development meets the needs of the present tourist and host regions, while protecting and enhancing opportunity for the future. It is envisaged as leading to management of all resources. The concept of sustainability has multiple dimension-economic, environment and social aspects and, therefore, holistic view is sine qua non for sustainability.

Similarly, Eber defines sustainable tourism as,

"Tourism and associated infrastructures that both now and in future:

- Operate within natural capacities for the regeneration and future productivity of natural resources;
- Recongnise the contribution that people and community, customs and lifestyles, make to the tourism experience;
- Accept that these people must have an equitable share in the economic benefits of tourism;
- Are guided by the wishes of the local people and the communities in the host areas."

(Eber: 1992)

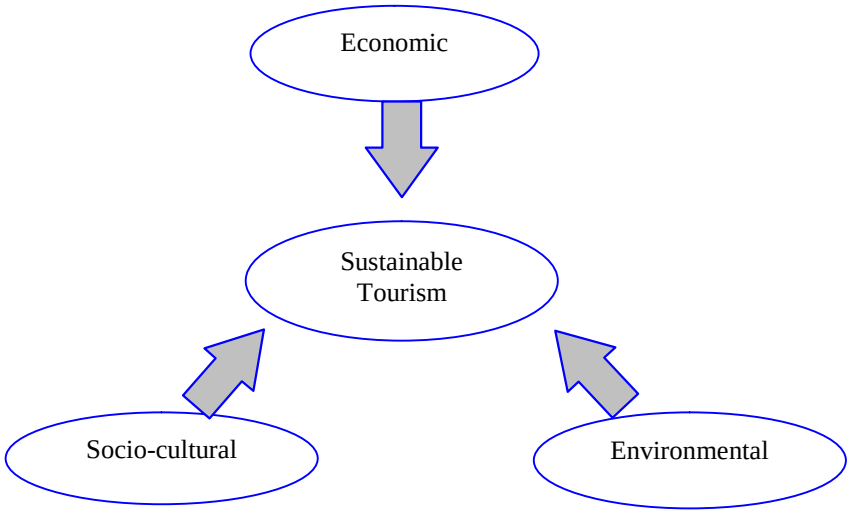
In the same way, FNNPE (Federation of Nature and National Parks of Europe) defines sustainable tourism as, "All forms of tourism development, management and activity, which maintain the environmental, social and economic integrity and well-being of natural, built and cultural resources in perpetuity." (FNNPE: 1993)

According to the Department of National Parks and Wildlife Conservation (DNPWC)/Tourism for Rural Poverty Alleviation Programme (TRPAP), sustainable tourism in its true sense is an industry, which attempts to make a low impact on the environment and local culture, while helping generate income and employment, and conserve local ecosystems. It is responsible tourism, which is both ecologically and culturally sensitive. The International Centre for Integrated Mountain Development (ICIMOD) has defined sustainable tourism as "if tourism contributes to the maintenance and preservation of biological resources and their diversity; if it ensures the preservation of culture and values of people and strengthens community identity; if a process is set in motion in which the benefits of tourism are broadly shared and a wider participation in decision making related to development and the management of natural resources is promoted; if economically efficient, positive backward and forward linkages among economic activities are increased to relieve the pressure on fragile resources and contribute to improvement of the quality of life of the population; if resources are managed in which, which not only support present needs but also supports the needs and aspiration of the future generations; then the presumption is that the tourism is sustainable".

2.4 Principle of Sustainable Tourism

The concept of sustainable Tourism also entails a broad spectrum ranging in almost all dimensions of socio-economic, cultural and environmental aspects.

Figure 1.2 Principle of Sustainable Tourism



Source: DNPWC and TRPAP, 2005

Some of the facts associated with environment and tourism as envisaged by sustainable tourism:

Any development without some controls, without any thought given to the environmental factors can, in fact, prove to be disastrous and ultimately will be counter-productive for tourism itself.

Tourism development can become a positive factor for improving the environment only when the host destination devises a careful plan.

In this regard, sustainable tourism entails certain principles in which the lowest possible consumption of non-renewable resources is also a key among others principles.

2.5 Energy and Tourism

Energy is a part and parcel of the tourism industry. Energy is so important for this sector that it virtually determines sustainability of this industry. It is a major component bearing direct impact on bottom-line profits. The Article 3.1 and 3.2 of the Global Codes of Ethics for Tourism of UNWTO call for the development of sustainable tourism. "All stakeholders in tourism development should safeguard the natural environment with a view to achieving sound, continuous and sustainable economic growth geared to satisfying equitably the needs and aspirations of present and future generations. Tourism activities which are oriented to preservation and protection of rare species, natural resources and waste management should be given top priority by national, regional as well as local authorities.

As a unique energy saving campaign encouraging hotels and lodges to become "carbon neutral", a project called Renewable Energy for Sustainable Tourism (REST) was launched in six member states of the European Commission (EC) by EC and Energy-Cites in 2003. The project claims, "As a general rule, energy savings of up to 30 per cent can be made in ways that will pay for themselves in no more than a couple of years. Simple changes to the way you run your hotel may cost you nothing but can be very effective. And using renewable energy will make an extra contribution to protecting our climate and environment."

The project also asserts that hotels consume much more energy than private households.

The Hotel Victoria in Freiburg (Germany) showed that turning it into a "Zero Emission Hotel" produced a huge reduction in energy cost. At the same time, the number of guests has increased attracted by its green credentials.

Taking into account the close relations between the use of renewable energy, environment conservation and sustainable development, many countries of the globe have started adopting policies for the promotion of RETs. In this regard, the largest ever gathering of environment ministers was held in the United Arab Emirates (UAE) in February 2006. At the meeting, they held extensive discussions on how best to deliver sustainable energy and more environmentally-friendly tourism.

“There is every sign that we are seeing a renaissance in the commitment to global environmental issues. This is being driven partly by the soaring demand and price for fossil fuels," said Klaus Toepfer, Executive Director of UNEP.

He added, "It is the first time we have held our Governing Council in this part of the world. The commitment of the late Sheikh Zayed to environmental causes, the importance of energy and tourism to this country, makes Dubai the ideal venue."

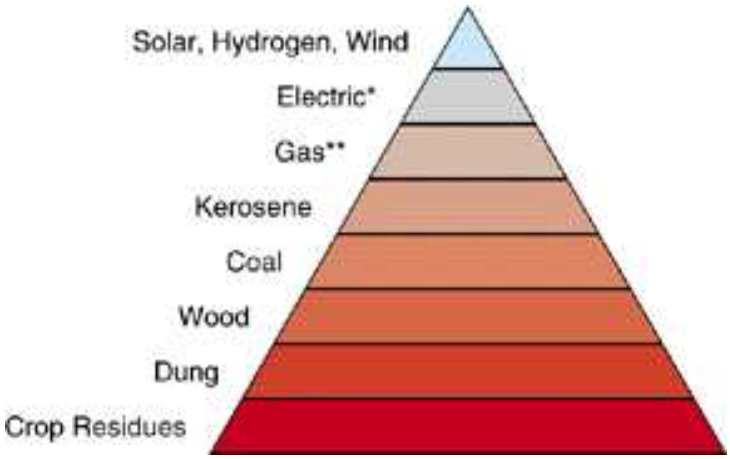
2.6 Opportunity for Energy and Tourism

As renewable sources of energy are abundant, clean, inexhaustible and decentralized, it offers many opportunities for the people to use and benefit from clean and renewable energy systems. Wind, solar and hydropower are the cleanest forms of energy, as there is no combustion. Such energy sources provide a particular solution to the challenge of energy supply in the tourist destination. A comparative analysis of the benefits that renewable sources of energy have over non-renewable sources can be summarized as:

- Renewable sources are non-polluting and environment friendly;
- They are decentralized and available everywhere whereas non-renewable source of energy are centralized;
- They lower the burden of energy crisis, to some extent, that the earth is going to face in near future and
- They are a natural stock and never exhausted and can be reused.

It is a matter of fact that non-renewable sources of energy are comparatively easier to use, but they produce excessive pollution, which, in turn bring in many environmental and health-related problems. Renewable sources of energy, on the other hand, are quite time-taking, but pollution free. These sources of energy have no side effect at all. Realizing the greater importance of renewable sources of energy, tourists are also found demanding this type of energy to meet their basic needs while in the host countries. At this juncture, it is quite useful and appropriate to illustrate the energy pyramid based on efficiency and pollution.

Figure 1.3 Energy Pyramid Based on Efficiency and Pollution



(Source:www.burningissues.org/energy-ladder.htm)

Solid fuels or biomass are less efficient than oil, natural gas or propane. It takes larger quantities of peat, wood, or coal to do the job and they will produce larger quantities of smoke when they are burned. Solid fuels produce dramatically less heat for fuel consumed and produce dramatically more pollution. When we use fuels that are more efficient, we produce less pollution. This has been described as the energy ladder. The dirtiest fuels such as grass and animal dung are at the bottom. Going up the ladder, gradually with wood, then coal, until the next most efficient type of fuel is used. Dramatic reduction in pollution occurs when the next physical state, liquid kerosene is reached. Liquid fuel is less polluting than solid fuel. Natural gas and propane are dramatically less polluting than solid or liquid fuels. Electric energy produces no at site pollution although its generation does produce pollution. Wind, solar and hydropower are the cleanest forms of energy, as there is no combustion. Carrying the ladder analogy further, an Energy Pyramid symbolizes both quantity of fuel used and quantity of pollution produced going up the

energy ladder. Say we do not know the number of grams that charcoal briquette combustion would produce. Charcoal briquettes are actually wood, initial combustion has burned off some of the start up pollutants. Thinking of the energy ladder, we can place this cooking fuel in a pollution ranking because we know that it is in a solid form (*www.burningissues.org/energy-ladder.htm)*.

The broad spectrum of major renewable sources of energy for the tourism sector includes biomass, solar energy, hydroelectricity, geothermal energy and wind energy.

In this regard, solar energy and micro-hydropower may be better alternatives for the areas where hydroelectricity through grid system and promotion of biomass energy application technologies are not accessible. The benefits and opportunities that the use of renewable sources of energy can meet the energy demand for tourism sector are broadly categorized into the following dimensions:

Energy Security: Being diversified and decentralized in nature, renewable energy promotes energy security and ensures price stability. Renewable sources of energy can reduce dependence on imported fuels that is major cause for causing trade deficit, as in case for Nepal.

Economic Security: Renewable energy enhances national savings. It is cost effective, easily handled, and simple in construction and demands less investment.

Environment: Renewable energy can significantly help in improving quality of tourist destinations by reducing air pollution. On the other hand, the use of non-renewable sources of energy like fossil fuels and fuel-wood could have negative impact on quality of air and water.

Poverty Reduction: Tourism has been recognized as a potential industry for poverty reduction. The use of renewable sources of energy can bring prosperity to the local people by improving the health of people, environment, supporting local economy and many more opportunities. It is because environment and poverty are directly related to each other and they are mutually reinforcing to improve the level of poverty and the quality of environment. (Source: UNEP, 2003)

2.7 The Kyoto Protocol

The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). The treaty was negotiated in Kyoto, Japan in December 1997, opened for signature on March 16, 1998, and closed on March 15, 1999. As of October 2006, a total of 166 countries and other governmental entities have ratified the agreement (representing over 61.6% of emissions from the member countries). Notable exceptions include the United States and Australia. Other countries, like India and China, which have ratified the protocol, are not required to reduce carbon emissions under the present agreement despite their relatively large populations.

Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other greenhouse gases, or engage in emissions trading if they maintain or increase emissions of these gases.

The Kyoto Protocol now covers more than 160 countries globally (not including the United States and Australia) and over 55% of global greenhouse gas (GHG) emissions.

2.7.1 Principles of Kyoto Protocol

At its heart, the Kyoto protocol has established the following principles:

a) Kyoto is underwritten by governments and is governed by global legislation enacted under the UN's aegis

b) Governments are separated into two general categories: developed countries, referred to as Annex 1 countries (who have accepted GHG emission reduction obligations); and developing countries, referred to as Non-Annex 1 countries (who have no GHG emission reduction obligations)

c) Any Annex 1 country that fails to meet its Kyoto target will be penalized by having its reduction targets decreased by 30% in the next period.

d) By 2008-2012, Annex 1 countries have to reduce their GHG emissions by around 5% below their 1990 levels (for many countries, such as the EU member states, this corresponds to some 15% below their expected GHG emissions in 2008). Reduction targets expire in 2013.

e) Kyoto includes "flexible mechanisms" which allow Annex 1 economies to meet their GHG targets by purchasing GHG emission reductions from elsewhere. These can be bought either from financial exchanges (such as the new EU Emissions Trading Scheme) or from projects which reduce emissions in non-Annex 1 economies under the Clean Development Mechanism (CDM), or in other Annex-1 countries under the Joint Implementation (JI).

f) Only CDM Executive Board-accredited Certified Emission Reductions (CER) can be bought and sold in this manner. Under the aegis of the UN, Kyoto established this Bonn-based Clean Development Mechanism Executive Board to assess and approve projects ("CDM Projects") in Non-Annex 1 economies prior to awarding CERs. (A similar scheme called "Joint Implementation" or "JI" applies in transitional economies mainly covering the former Soviet Union and Eastern Europe).

What this means in practice is that Non-Annex 1 economies have no GHG emission restrictions, but when a GHG emission reduction project (a "GHG Project") is implemented in these countries, that GHG Project will receive Carbon Credits which can be sold to Annex 1 buyers.

The Kyoto linking mechanisms are in place for two main reasons:

1) The cost of complying with Kyoto is prohibitive for many Annex 1 countries (especially those countries, such as Japan or the Netherlands for example, with highly efficient, low GHG polluting industries, and high prevailing environmental standards). Kyoto, therefore, allows these countries to purchase Carbon Credits instead of reducing GHG emissions domestically; and,

·2) This is seen as a means of encouraging Non-Annex 1 developing economies to reduce GHG emissions since doing so is now economically viable because of the sale of Carbon Credits.

All the Annex 1 economies have established Designated National Authorities to manage their GHG portfolios under Kyoto. Countries including Japan, Canada, Italy, the Netherlands, Germany, France, Spain and many more, are actively promoting government carbon funds and supporting multilateral carbon funds intent on purchasing Carbon Credits from Non-Annex 1 countries. These

government organizations are working closely with their major utility, energy, oil & gas and chemicals conglomerates to try to acquire as many GHG Certificates as cheaply as possible.

Virtually all of the Non-Annex 1 countries have also set up their own Designated National Authorities to manage the Kyoto process (and specifically the "CDM process" whereby these host government entities decide which GHG Projects they do or do not wish to support for accreditation by the CDM Executive Board).

2.7.2 Objectives of Kyoto Protocol

The Kyoto Protocol is intended to cut global emissions of greenhouse gases. It has set the following objectives:

© The objective is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

© The Intergovernmental Panel on Climate Change (IPCC) has predicted an average global rise in temperature of 1.4°C (2.5°F) to 5.8 °C (10.4°F) between 1990 and 2100. Current estimates indicate that even if successfully and completely implemented, the Kyoto Protocol will reduce that increase by somewhere between 0.02 °C and 0.28 °C by the year 2050.

Source: http//www.en.wikipedia.org/wiki/Kyoto_Protocol

2.8 Various Sources of Renewable Energy Used in Tourism Sector

The World Summit on Sustainable Development, held in Johannesburg in 2002, acknowledged tourism as one of the major energy-consuming sectors. UNEP reports that about 90 percent of energy consumption in tourism today is spent on transportation. In addition, most of the energy in lodging is spent on heating rooms and water, cooking food and lighting. It is obvious that consumption levels in lodges are geometrically linked to the level of luxury of hotels. The AEPC in Nepal has shown that the number of tourism businesses using solar cookers in the Himalayas has been on the rise.

Broadly, renewable energy can be used in various sectors like:

Heating: Solar heating system

Cooking: Solar cooker

Lighting: Solar lantern, solar torch, solar light

Transportation: Solar vehicles

Communication & Technology like solar phone, etc.

2.9 Tourism and its impact on Forest Resources

It is generally accepted that healthy environment is call of the day for fostering tourism in any region. Despite the generation of income and employment, tourism often creates some detrimental impacts on both the social and natural environment of the host destinations. So, if such environmental issues are not addressed in time, the future of tourism will be jeopardized. Therefore, for the longevity and sustainability of tourism, top priority should be accorded to environmental preservation rather than economic benefits alone. It is a matter of fact that tourism activities can have localised impacts in and around settlements. Lodges and house buildings, for example, cause soil erosion and landslide. A growth in tourist numbers can be associated with increased trampling and erosion of vegetation cover.

In this context, it may be appropriate to quote Paul Rogers and John Aitchison. They say forest management in Khumbu has been strictly controlled by the SNP since its inception in 1976. The SNP forestry policy specifically outlaws the cutting of all live wood, except where a permit is issued for construction timbers. As part of a coordinated effort to promote forest conservation within the park, a great deal of assistance (financial and technical) has been provided by the Himalayan Trust. Local people have also become actively involved in the management process- most notably through the reintroduction and employment of *shing gi nawa* (traditional forest guardians). This approach to forest management has achieved notable success and SNP forests are well-maintained (Baker, 1993, 1995; Ledgard, 1994, 1996, 1997; Sherpa, L.N., 1993). It is also encouraging to note that following initial reservations, Khumbu residents now fully appreciate the benefits of a strict Park Policy.

Two other measures have helped to alleviate the pressure on local forests. Firstly, all group trekkers are required to use kerosene for cooking. Secondly, in 1994 the completion of the Thame hydroelectric plant made a considerable difference to fuel wood

consumption patterns. This 650kw installation now provides electricity to virtually all households in the Thame valley, Khumjung, Kunde and Namche. Surveys confirmed that in these locations between 1993 and 1996, lodges halved their consumption of fuel-wood while households reported reducing consumption by over two-thirds.

Notwithstanding the achievements of the partnership between government, national and international NGOs and local people, two criticisms of forest management did, however, emerge at the local level. Firstly, with regard to the allocation of timber permits, it was reported that elites could gain new timbers far more easily than those of lower or more marginal status- the practice of applying for timber permits for personal use and then selling them to others was also reported. The second criticism relates to the consumption of Juniper.

Despite the ban on the cutting of trees, at higher elevation lodges, households and porters have continued to cut and consume quantities of juniper and birch. Given that juniper takes sixty or more years to mature to the size of 35cm above the ground (Bjonness, 1980). All tourist related juniper consumption can be considered unsustainable. Yet, to avoid confrontation, the SNP has assumed a relaxed, non-persecutory approach to such use. Despite this, in 1995 and 1996 lodge and household surveys indicated that juniper consumption had actually declined. Against this trend, however, the number of lodges in the park's higher reaches is increasing which may be causing an overall increase in consumption. As surveys suggested that several high altitude lodges no longer consume juniper, there is a pressing case for the enforcement of cutting regulations. Many local people also stated that they would support such a ban. In spite of some shortcomings, it is possible to conclude that strict management practices and use of alternative energy have been responsible for maintaining healthy forests within the SNP. Extending the provision of alternative sources of energy supply across the Khumbu Region, and enforcing regulations pertaining to the cutting of juniper and birch, should guarantee the future conservation of SNP's forest estate (Rogers Paul & John Aitchison, 1998).

2.10 Energy and Poverty Reduction

Poverty in Nepal is more pervasive in remote rural areas, where decentralised energy system is the only viable option for providing energy services. Micro-hydro, SHSs, bio-gas plants and Improved Cooking Stoves (ICS) are the main RETs. Energy is one of the most essential inputs for sustaining people's livelihoods as well as economic growth.

Renewable energy can also improve access to energy services by providing reliable and affordable energy supply for people in rural and urban areas. The benefits provided by renewable energy will differ among and within countries, depending on the local situation, available resources, options, and concerns. Among them, the benefits that could accrue from increased use of renewable energy are: enhanced security of energy supply, reduced threat of climate change, stimulation of economic growth, job creation (often in rural areas), higher incomes, improved social equity, and protection of environment at all levels. Increased utilisation of renewable energy should be seen as a means to such ends (Nepal G. and V.B. Sharma, 2004). Therefore, widening access to modern energy services has potential to be a catalyst for sustainable human development. But, increased income is necessary to be able to afford to climb another step of energy ladder and release human time and energy for human development purposes. The World Summit on Sustainable Development (WSSD, 2002) agreed on a comprehensive agenda on energy for sustainable development guided by the overarching objectives of sustainable development and poverty alleviation, participating governments to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services and resources.

There are various types of energy, which are obtained from different sources. Energy generation process may produce by-products, some of which are very detrimental to human health and environment. Therefore, emphasis is given to the promotion of clean energy services that can be used for various purposes with no or least negative impact. Poverty reduction has been a major challenge to the state and the world as a whole. Poverty is multi-dimensional. In a broader sense, it is deprivation, which may be traced to five interrelated clusters of disadvantages: (a) Physical weakness (lack of strength, under nutrition, ill-health, disability, high ratio of dependents to active adults); (b) Isolation (physical remoteness, ignorance, lack of access to information or knowledge); (c) Income poverty (lack of income and wealth); (d) Vulnerability (increased exposure to contingencies, danger of becoming more deprived); and (e) Powerlessness (inability to cope, adopt and choose).

Poverty reduction, in simple term, can, therefore, be expressed as: (a) Increasing access of poor people to adequate levels of food, water, clothing, shelter, sanitation, healthcare and education; (b) Increasing access to information and infrastructure; (c) Increasing opportunities for income generation; (d) reducing vulnerability by reduced exposure to

contingencies and of being deprived and (e) Increasing ability to cope, adopt and choose one's own living.

Energy is needed to improve the services and provisions to achieve all of above objectives. Therefore, development initiatives, focussing on targetting poverty reduction in developing countries need to focus on improving people's access to adequate, affordable and sustainable energy services and provisions. Energy provisions invariably enhance services that are linked and necessary to achieve above objectives, whether it be through rural electrification, improved management and bio-mass, increased use of renewable energies, increasing energy efficiency, other wide reaching measures or any combination of such measures. Many development agencies are now convinced that the provision of affordable, sustainable energy services will sustainably facilitate the achievements of many of the UN agreed Millennium Development Goals (MDGs) to eradicate poverty and improve the general wellbeing of communities. Integration of energy with rural development activities will definitely contribute to poverty reduction (Nepal G. and V.B. Sharma, 2004).

2.11 Renewable Energy and Tourism in the Tenth Plan

With a view to accomplishing the development goals, Nepal, with the assistance of donors, has prepared its Poverty Reduction Strategy Paper (PRSP). As a PRSP for Nepal, the Tenth Five-Year-Plan (2002-2007) has focussed its efforts on poverty reduction as its overarching goal. For the first time, it has defined roles of the state, civil society, private sectors and the non-governmental organisations (NGOs) for poverty reduction. The Tenth Plan attempts to bring down the population below the poverty line from 38% to 32% by the end of the plan. Through the development and promotion of renewable energy in the nation for poverty reduction, the tenth plan has envisaged accelerating economic development, improving living standard of the rural people, increasing the employment opportunities, and maintaining environmental sustainability through the development of rural energy systems. Furthermore, the tenth plan has also kept an objective of developing of science and technology and its use in achieving a sustainable and overall development of the country through maintenance and improvement of traditional technologies that can contribute in the rural development including the research and development of practical technology and to extend necessary contribution to make children, women and deprived section economically independent through science and technology. To realise the long

term objective, the Tenth Plan has set the objective of renewable energy development as "Developing and expanding alternative energy, as a powerful means for alleviating poverty, raising buying power of the rural people by developing alternative energy technologies based on the local resources, skill and increasing consumption of alternative energy and reducing dependency on improved energy by lowering the cost of installation through the proper utilisation of local resources and means" (NPC, 2002).

Similarly, the Tenth Plan has also pronounced for the sustainable development and promotion of tourism in the nation for effective and prioritised implementation of the programmes in the tourism sector that has already as an important organ of the national economy, will not only contribute to national economy but will also provide benefits to foreign tourists as well as increase the income generation and employment opportunities. In view to this, the following objectives have been set forth in the current 10th Plan:

a) Sustainable development and qualitative promotion of the tourism sector;
b) Conservation and preservation of historical, cultural, religious and archaeological heritage and enhancement of their practical utilisation;
c) To render air transportation services easily accessible, secure, standard and reliable;
d) To promote and disseminate RETs as the powerful means to enhance the livelihoods of the rural people for poverty alleviation;
e) To develop RETs based on local resources and means and commercialise them to supply the energy needs for domestic and economic use;
f) To reduce the cost of RETs to increase the access of rural people and
g) To reduce the consumption of traditional energy sources.

(Source: NPC, 2002)

2.12 The Government's Policy on Renewable Energy Technologies

Considering the importance of the renewable sources of energy for meeting the growing needs of energy in Nepal, the Government has paid attention towards the development and promotion of RETs. The importance of RETs was recognised during the Seventh Five-Year Plan (1997-92). The development of energy sector was accorded special priority during the Eighth Plan (1993-98). The Renewable Energy Subsidy Policy 2000 and Renewable Energy Subsidy Delivery Mechanism 2000 have been approved and implemented since the Ninth Plan.

The government has set the following policies and strategies on RETs:

a. Renewable Energy (RE) will be integrated for socio-economic development (enterprise and human development);
b. Services of RETs: Micro-Hydro (MH), bio-gas, solar, wind and ICS will be provided to about 1,800 VDCs during the Tenth Plan period;
c. Emphasis will be given for locally available resources and skills;
d. Priority will be given to programmes which are aimed at the integrated implementation for supporting the social, economic and environmental sustainability;
e. Emphasis will be given for research and development activities aiming to reduce upfront cost of RETs;
f. Rural Energy Fund (REF) will be set up and expanded up to the district and village levels in order to create enabling environment to attract private sector in the development of RETs;
g. Institutional arrangements will be made up to the district level in order to develop and promote RETs;
h. Emphasis will be given to individuals and community ownership and management in the development and dissemination of RETs;
i. Improvement will be made in the existing institutional arrangements for the development and dissemination of RETs and
j. Subsidy policy will be revised as per need in order to increase the access to rural households/communities to RETs and provide maximum benefits to them.

2.13 Targets of Tenth Plan on Renewable Energy Technologies

The PRSP has set the prime objective of reducing the poverty and establishing cultured, modern and competent society in the nation. For this, the plan has emphasized for the promotion and development of RETs in the nation. The targets set by the 10^{th} plan on RETs given below:

a. Provide electricity services to 12% of 5the rural people (existing 7%);
b. Installation of 2,00,000 Biogas plants in 65 districts (44 MW);
c. Installation of 4,000 Improved Water Mill (IWM);
d. Generating of electricity equivalent to 10,000 KW (10 MW) from MH in 47 districts;
e. Installation of 52,000 SHSs with large PV system in 52 districts (3.6 MW);
f. Installation of 2,700 solar dryers and cookers in 20 districts;
g. Installation of 100 solar PV water pumping systems in 15 districts;

h. Generation of electricity from wind- 20 KW and mapping in 20 districts;
i. Improved Cooking Stoves (ICS)- 250,000;
j. New Micro-Hydro schemes- 9,500 KW;
k. Rehabilitation- 400 KW and
l. Electrification from IWM-100 KW.

2.1.4 Subsidy Policy on Renewable Energy Technologies, 2000

In a bid to promote RETs, the government has adopted the policy of giving subsidies on various technologies of renewable energy.

2.1.4.1 Subsidy Policy on Renewable Energy Technologies, 2000

a. Micro-Hydropower

- Peltric set (less than 3 KW) Rs. 55,000/KW
- Micro-Hydro (3-100 KW) Rs. 70,000/KW
- Transportation of materials and equipment- Rs. 8,750/KW (2-5 days walk), Rs. 21,000 (more than 5 days walk), no subsidy for less than 2 days walk and Rs. 35,000/KW for rehabilitation.

b. Solar Energy

- Subsidy for 10, 20 and 30 watt or more than 30 watt solar PV Home System
- Subsidy for 30 or more than 30 watt SHS Rs. 8,000 for accessible areas, Rs. 10,000 for remote and Rs. 12,000 for very remote areas
- 50% subsidy for less than 30 watt, but which is not more than Rs. 8,000 for accessible areas, Rs. 10,000 for remote areas and Rs. 12,000 for very remote areas
- Subsidy for accessible areas is reduced from 10 percent fiscal year 2059/060.
- 50% subsidy for solar cooker or Rs. 3,750 whichever is less
- 50% subsidy for solar dryer and if it is installed in rural areas, subsidy will be 70%. The additional 25% will be given for commercial dryer for remote areas.
- 75% subsidy for solar water pumping system for up to 500 WP and
- For public institutions like schools, health posts, VDC buildings. etc., 75% subsidy of the cost of SHS.

c. Bio-gas Plants

- Subsidy for plants, size of 4-10 m3

- ❖ Rs. 5,000 per plant in 20 districts of Terai
- ❖ Rs. 8,000 per plant in 40 hill districts accessible by road
- ❖ Rs. 11,000 per plant in 15 districts of remote and inaccessible by road
- ❖ Additional Rs. 500 in districts of low penetration and
- ❖ For 4-6m3 plants, the additional Rs. 500 to encourage the low-income people.

d. Improved Water Mills

- ❖ Subsidy will be provided for grinding and hurling only
- ❖ Rs. 10,000 subsidy for grinding and Rs. 20,000 in all districts which are accessible by road and
- ❖ Additional Rs. 1,500 for grinding and Rs. 3,000 will be provided in 15 districts of remote and inaccessible by road.

2.1.4.2 Criteria for Subsidy on Renewable Energy Technologies

In order to promote RETs, the government introduced criteria for subsidy in 2000.

a. Micro-Hydro

- ❖ Productive end use must be above 10% of the total capacity of the MHP
- ❖ Create a fund for operation, maintenance and capital replacement
- ❖ Multi-purpose power projects will be given special preference
- ❖ The proposed installation must be in the area where national grid is unlikely to reach within the loan repayment period (within next five years)
- ❖ Monthly tariff for basic consumption of electricity is at least as high as NEA's average tariff
- ❖ Investment in micro-hydro project does not exceed as follows:

- Less than 2 days walk-- Rs. 150,000/KW
- Two-five days walk-- Rs. 158,700/KW
- More than five days walk-- Rs. 171,000/KW

- ❖ For multi-purpose power project, the above limitation of investment does not apply

b. Solar Energy (Solar Home System)

- ❖ Subsidy will be given in the areas where micro-hydro or national grid is unlikely to reach within the next five years.
- ❖ At least 10 systems should be installed in one VDC or within location of three hours walking distance.
- ❖ SHSs must be of international quality.
- ❖ The solar company installing the SHSs must be qualified by AEPC, and
- ❖ Only the Council of Technical Education and Vocational Training (CTEVT) certified technicians can install the SHSs.

c. Bio-gas Plants

- ❖ Only qualified or recognised bio-gas companies can construct the bio-gas plants.
- ❖ Subsidy will be provided to all the areas, except very cold regions.
- ❖ The model of bio-gas plants must be GGC 2047, and
- ❖ Generally, there should be enough cattle dung to install the bio-gas plants.

2.1.4.3 Subsidy for Renewable (Rural) Energy, 2006

With a view to making the Subsidy Arrangement, 2000 equitable, inclusive and effective, the Government of Nepal has formulated the Renewable (Rural) Energy Subsidy Arrangement, 2006. The Renewable Energy Subsidy Arrangement 2000 has been scrapped with the introduction of the new subsidy policy. As per the Subsidy for Renewable (Rural) Energy, 2006, it incorporates the following objectives:

a) To maximise the service delivery and service delivery efficiency in the use of renewable energy resources and technologies in the rural areas and to provide opportunity to low-income rural households to use RETs.
b) To support rural electrification as well as gradually reduce the growing gap of electricity supply, consumption, etc. between rural and urban areas.
c) To make the use of grant assistance provided by donors, existing and forthcoming, in a more effective and objective-oriented way and hereby attract additional donors and other investors in RETs sectors.
d) To support development and extension of RET market by attracting private sector entrepreneurs.
e) To support to the envisaged long-term targets of the Government of Nepal in providing rural electrification and energy services.

Policy Statement, Subsidy Type and Level

Micro-Hydro Power

Apart from revision in the subsidy rate warranted due to increased cost of micro-hydro (MH) installation, the new subsidy to micro-hydro will be provided based on the number of households to be served by MH. This will ensure indirectly that all households in the communities are served by MH, thereby making the policy inclusive. The subsidy for MHP projects/schemes is as follows:

a) A subsidy amount of NPR 8,000 per household will be provided for new MHP project up to 5KW capacities. But the subsidy will not be more than NPR 65,000 per installed KW.
b) A subsidy amount of NPR 10,000 per household will be provided for new MHP project from above 5 KW to 500 KW. But the subsidy will not be more than NPT 85,000 per installed KW.
c) A subsidy amount of NPR 4,000 per household will be provided for to add on MHP project (Improved Water Mill), if it is for electrifying villages. But the subsidy will not be more than NPR 40,000 per installed KW.
d) In respect of rehabilitation of MHP project of more than 5 KW capacities, a subsidy of NPR 10,000 will be provided to per additional household if it is served by MHP as a result of rehabilitation. But the subsidy will not be more than NPR 85,000 per incremental KW due to rehabilitation.
e) An additional subsidy will also be provided for the transportation of equipment and materials of the MHP project. The transportation subsidy will be given based on distance from the nearest road head to project site. The MHP projects will be categories for transport subsidy as shown below: Rehabilitation projects, as mentioned in (d), will receive 50 percent of transport subsidy specified below:

Geographical Location	Location of MHP Projects	Subsidy in NPR/HH Installed
Category A	All projects in Karnali and adjoining specified districts* and projects that are located at the distance of more than 50 km walking distance from nearest road head	3,000
Category B	Projects located at a distance of 25 km to 50 km walking distance from nearest road head	1,200
Category C	Project located at a distance of less than 25 km walking from nearest road head	No additional subsidy

*Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh, Darchula

Solar Energy System

In addition to revision in the subsidy rate warranted due to increase in cost of SHS, solar cooker, solar dryer and solar water pump, the revision is also required to male the policy more pro-poor and inclusive. The subsidies are as follows:

Solar Home System

a) Subsidy will be provided to households for installing SHS of 10-18 Wp, and more than 18 Wp from now onwards as mentioned in the following regions:

Geographical Location	10-18Wp (NPR)	More than 18 Wp (NPR)
Karnali and adjoining districts* and very remote VDCs# categorised A in other districts	7,000	10,000
Remote VDCs# categorised in other districts	6,000	8,000
Accessible VDCs	5,000	6,000

*Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh and Darchula

#The very remote and remote VDCs of the remote districts are as per the Ministry of Local development (MOLD), the Government of Nepal notification in the Nepal Gazette. The category "A" comprises of very remote VDCs, while category "B" represents remote VDCs as specified in Annexe-1.

b) The subsidy for SHS used by public institutions such as the VDC buildings, schools, clubs, health post/centres, etc. will be up to 75% of the cost.

c) In order to provide quick relief from kerosene *tuki, jhari,* etc. in the rural areas, a small solar system based on white LED known as solar *tuki* will be promoted. A solar *tuki* consisting of 2-5 Wp solar panels along with two sets of solar lap will be provided a 50% subsidy on the cost but not exceeding NPR 1,250 per system.

Solar Cooker

Realising the usefulness of solar cooker and the increased recent prices, the subsidy to solar cooker will be 50% of its market value, but will not exceed NPR 4,000.

Solar Dryer

The solar dryers may have extensive use in the rural areas, taking into their contributions to saving fuel-wood and drying of agriculture products/food without quality deteriorations. Solar dryers might contribute to rural household income as well. So, the subsidy will also be provided to family sized solar dryers as well as the solar dryers, which could be used in commercial purpose.

The subsidy to family sized solar dryers costing up to NPR 20,000 will be provided up to 50%. If the dryers are to be installed in rural areas for commercial purposes, the subsidy will be up to 70% of the total cost.

Solar Water Pump

In order to encourage solar PV use in the areas where rural electrification has not been done, solar pumps will be used for the activities like irrigation and drinking water. The poor people in the high lands in mountains can benefit from irrigation. Therefore, to promote productive use of solar PV, the subsidy of solar pumps up to the capacity of 1,000Wp will be 75% of its cost. AEPC will provide necessary technical support to such schemes.

Biogas

Among all the Renewable Energy Technologies, biogas has occupied an important role and in order to provide maximum benefit to rural households and to mitigate the environmental degradation and to meet the household energy requirements, the Government of Nepal, German Government (KFW), the Netherlands Government

(SNV/Nepal) have been providing the subsidy to biogas plants since 1992. As per the objective of timely revision of the subsidy and increasing the access of this technology to lo-income population, the subsidy for family biogas plants will be as follows:

a) An additional subsidy of NPR 500 for those districts, which have low penetration of biogas plants.
b) In order to increase the access of the rural poor in the technology, subsidy to the rural areas will be higher than the urban areas.
c) The currently followed subsidy delivery process has been simple and internationally accredited (ISO9001-2000), the procedure will be continued.

S.N.	Geographical Distinction (Districts)	Subsidy Rate
1.	20 districts of Terai as specified by the Government of Nepal-Annex 2 (1)	NPR 6,000 per plant
2.	40 hilly districts with road access as specified by the Government of Nepal- Annex 2 (2)	NPR 9,000 per plant
3.	15 remote districts without road access as specified by the Government of Nepal- Annex 2 (3)	NPR 12,000 per plant
4.	Specified low penetrated districts will be provided with additional subsidy of NPR 500 per plant- Annex 2 (4)	
5.	To encourage small users, 4-6 cu.m. capacity plants will be provided with additional of NPR 500 per plants	

Note: If there is change in the category of remote and accessible districts, it will be as specified by the Ministry of Local development.

Due to usefulness of biogas programme, high potential and benefits of the technology, the policy to subsidise biogas will be continued even after the completion of the current programme by mobilising new donors and investors. The current subsidy policy is applicable to only GGC 2047 Model of capacity 4-10cu.m. Feasibility study and pilot projects of the community biogas plants will be undertaken to explore possibility of using solid waste and other vegetable waste feed stock in addition to cattle for biogas generation.

Improved Water Mill

Agricultural product processing such as milling, hulling and shelling is done traditionally using water mills in Nepal. Various NGOs have supported in improving these traditional mills in the last 10-15 years to increase efficiency and capacity and thereby providing improved services in the rural areas. This has reduced work load of rural people and increased employment in rural areas resulting in socio-economic development. Realising the need and effectiveness in socio-economic upliftment, since 2003/04 (NFY 2060/61), the subsidy is being provided to improved water mill programme to develop the improved water mill and increase the low-income people's access to it, the subsidy to improved water mill is as follows:

a) NPR 9,000 for grinding and NPR 18,000 for hulling and grinding in all districts, except as specified in Annex-3.
b) Additional NPR 1,500 for grinding and NPR 3,000 for hulling and grinding in all remote districts, and not connected by road as specified in Annex-3.

Improved Cooking Stove

a) No subsidy has been provided to households using mud improved cook stoves in hills and mid-hills of Nepal.
b) 50% subsidy will be provided to improved cook stoves in high mountains for cooking and space heating, as they are costly and unaffordable. The subsidy amount will not exceed NPR 2,500.
c) Quite a number of institutions are involved in the development of ICS. These institutions have provided various kinds of support. Close relationship of contact with NGOs and donors will be established to make the direct and indirect support to ICS made by them more effective.

Wind Energy

a) The energy demand can be met to some extent by exploiting wind energy, if we consider the topography and climate of Nepal. Mechanical and electrical energy can be generated by wind energy. However, potential areas for wind energy exploitation have not been fully explored. The present effort of wind data collection and wind mapping will be continued.

b) Feasible wind electrification projects based on wind chargers to provide lights in villages will be provided subsidy at a rate similar to solar home system based on number of households served by each installation.
c) The financial and technical support will be provided for pilot project of wind if the electricity generated from it is to provide in the remote areas where there is no access of national grid and MHP.

Other Renewable Energy

Although there is no direct subsidy, studies, researcher\s and development, training and pilot projects will be undertaken in the field of other renewable energy, e.g., biomass briquette, institutional gassifier for school hostels, hotels, etc. and geothermal energy applications.

Subsidy Delivery Procedure

a) Renewable/rural energy has proven to require credit for users to be able to afford the installation, Despite various efforts, access to credit in rural areas for renewable energy investment has been found to be utterly inadequate. In the long-run, when subsidies are withdrawn, it is expected that credit replaces the subsidy and is only a reasonable way to expand the service delivery sustain ably. The Government of Nepal desires that an appropriately long-term credit at an affordable interest is available for investment in the field of renewable energy. In order to encourage, financial institutions to invest in renewable energy, efforts will be made in creating an institutional credit mechanism through credit guarantee scheme under the Rural Energy Fund, which will supervise and disburse the subsidy. The necessary details in this regard in the delivery mechanism.
b) In order to disburse the above-mentioned subsidy in a simple and effective way, AEPC will prepare the renewable energy subsidy mechanism and will enforce it after approval from the Ministry of Environment, Science and Technology.
c) The above-mentioned subsidy for renewable (rural) energy will be disbursed through AEPC.
d) The level of subsidy will be reviewed every two years.

While comparing the two subsidy policies, the Subsidy for Renewable (Rural) Energy, 2006 seems to be more encouraging for the promotion of micro-hydro. The new policy has slightly increased the amount of subsidy for micro-hydro projects. However, the government has cut down in the subsidy amount for solar energy technology.

Because the study area is rich in water resources, the new policy could be helpful in the development of micro-hydro there.

CHAPTER THREE

RESEARCH METHODOLOGY

Chapter Three offers research methodology applied for carrying out the research work. The methodology includes the rationale for the selection of the study area, research design, nature and sources of data, sampling procedure, variables and their operationalisation, data collection techniques, reliability and methods of data analysis.

3.1 Rationale for the Selection of the Study Area

The study was conducted on the Lukla-Monjo trekking route in the Chaurikharka VDC in the Khumbu Region. The study is limited only to tourist hotels and lodges along the trail. The basic reason for selecting the study site can be justified on the following grounds:

1) The study area is one of the world's major trekking and tourism destinations;

2) Until now, no micro level study has been conducted regarding the use of renewable sources of energy linking with sustainable tourism development;

3) The researcher is quite familiar with the area's energy sources and ecology;

4) The research in the area is essential to influence both national and local policies on development of sustainable tourism through promotion of RETs.

3.2 Research Design

- The nature of the research is both descriptive and exploratory in nature.
- It is descriptive because it is based on investigation and records of the study area.
- It is exploratory, as the information collected from the field survey has been used for analysis.

3.3 Nature and Sources of Data

Both primary and secondary data were used in this study. Primary data were collected from the study site. Similarly, secondary data were collected from various sources such as published and unpublished materials related to the subject matter.

3.4 Sample Size

There are about 100 tourist standard hotels and lodges along the trekking route between Lukla and Monjo. The hotels and lodges are the universe of the study. Altogether 40 hotels and lodges, which share about 40 percent of the universe, were selected as a unit of the study on a simple random basis.

3.5 Variables and their Operationalisation

In the study, the following variables have been operationalised:

S. No	Variables	Operationalisation
1	Trend analysis of energy use	- document collection - energy saving - analysis of flow of tourists before and after use of renewable sources of energy
2	Demand analysis of renewable source energy	- evaluation of market value - demand situation based on opinion
3	Institutional barrier	- accessibility - maintenance - quality performance of energy source
4	Installation barrier	- purchasing power - technology problem - availability of human resource
5	Level of awareness	- Level of awareness - Consciousness - Perception
6	Opportunity	- application area - opportunity to invest by private sector - waste recycling viability - other energy options

3.6 Data Collection Techniques & Instruments:

For the collection of secondary and primary data, the following techniques and instruments were adopted:

a) The secondary data were collected from a wide range of sources. The major sources included the Central Library, TU, various published and unpublished documents and relevant websites, reports prepared and published by different institutions such as the REDP, AEPC, NTB, TRPAP and Lotus Energy (P) Ltd.

b) The primary data were taken from a field study with the help of the following techniques and instruments:

i. Household Survey

A total of 40 households (hotels and lodges) were surveyed to gather information for the study. From each household of member was selected for an interview. A structured questionnaire was used for interviewing the respondents.

ii. Key informants' interview

In this study, the National Programme Manager (NPM), Deputy Programme Officer and Energy Advisor of REDP, Managing Director (MD) of Lotus Energy (P) Ltd., Environment Specialist and Geographic Information System (GIS) Associate of TRPAP, officials of local energy consumers' committees of Monjo, Phakdin and Lukla and officials of the Community Forestry User Groups (CFUGs) of the study area were the key informants.

iii. Observation

The researcher had observed the physical setting of the study area, relationship among hotel entrepreneurs, visiting tourists, local people and the SNP employees. The energy consumption pattern and situation was also observed during the field survey. An observation sheet was used as an instrument.

iv. Focus Group Discussion (FGD)

The hotel and lodge owners and other energy consumers and key actors involved in the promotion of energy in the study area were gathered for a brainstorming discussion. Apart from this, Participatory Rural Appraisal (PRA) was also applied to discuss on various issues and problems associated with renewable energy use for promotion of sustainable tourism.

3.7 Reliability:

With a view to ensuring the reliability of research tools, the findings were tested at least three times to minimise errors as far as possible. Much focus was given for the selection of the sample size.

3.8 Methods of Data Analysis

The collected data were coded, edited, classified and tabulated for their organization. The quantitative data were analysed with the help of suitable statistical tools like numbers, percentage and mean. Moreover, pie charts, bar-diagrams and trend analysis, graphs, pictures, photographs, etc. were used to make the analysis and presentation more attractive. Similarly, the qualitative data were interpreted and analysed in a descriptive way based on their numerical characteristics.

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

Chapter Four presents an analysis and interpretation of data collected during the field survey. It has also described Solukhumbu district at a glance, tourism potentiality in Khumbu region, description of the study area, major attractions of the study area, accessibility, accommodation, tourist flow trend, energy use scenario in Solukhumbu, district energy resources and technologies, energy consumption scenario, total energy consumption in commercial sector, socio-economic profile of the respondents, ethnic composition, education, level of awareness of the respondents on renewable sources of energy, amenities in hotels/lodges, sources of investment in renewable sources of energy, sources of investment in renewable sources of energy, sources of credit, awareness level of the respondents on the provision of subsidy, type and quantity of energy used in hotels and lodges, reasons behind the use of renewable sources of energy, energy use pattern, energy types used in hotels and lodges, types of energy resources used before installation of renewable sources of energy, major factors responsible for deciding to install renewable sources of energy, major application areas of renewable sources, major areas of using renewable energy, impact of energy use, satisfaction level of hotel entrepreneurs towards the use of renewable sources of energy, respondents' views on the promotion of quality hotel management by use of renewable sources of energy, reduction of use of non-renewable sources of energy, use of renewable sources of energy and forest conservation, sustainable tourism promotion and use of renewable sources of energy, satisfaction level of the respondents on subsidy policy and the challenges of using renewable sources of energy.

4.1 Solukhumbu District At A Glance

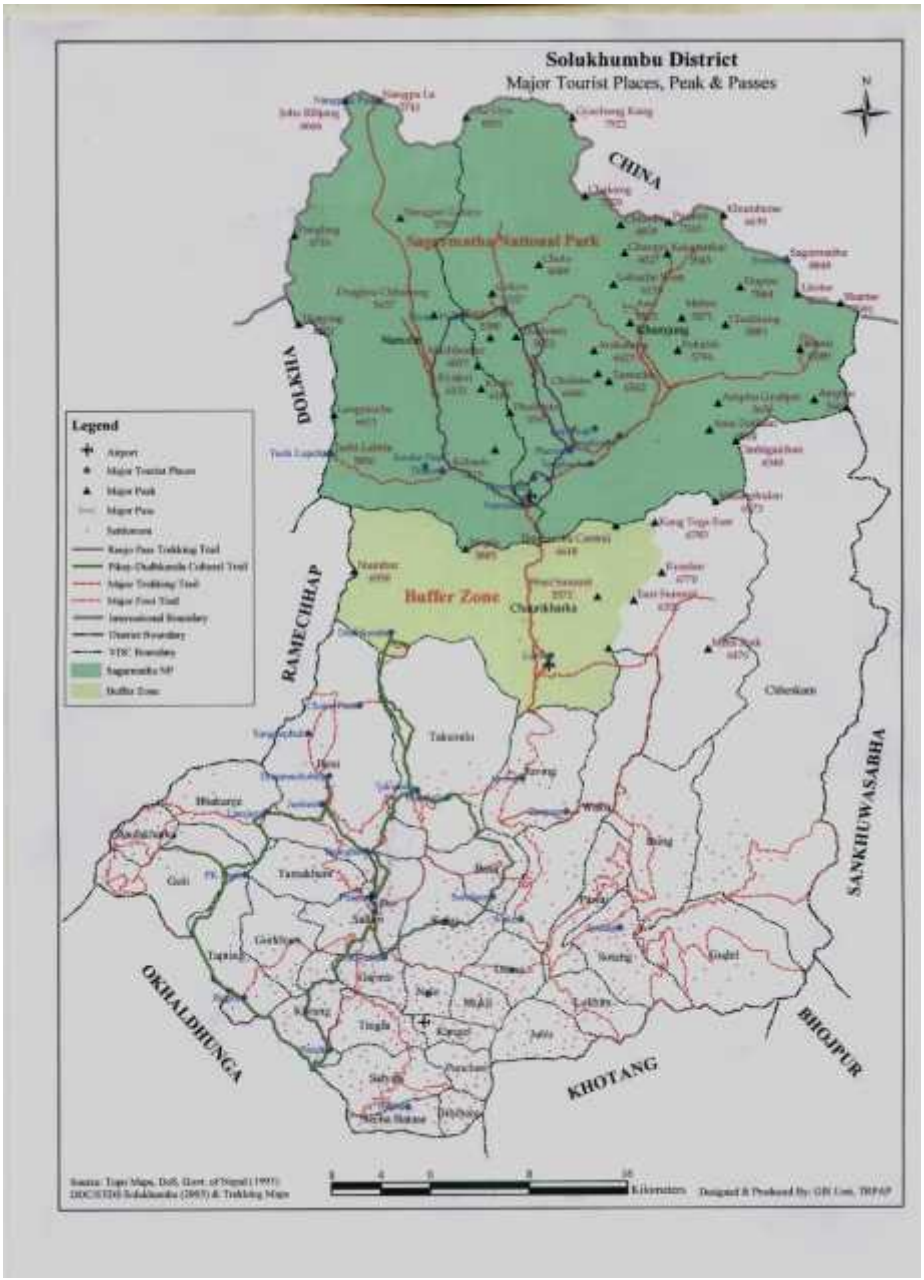
Lying in the Eastern Development Region of Nepal, the Solukhumbu district has made the country known to the outside world due to the world's highest peak, Mt. Everest (8,848m.), and many other mountain peaks. The district is situated within the latitude of 27⌈20'39" and 28⌈06'24" north and the longitude of 86⌈00'21" to 87⌈00'01" east. The district shares its borders with the Tibet Autonomous Region (TAR) of the People's Republic of China (north), Sankhuwasabha and Bhojpur districts (east), Dolakha and Ramechhap (west) and Okhaldhunga and Khotang (south). The district that covers an area

of 3, 39,776 hectares of land has much to offer to tourists. Of the total landmass, about 56.66 percent is in the Himalayan region, while the high hilly region and mid-hilly region account for 42.51 percent and 0.82 percent respectively. With topographical and latitudinal variations, the district has diverse climatic conditions. The altitudinal variations in the district are so distinct that it stretches from 600m to 8,848m above sea level.

Established in 1976, the Sagarmatha National Park (SNP) covers two touristically important VDCs-- Namche and Khumjung. This unparalleled park covering a total area of 1,148 sq. km. was listed on World Heritage Sites of United Nations Educational and Scientific Organisation (UNESCO) in 1979. The Makalu Barun National Park (MBNP) is expanded both the Solukhumbu and Sankhuwasabha districts. It covers the Chheskam and Bung VDCs of Solukhumbu. Together with SNP and MBNP and their Buffer Zones (BZs), about 44.27 percent of the total part of the district is in the conservation area.

As per a projection made by the Informal Sector Research & Study Centre in 2004, the total population of the district was 1, 12,147. Of them, the number of male and female stood at 55,376 and 56,771 respectively. Out of the total population, the number of economically active ones was 66,903. The population growth rate in the district is 1.4 percent as against 2.24 percent average national rate. Similarly, the population density rate is 34, while the country's average rate stands at 157 per square kilometres. About 45.81 percent people are literate in the district. There are a total of 21,667 households.

Map 1 Map of Solukhumbu District



4.2 Tourism Potentiality in Khumbu Region

Trekking in the Khumbu Region of Nepal provides a wide range of wilderness and cultural encounters. As a small piece of 'heaven', the nature-blessed area is different to different people. There are those who wish to reach the highest point on earth (Mt. Everest), while there are others who choose to live out their dreams by standing at the foot of the world's tallest peak. Still others prefer a middle ground south of Khumbu such as Solu. It is an opportunity to observe and participate in the daily life of the legendary

Sherpa people walking through the middle hills of Solu and trekking in the higher altitudes of Khumbu to the base of Sagarmatha. Recognized as a World Heritage Site, the SNP is one of the few places on earth that has a unique bio-diversity and the highest and the youngest mountain system in the world. The park is the home to three of the world's seven highest mountains -Sagarmatha, Lhotse and Cho-Oyu. It also contains several other prominent peaks most of which are above 6,000m. The hard grind of daily life in the high Himalayas is interrupted by seasons of feasts and festivals, marked by dancing and general merry-making for the people of Khumbu. The region is dominated by the Sherpas and in the lower region the Khaling Rai community can also be found. A deep adherence to the Tibetan Buddhist religion dominates their home lives and their biggest festival- *Mani Rimdu* which depicts the victory of Buddhism over the ancient Bon faith.

The unique settlements and attractive landscape, unspoilt culture, inept hospitality of the Sherpa people, no where found highest mountains, ever flowing glaciers and waterfalls and rich bio- diversity are the major attractions of the Khumbu Region. Hence, these all undoubtedly speak of huge potentiality of tourism in the region.

4.3 Description of the Study Area

Situated at an elevation of more than 2,800 metres above sea level, the Lukla-Monjo trekking route is very important in the sense that the route leads to Everest Base Camp as well as many other trekking sites in the Khumbu Region. The tourism business does not operate in the area throughout the year due to climatic variations. Tourists visit the area mainly during Spring (March-May) and Autumn (September-November). The temperature of the area ranges between 22-0 Degree Celsius. Sometimes the temperature drops down even below zero Degree Celsius.

As the second largest trekking region after the world-famous Annapurna Region, the Khumbu Region alone attracts a large number of trekkers and adventure seekers. In 2000, the region lured a total of 25,291 trekkers, while the number decreased to 13,786 in 2002. The study area covers the popular trekking route from Lukla to Monjo in the Chaurikharka VDC of the district. To cater to such a large number of tourists, the area has high demand for energy. Therefore, the forest resources and wildlife in and around the area have been facing a serious threat. The ecology of the area is very fragile. Despite the increased level of awareness among the local people about sanitation and the efforts made by various agencies, including the Sagarmatha Pollution Control Committee (SPCC) for waste

management, the area often hits news headlines. In the late 1980s, the international media dubbed as the 'highest trash dump' due to the poor management of waste disposal.

With about 4,000 population, the Chaurikharka VDC has the domination of the Sherpa community. Most of the local residents have been directly or indirectly engaged in the tourism business. There are roughly 100 tourist standard hotels, resorts and lodges in the study area (along the trekking route between Lukla and Monjo).

Of a total of 454.90 Square Kilometres (Sq. Km) area, forest land and shrub land cover 47.34 and 61.70 area. Water bodies account for 4.92 sq. km. area.

Table 4.1 Description of Land Use Type in Chaurikharkha

Land Use Type	**Area in Sq. Km.**
Cultivated Land	4.95
Forest Land	47.34
Bush/Shrub Land	61.70
Grass Land	25.56
Orchard Nursery	1.42
Water Bodies	4.92
Glacier Part	41.93
Waste/Barren Land	1.75
Ice/Rock	256.00
Landslide	0.34
Total Area	**454.90**

Source: GIS Section/TRPAP, 2006

4.3.1 Major Attractions of Study Area

The study area holds a lot of potential for tourism promotion. The tourist attractions in the area range from beautiful landscape, breathtaking view of the mountain ranges, glaciers, rivers, waterfalls, trekking trails, various species of flora and fauna to the Sherpa-dominated settlements and their unique culture and festivals. The friendly and brave Sherpa people, who are the indigenous community of the area, have been quite popular among the visiting tourists because of their mountaineering skills. Moreover, the Sherpa community people are equally famous for their warm hospitality.

4.3.2 Accessibility

Despite the five plus decade of tourism operation in this region, this part of Nepal is still not directly connected by road. The area is accessible only by air and on foot. There are two airports in the Khumbu Region-- one at Lukla of the Chaurikharka VDC and another at Syangboche of the Namche VDC. The Lukla airport, which is situated at a height of about 2,860 metres above sea level, is considered as the busiest airport in the country after the Tribhuvan International Airport (TIA). Various airlines, including the Nepal Airlines Corporation (NAC), the only national flag carrier, operate flights to Lukla from Kathmandu and Biratnagar. During the peak tourist season, more than 40 flights are operated daily despite the difficult topographical conditions of the area. The flights carry passengers as well as cargo. One-way airfare for a foreigner is US$ 97 on Kathmandu-Lukla sector, while a Nepali passenger has to pay Rs. 2,355. The fare for cargo amounts Rs. 35 per kilogramme.

Many trekkers, porters and local people visit the area on foot via Jiri as well. Jiri, which is located in the Dolakha district that shares its borders with the Ramechhap and the Solukhumbu districts, is one of the major gateways to the Khumbu Region. The Hillary Trail connects Jiri with Lukla. Trekkers can cover this famous trail within about six days of normal walk.

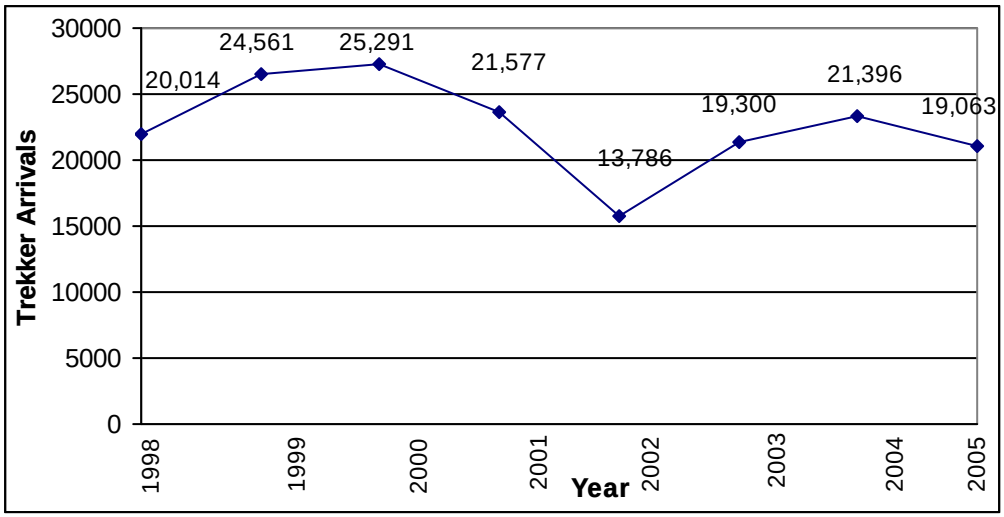
4.3.3 Accommodation

As the only trekking route to Namche and other parts of the Khumbu Region, the Lukla-Monjo trekking trail now has necessary accommodation facilities. The number of tourist hotels, resorts and lodges along this trail stands at over 100. The type and quality of hotels in the area range from highly sophisticated to moderate ones. With the rapid development of the hotel industry, the visiting tourists do not feel that they are in a remote area. On average, the number of beds in a hotel ranges from 15 to 20.

4.3. 4 Tourist Flow Trend

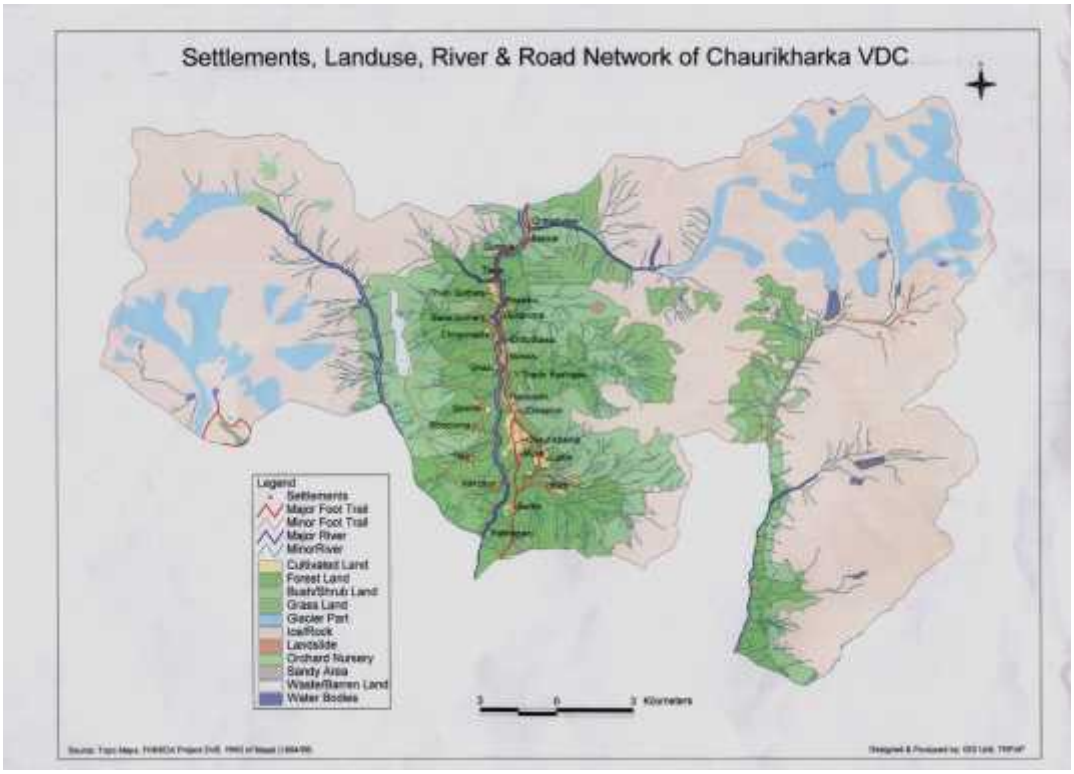
As the tourism industry as a whole is a seasonal business, tourism in the study area is no exception to this. Although some trekkers and nature lovers visit the area throughout the year, the increased flow of visitors is recorded mainly during the Spring (March-May) and the Autumn (September-November). The data given below depict the tourist flow trend in the area:

Graph 1 Trekker Arrivals in Sagarmatha National Park



Source: SNP, 2006

Map 2 Map of the Study Area



4.4 Energy Use Scenario in Solukhumbu

Various data and statistics show that the energy use pattern of the Solukhumbu district is highly dependent upon non-renewable sources rather than renewable ones. Most of the

people rely on traditional sources of energy like fuel-wood, kerosene, agricultural residue, animal power and human labour to fulfill their needs (District Energy Development Section, DDC Solukhumbu, 2004).

The overall energy use scenario, nature and sources of energy, energy-related technologies and sectoral use of energy in the study area have been described under different headings below:

4.4.1 District Energy Resources and Technologies

In the Solukhumbu district, the share of energy resources is as follows:

Forest Area: In the district, the forest area covers about 105,330 hectares of land (District Forest Office, 2059/060 B.S.). Sub-tropical deciduous broad leaved hard wood forest, lower temperate mixed deciduous and coniferous hard wood forest, upper temperate mixed deciduous and coniferous hard wood forest, high altitude coniferous forest and shrub are the types of forest found in the district. The local people basically use *Sal*, *Khotesalla*, *Khashru*, *Thingre Salla*, etc. to meet their energy needs.

Agricultural Residue: Agricultural residues like paddy husk and straw/stalks of paddy, wheat, maize, etc. are also part of energy resources. However, the use of the ICS technology and bio-briquette is found to be utilised in a minimum scale.

Animal Waste: In the district, utilisation of the animal dung as a source of the energy is negligible. The people of the area utilise animal dung in the form of *guitha* (dung cake) mainly for cooking and heating purpose. No bio-gas plant technology is in operation. So, animal dung has not been utilised properly for energy generation.

However, a research study carried out by Biogas Support Programme Nepal (BSP- Nepal) has found out that bio-gas can be generated even in the high altitude regions with the help of the Heap Composting Technology. The study report has shown that the bio-gas formation process gets disturbed in the cold regions due to temperature fluctuations. However, if the grass-bed of animals (*Sottar*) during the time of removing is placed above the dome of the bio-gas plant up to three-metre high, the waste during the time of decaying produces a kind of heat. The heat, in turn, helps the bio-gas plant system to maintain the needed temperature. Thus, this technology can help generate bio-gas even in the cold regions.

Water Resources: Although the study area harbours a huge potentiality of natural force of Water, only limited water resources have been harnessed for energy generation. However, the use of peltric sets for energy generation has been on the rise there. Despite abundant water resources, no micro-hydro plant has been installed, so far, in the region. Some institutions have now been involved in promoting micro-hydro projects there. The key informants of the area informed the researcher that various feasibility studies have been carried out and some are in the pipeline. According to them, the 100-KW Bom Khola Project is under construction in partnership between REDP, TRPAP and SNP Buffer Zone Management Committee (SNP/BZMC). Similarly, the feasibility studies of the Monjo Khola (50 KW) and the Tok Tok Khola (60 KW) have been carried out. The projects are also under construction with the financial and technical support of the institutions such as WWF and SNP/BZMC. In addition to it, REDP is planning to carry out a feasibility study of the 30-KW Thadokoshi project next year.

Solar Energy: Solar energy is one of the major renewable sources of energy used in hotels and lodges. However, its utility has been limited only to lighting purpose. Solar PV and solar heater are broadly used in the study area.

Wind Energy: Although the development of wind energy is viable in some parts of the study area, this form of renewable energy is yet to be tapped.

4.5 Energy Consumption Scenario

This part mainly deals with the total energy consumption, sectoral consumption of the energy, total energy consumption in the commercial sector, and satisfaction level of the respondents on the use of renewable sources of energy.

Energy can neither be created nor destroyed. But, it can be changed from one form to another. There is no denying the fact that energy is needed in our daily life. Energy has undoubtedly made our life easier. Thus, it is widely acknowledged that energy should be consumed in a sustainable manner. Otherwise, the future generations will be jeopardised. The energy consumption pattern in the Solukhumbu district is as follows:

Table 4.2 Total Energy Consumption

Kerosene	Fuel-wood	Electricity	Other
1.72%	98.01%	0.1%	0.1%

Source: Distinct Energy Situation Report, Solukhmbu, 2004

The above diagramme shows the total consumption pattern of energy in the Solukhumbu district. Fuel-wood consumption accounts for 98.01% followed by kerosene (1.72%), electricity (0.1%) and others (0.1%). This scenario reveals that the use of non-renewable sources of energy is very high the district. This could be detrimental to sustainable tourism development in the area if energy consumption pattern is not addressed in due course of time.

4.5.1 Total Energy Consumption in Commercial Sector

The District Energy Situation Report, 2004 of the Solukhumbu DDC shows that energy is primarily used in industrial, residential, commercial, and agricultural and transportation sectors in the district.

Table 4.3 Total Energy Consumption in Commercial Sector

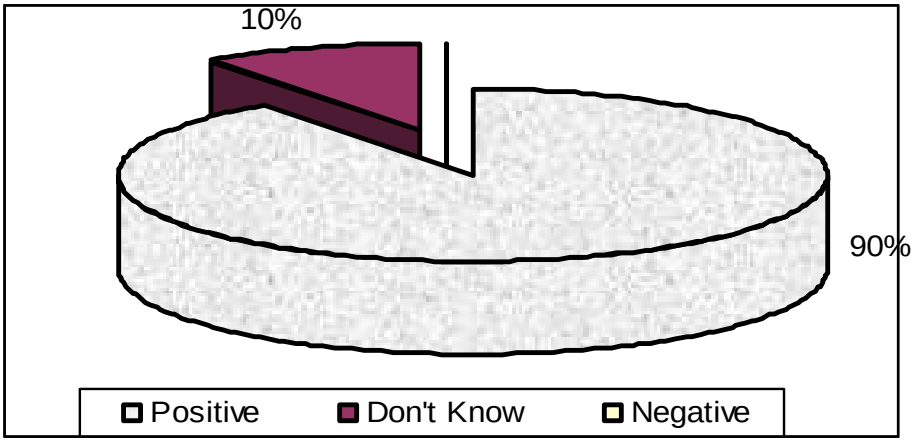
Places	Cooking	Space Heating	Water boiling	lighting
Restaurants	3438.1	287.7	9.3	0
Hotels/Lodges	3203.4	42.7	22.5	0
Total	6641.5	330.4	31.8	0

Source: District Energy Situation Report, Solukhumbu, 2004

About 3438.1 GJ of energy was found to be used for cooking purpose in restaurants, while about 3203.4 GJ used for the same purpose in hotels and lodges. Similarly, about 287.7 GJ of energy was found consumed in space heating in restaurants and about 425.7 GJ for the same purpose in hotels and lodges. Likewise, about 9.3 GJ of energy was used for boiling water in restaurants and about 22.5 GJ for similar purpose in hotels and lodges. In total, about 6641.5 GJ of energy was used for cooking, 330.4 GJ for space heating and 31.8 GJ for boiling water. Restaurants were found using much more energy for cooking as compared to hotels and lodges.

In Solukhumbu, per capita energy consumption is relatively low, which indicates lower living standard of the people. Solar PV and peltric sets are quite popular but solar is limited to lighting. Many peltric sets are not in operation due to lack of technical back-up.

Graph 3 Total Energy Consumption in Commercial Sector



Source: Field Survey, May 2006

While assessing the satisfaction level of the respondents on the use of renewable sources of energy, about 90% were found positive followed by unknown (10%) and negative (0%). This indicates that there is high demand for renewable energy in the study area.

4.6 Socio- economic Profile of the Respondents

Socio-economic characteristic is an important aspect of an analysis and interpretation of any kind of research work. The socio-economic characteristics of the respondents here include ethnic composition, education, level of awareness, and annual income.

4.6.1 Ethnic Composition

The Sherpas are the dominant ethnic community in the study area. The population is mostly homogenous and so are the respondents. With the promotion of tourism in the area, the local culture has been affected, to some extent. However, the locals are aware about the importance of preserving their tradition and culture. Various environmentalists suggest that any development project should be culturally suitable, socially acceptable as well as environmentally friendly. Meanwhile, the researcher has found majority of the people being aware of the importance of environmental protection. But they are compelled to encroach upon forests due to lack of other better energy options available in the region.

4.6.2 Education

It is well-known fact that education is the major foundation for all the development activities. The literacy rate of the district is about 47.86**%**. The status of educational institutions in the district is presented below:

Table 4.4 Educational Institutions in the District

Primary	Lower Secondary	Secondary	Higher Secondary	Private School	Total School	Total College
195	27	27	06	04	259	03

Source: District Profile 2059/2060 B.S.

There are 195 primary schools, 27 lower secondary schools, 27 secondary schools, six higher secondary schools and four private schools. Altogether, there are 259 schools and three colleges in the district.

The researcher has also analysed the educational status of the respondents. The details of their educational status are presented in the table below:

Table 4.5 Educational Status of the Respondents

Educational status	Total	
	No.	Percent
Illiterate	5	12.5
Literate	35	87.5
Total	40	100

Level of Education	Total	
	No.	Percent
Non-formally educated	9	25.71
Primary level (1-5)	13	37.14
Lower secondary level (6-8)	8	22.85
Secondary (9-10)	3	8.57
SLC	1	2.85
Above SLC	1	2.85
Total	35	100

Source: Field Survey, May 2006

In course of assessing the level of education of the respondents, the researcher has found 87.5% educated, and the remaining 12.5% uneducated. Among the educated, only about 2.85% have acquired degrees above SLC (School Leaving Certificate) and about 2.85% have passed SLC. Similarly, about 8.57% have completed secondary level education, while 22.85% have passed class 8. About 37.14% have acquired primary level education and about 25.71% have been educated through non-formal education programmes. Hence, it is highly recommended to increase the level of education of the local people.

4.6.3 Level of Awareness

The level of awareness is also one of the important aspects of the research analysis. It is a matter of fact that those hotel entrepreneurs using the renewable sources of the energy had higher level of awareness than the rest.

Table 4.6 Attitude of Hotel Entrepreneurs towards Use of Renewable Sources of Energy

Attitude	Total		Annual Income
	No.	Percent	
Positive	36	90	Rs. 500,000
Neutral	4	10	Rs. 450,000
Negative	0	0	
Total	40	100	

Source: Field Survey, May 2006

It is interesting to note that no respondent had negative attitude toward the use of renewable sources of energy. About 90% of the respondents had positive attitude towards it followed by 10% neutral. Although the use of renewable energy is very negligible, the respondents have been found ready to install renewable sources of energy only when it has increased efficiency and lower cost. As an observer, the researcher suggests that the amounts of subsidy for accelerating the use of renewable energy should be increased considerably in the study area. About 90% of the respondents' level of annual income has been found exceeding Rs. 500,000, while the remaining 10% had about Rs. 450,000 income annually.

4.6.4 Amenities in Hotels/ Lodges

The amenities possessed by hotels and lodges are a significant aspect to analyse the survey. Therefore, keeping this fact in mind, the researcher collected the data of amenities that are supposed to consume energy. Such amenities included:

Table 4.7 Possession of Amenities in Hotels and Lodges

S. N.	Amenities	Number	Power
1.	TV/radio	72	(4,000+600) Watt
2.	Bulbs (electric)	256	12,800 Watt
3.	Bulbs (solar)	406	16,240 Watt
4.	Space heater (in bed-rooms)	43	43,000 Watt
5.	Solar water heater + back boiler + kerosene heater	20 +36 +10= 66	--
6.	Refrigerator	38	38,000 Watt

Source: Field Survey, May 2006

The above table shows that there were 70 televisions and radio sets among the total hotels and lodges surveyed. Similarly, there were 256 electric bulbs followed by solar bulbs (406), space heaters (43), solar water (20), back boiler (36), kerosene heater (10), and refrigerators (38). It has been found TV/radio, bulbs, space heaters, refrigerators and solar water heaters run with the help of renewable sources of energy.

Fuel-wood is used for multiple purposes such as cooking food, boiling water and heating rooms. During tourist season, one hotel consumes nearly 30kgs of fuel-wood per day. In addition to this, kerosene is also used for many purposes like cooking food, boiling water and heating rooms. The researcher wanted to know why the hotels and lodges used much non-renewable sources of energy as compared to the renewable sources. The respondents informed the researcher that fuel-wood easily available and it is much more cheaper than the renewable sources of energy. Furthermore, they added that the main reason for using kerosene is that it is easy to use.

Considering the above situation, the researcher arrived at a conclusion that the use of energy in hotels and lodges has been at a greater scale.

4.6.5 Sources of Investment in Renewable Sources of Energy

A greater attention has to be paid to the economic aspect of the respondents while conducting any kind of research work. Thus, an attempt was made by the researcher to

assess the sources of investment in renewable sources of energy. In this regard, the information gathered from the field survey has been tabulated underneath:

Table 4.8 Sources of Investment of the Respondents in Renewable Sources of Energy

S.N.	Response	Total	
		Population No.	Percent
1.	Saving	26	65
2.	Credit	10	25
3.	Installment	4	10
	Total	40	100

Source: Field Survey, May 2006

While assessing the sources of investment of the respondents in renewable sources of energy, it has been found that about 65% invested for the installation of renewable sources of energy through saving followed by credit (25%) and installment (10%). This scenario reveals that most of the hotel and lodge owners are capable of investing, as they are able to save. Also, it is encouraging to say that some respondents have used renewable sources of energy such as solar power and peltric sets with the help of credit facilities. The data show that respondents have positive attitude towards the use of the renewable sources. Therefore, for those who are capable of receiving loan or maintaining the credit should be encouraged by providing easy loan, and to those who are willing to install the renewable energy source should be provided with the credit facilities and encouraged to use credit facilities so that they would be motivated to install renewable sources of energy to meet their daily energy needs.

4.6.6 Sources of Credit of the Respondents:

Connected with the sources of investment in the renewable sources of energy, an attempt was also made by the researcher to know the sources of the credit the respondents had received. The collected data is presented in the table below:

Table 4.9 Sources of Credit of the Respondents

S.N.	Source of Credit	Total	
		No. of the Respondents	Percent
1.	Personal	6	60
2.	Bank	1	10
3.	Cooperative	2	20
4.	Others	1	10
	Total	10	100

Source: Field Survey, May 2006

The above table shows that about 60% gained credit through personal burrowing, followed by 20% cooperatives, 10% banks and 10% others, particularly through relatives, friends, etc.

It has been found that those who were getting loan from their relatives and friends were paying high interests, which ultimately put the respondents into problems in the latter days.

4.6.7 Awareness Level of the Respondents on the Provision of Subsidy

In due course of conducting field survey, an attempt was made to analyse the awareness level of the respondents on the provision of subsidy. From the field survey, the following data were obtained:

Table 4.10 Awareness Level of the Respondents on the Provision of Subsidy

S.N.	Response	Total	
		Population No.	Percent
1.	Yes	22	55
2.	No	18	45
	Total	40	100

Source: Field Survey, May 2006

The above table shows that of the total respondents, about 55 percent have been found aware of the subsidy provisions. On contrary, they had no idea about getting loans and the formalities to be accomplished.

Most of them informed that they knew about the from their friends and relatives. At the same time, they did not prefer to take loans because of high risks involved in it. They also conceded the fact that it was easier for them to get fuel-wood collected from the nearby forests.

Meanwhile, 45% of the respondents had no idea about subsidy provisions. They were found getting loans from their neighbours at higher interest rates. Some of the hotel owners however, said that they were unable to use the facilities due to their ignorance.

4.7 Type and Quantity of Energy Used in Hotels and Lodges

While collecting the primary data from the field survey, the researcher tried to assess the type and quality of energy being used at tourist hotels and lodges. An attempt was made to collect the exact data and information. But it was not possible due to the unavailability of accurate quantitative data.

Table 4.11 Respondents' Views on the Use, Quality and Cost of Energy

S.N.	Particulars	Quantity		Rate (Rs)	Total amount (Rs)
		No (per day)	Weight		
1.	Fuel-wood	1 Bhari (Bundle)	20-25 kg.	150	22,500
2.	LPG Gas	1 Cylinder	14.2 kg.	3,600	216,000
3.	Kerosene	1 Gallon	5 kg	105	78,750

Source: Field Survey, May 2006

The above table shows an average daily and annual energy consumption in a hotel or a lodge. The owners of hotels and lodges were found spending about Rs. 216,000 only for LPG per annum. Similarly, they spend about Rs.78,750 in kerosene and about Rs.22,500 in fuel-wood. The use of such fuels ranges from cooking, heating room and water, lighting, etc.

Despite having a huge potentiality for water resources, electricity generation through micro-hydro plants is still a matter of luxury to the highlanders. The consumption of fuel-wood shares the highest of all forms of energy, as it is available at a cheaper rate. The total price paid by the hotel and the lodge owners is comparatively low (Rs. 22,500). This indicates the probability of increasing the use of the fuel-wood leading ultimately to

further deforestation and landslide in the area. This means low inflow of tourists and less income of the local people.

4.8 Reasons Behind the Use of Renewable Sources of Energy

During the research, it was felt necessary to assess the reasons behind the use of renewable sources of energy. It is the motivating factors that play an important role in promoting renewable sources of energy. As per the responses of the respondents, the following reasons were behind the use of renewable sources of energy:

Table 4.12 Respondents' Views on Use of Renewable Sources of Energy

S.N.	Major Reasons	No.	Percent
1.	Better lighting quality	28	70
2.	Economic saving	8	20
3.	Environmental preservation	4	10
	Total	40	100

Source: Field Survey, May 2006

While analysing the reasons behind the use of renewable sources of energy, about 70 percent were found using them for better lighting quality followed by economic saving (20%) and the remaining environmental preservation (10%).

4.9 Energy Use Pattern

In this section, energy use pattern in the study area has been presented.

4.9.1 Energy Types Used in Hotels and Lodges

The major types of the energy used at hotels and lodges are as follows:

Table 4.13 Major Energy Types Used in Hotels and Lodges

Energy type	Total	
	No.	Percent
Fuel-wood	40	100
Fossil fuel	40	100
Solar	34	97.14
Biogas-plant	0	0
Electricity (Peltric Set)	16	40

Source: Field Survey, May 2006

The above figure depicts an energy use pattern of the respondents. Almost all the respondents were found using fuel-wood and fossil fuels. About 97.14% used solar and about 40% electricity produced from peltric sets. The use of renewable sources of energy at hotels and lodges was found very minimal. Electricity was found used only for lighting. For heating and cooking purposes, people have been seen fetching fuel-wood due to unavailability of other viable options.

4.9.2 Types of Energy Resources Used Before Installation of Renewable Sources of Energy

The major energy types used at hotels and lodges has been presented in the table below:

Table 4.14 Types of Energy Used Before Installation of Renewable Source of Energy

Fuel Type	Total	
	No.	Percent
Fossil fuel	34	85
Fuel wood	3	7.5
Agricultural residue	3	7.5
Total	40	100

Source: Field Survey, May 2006

The above table shows the consumption pattern of various traditional sources of energy before using various sources of renewable energy. About 20% of the respondents were found consuming oil lamp followed by fossil fuel (65%), agricultural residue (7.5%) and fuel-wood (7.5%).

These data clarify that almost all the hotel entrepreneurs used to consume fuel-wood as a source of energy. Such a practice of energy consumption might have brought significant negative impact on tourism development of the area.

4.9.3 Major Factors Responsible for Deciding to Install Renewable Sources of Energy

During the study period, it was known that various private sector institutions were engaged in promoting renewable sources of energy aiming to develop sustainable tourism in the study area. Moreover, the hotel owners were found to be motivated to use renewable sources.

Table 4.15 Major Factors Responsible for Deciding to Install Renewable Sources of Energy

Motivating Factors	Total	
	No.	Percent
Self-motivated	14	35
Neighbours	9	22.5
Tourist	10	25
Institution	6	15
Family members	1	2.5
Total	40	100

Source: Field Survey, May 2006

The above table indicates the major factors responsible for the installation of RE. About 35% were self-motivated to use renewable sources of energy, while about 22.5% were motivated by their neighbours followed by tourists (25%), local institutions (15%) and family members (2.5%).

Being self-motivated for the use of RE is praiseworthy. However, institutional development for the development and promotion of this type of energy was found less effective. It is interesting to note that even tourists motivated and suggested the local people to use RE for the betterment of tourism industry itself.

4.9.4. Major Application Areas of Renewable Energy

In the study area, the use of renewable sources of energy was found confined to mainly lighting , space heating and cooking.

Table 4.16 Major Areas of using Renewable Energy

Areas	Total	
	No.	Percent
Cooking	7	17.5
Lighting	24	60
Water boiling	3	7.5
Space heating	6	15
Total	40	100

Source: Field Survey, May 2006

About 17.5% of the respondents were found using RE for the purpose of cooking, while an overwhelming mass (60%) using RE for lighting. Similarly, about 7.5% of them used RE for water boiling followed by space heating (15%).

Although RE has a wide area of application, its use is limited to lighting. This signifies the limitation of the available modern technology. In other words, technological advancement is still in poor performance which indicates RE has not significantly contributed for the promotion and development of tourism industry.

4.9.5 Impact of Energy Use

The use of energy can have both negative and positive impact on the respondents. The impact can be economic, social, health, environmental, political etc. However, the satisfaction level, economic saving, cleanliness of hotels, satisfaction level of tourists are some of the positive aspects of the renewable energy use.

Table 4.17 Benefits Achieved from Renewable Energy by Hotel Entrepreneurs

Benefits
Better lighting quality
Multi-purpose use
Economic saving
Inflation control
Safety
Tourist satisfaction
Environmental conservation
Total

Source: Field Survey, May 2006

From Focus Group Discussion (FGD), it was found that the participants were positive towards the use of RE. It was revealed that the local people were able to trace tangible and intangible benefits from RE which can have significant contribution for the promotion of sustainable tourism in the area.

Thus, it can be interpreted that there is ample level of awareness among the local people, but RE has not become the only viable energy option to run their livelihood.

4.9.6 Satisfaction Level of Hotel Entrepreneurs Towards Use of Renewable Energy

During the research, the respondents were asked to express their reactions towards the use of renewable sources of energy. The expression made by them is as given below:

Table 4.18 Satisfaction Level of Respondents Towards Use of Renewable Energy

Satisfaction level	**Total**	
	No.	**Percent**
Good	31	77.5
Average	9	22.5
Poor	0	0
Total	40	100

Source: Field Survey, May 2006

So far as the satisfaction level of the respondents is concerned, about 77.5% had good satisfaction level, while 22.5% had average satisfaction level. It is interesting to mention that no respondent had poor satisfaction level on the use of RE.

Hence, it can be analysed that RE has helped the local tourism entrepreneurs to run their businesses efficiently, to some extent. But it has not contributed as expected.

4.9.7 Hotel Entrepreneurs' Views Regarding the Promotion of Quality Hotel Management by Use of Renewable Sources of Energy

Since it was considered relevant to know about the local hotel and lodge entrepreneurs' views and opinions on the use of RE for the enhancement of service quality, the respondents were asked on the following grounds:

Table 4.19 The Respondents' View on Enhancement of Quality Hotel Management Using Renewable Source of Energy

Response	Total	
	Number	Percentage
Good	30	75
Average	8	20
Poor	2	5
Total	40	100

Source: Field Survey, May 2006

In the course of analysing the satisfaction level of the hotel and lodge entrepreneurs' on the contribution of RE for enhancing the service quality, about 75% had good satisfaction level followed by average satisfaction level (12.5%) and unknown about it (12.5%).

This conveys the message that RE has created positive impact on the enhancement of service quality of hotels and lodges. The entrepreneurs, who were not aware about RES, were weak and poor in hotel management. Therefore, awareness training and orientation should be provided to them so as to enable them to promote sustainable tourism. The local hoteliers should also be informed of the Clean Development Mechanism (CDM) scheme and encouraged to reduce the consumption of non-renewable sources of energy. The adoption of the CDM scheme will help not only in promoting sustainable tourism through more effective hotel management but also will generate income by reducing CO2

emission substantially. At present, the international market price of one ton of CO2 ranges from US$ 5 to 20.

4.9.8 Reduction of Use of Non-renewable Sources of Energy

The replacement of non-renewable sources of energy by renewable ones is the need of the hour. Non-renewable sources of energy are exhaustible, whereas renewable sources are not exhaustible. So, priority has to be given for the use of RE. Based on this idea, the respondents were asked whether it was necessary to reduce the use of non-renewable sources of energy through promoting the renewable ones or not.

Table 4.20 Respondents' Views on the Reduction of the Use of Non-renewable Sources of Energy

Responses	Total	
	No.	Percent
Reduce	26	65
Don't reduce	10	25
Don't know	4	10
Total	40	100

Source: Field Survey, May 2006

The above table indicates that about 65% of the respondents were of the opinion that there should be a considerable reduction in the consumption of the non-renewable sources of energy. Similarly, about 25% of them said that the use of non-renewable sources should not be minimized, while the remaining 10% expressed their ignorance about it.

Despite a high level of awareness among the respondents about the importance of the use of renewable sources of energy, some more were opting for the non-renewable ones. This is probably because of relative cost factor, lack of sufficient development and promotion of renewable sources of energy such as micro-hydro.

4.9.9 Use of Renewable Sources of Energy and Forest Conservation

It needs no mention that the use of RE can help contribute in the conservation of forest resources. The reason for this is that the use of renewable sources of energy replaces the consumption of fuel-wood. As a result, deforestation and its other consequences can be checked. Above all, the utilisation of renewable sources of energy helps in saving energy.

Table 4.21 Respondents' Views on Use of Renewable Sources of Energy and its Contribution in Forest Conservation

Responses	Total	
	No.	Percent
Yes	28	70
No	7	17.5
Don't Know	5	12.5
Total	40	100

Source: Field Survey, May 2006

While assessing the views of the respondents regarding the contribution of RE towards forest conservation, about 70% expressed their opinions in a positive light. Similarly, 17.5% said that the use of RE could not help conserve the forest resources. And about 12.5% said they were unaware about it.

Meanwhile, the researcher had asked the respondents expressing their opinions in a negative light to support their arguments. They opinioned that cheaper rate of fuel-wood motivated them to go for fuel-wood consumption rather than using renewable sources. Thus, there is an urgent need to increase the price of fuel-wood. This may be possible through striking an agreement between and among the BZMC, CFUGs, hotel entrepreneurs, local people and the District Forest Office so that the demand for renewable sources of energy can be increased. This will automatically help conserve forest resources.

4.9.10 Sustainable Tourism Promotion and Use of Renewable Sources of Energy

It is a matter of fact that tourism is a multi-dimensional industry. It is associated with all kinds of human activities. The concept of sustainable tourism has emerged from sustainable development. Sustainable tourism has come in response to the various adverse social, economic and environmental impacts of mass tourism. As a sector consuming a huge quantity of energy, tourism of any destination can be sustainable only through the promotion of RE.

Table 4.22 Respondents' View on Use of Renewable Energy for Tourism Promotion

Responses	Total	
	No.	Percent
Yes	32	80
Can't say	7	17.5
No	1	2.5
Total	40	100

Source: Field Survey, May 2006

While assessing the views expressed by the respondents about the use of RE and its contribution to the promotion of sustainable tourism, about 80% stressed on the need to maximise the use of renewable sources of energy to lead the tourism business toward sustainability. In the meantime, about 17.5% of the respondents could not say anything about it, while the remaining 2.5% did not believe that the use of RE alone could not help promote tourism in a sustainable manner.

The findings show an encouraging situation of awareness among the respondents about the use of RE for the sustainability of tourism. But the currently used RETs have failed to meet the local energy demand. For the improvement of its use, more efficient and cost-effective technologies should be introduced in the area.

4.10 Subsidy Policy

The Nepal government has been providing subsidy to the users of the renewable energy during the time of installment. During the field survey, the researcher made an assessment whether the subsidy given on using renewable sources of energy was sufficient or not? The findings have been presented in the table below:

Table 4.23 Satisfaction Level of Respondents on Subsidy Policy

Level of Satisfaction	Number	Percent
Sufficient	10	25
Insufficient	17	42.5
Needs to increase	13	32.5
Total	40	100

Source: Field Survey, May 2006

While analysing whether the subsidy provided to them on use of RE was sufficient or not, about 25% said that the subsidy was sufficient. Meanwhile, about 42.5% informed the researcher that the subsidy was not sufficient, while about 32.5% spoke on increasing the subsidy facility from the existing one.

The findings suggest that the provision of subsidy should be improved if possible so that the people would be encouraged to use renewable sources of energy in the area.

4.11 Challenges of Using Renewable Sources of Energy

Increasing the use of renewable sources of energy is required from the point of view of energy saving, environmental conservation, economic saving and employment generation. However, there are certain challenges for the promotion of renewable sources of energy. The main challenges are associated with technology, its installation and operation, repairs and maintenance, etc. The respondents were asked about the challenges they have faced in the increased use of RE. Their responses are as follows:

Table 4.24 Types of Challenge Faced by Respondents

Challenges	Total	
	No.	Percent
Economic challenges	8	20
Technological challenge	13	32.5
Operation and maintenance challenge	7	17.5
Shortage of human resources	8	20
Institutional weaknesses	4	10
Total	40	100

Source: Field Survey, May 2006

While analysing the various challenges faced by the respondents for the use of RE, about 20% had encountered economic challenge followed by technological (32.5%), operation and maintenance (17.5%), shortage of human resources (20%) and institutional weaknesses (10%). Here, the shortage of human resources implies shortage of technical hands, who are supposed to help locals install, operate and maintain RETs. Similarly, institutional weaknesses here denote insufficiency of institutional development to promote RETs. Going by the above findings, it can be outlined that technological challenges are more severe as compared to others. So, necessary attention has to be paid toward technological advancement.

CHAPTER FIVE

FINDINGS, CONCLUSION AND RECOMMENDATIONS

Chapter Five concludes with findings and conclusion of the study. It also offers some vital recommendations for the development of sustainable tourism through promoting renewable sources of energy.

5.1 FINDINGS

Together with the emergence of the concept of sustainable development in the late 1980s, the phrase 'sustainable tourism' was coined. The idea of sustainable tourism came into being in response to the adverse environmental and social problems created by the mass tourism. This form of tourism is primarily associated with renewable energy and environmental conservation. From the point of view of energy, tourism can operate in any host destination in a sustainable manner only through the promotion of renewable sources of energy. Therefore, widening access to modern energy services has potential to be a catalyst for sustainable human development. However, the increased income is necessary to be able to afford. The WSSD held in 2002 also agreed on a comprehensive agenda on energy for sustainable development guided by the overarching objectives of sustainable development and poverty alleviation, participating governments to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services and resources. Poverty is a multi-dimensional phenomenon. In a broader sense, it is deprivation, which may be traced to five interrelated clusters of disadvantages-physical weakness, isolation, income poverty, vulnerability and powerlessness.

In the context of Nepal, it is widely accepted that the existing poverty can be significantly reduced only through the promotion of sustainable tourism. In the same vein, the title of this research study was selected with the objective of analysing the problems and prospects of renewable sources of energy for sustainable tourism promotion along the Lukla-Monjo trekking route in Chaurikharka VDC of Solukhumbu district.

The whole population living along the Lukla-Monjo trekking trail was the universe of the study. Only 40 out of around 100 tourist standard hotels, resorts and lodges were taken as

sample units based on gender composition. The respondents were selected randomly, while the sampling area was chosen purposively.

The major occupation of the respondents was tourism (hotel and lodge entrepreneurship). The inflow of tourists into the region has been fluctuated over the years. In 1998, a total of 20,014 trekkers visited the Khumbu Region followed by 24,561 in 1999, 25,291 in 2000, 21,577 in 2001, 13,786 in 2002, 19,300 in 2003, 21,396 in 2004 and 19,063 in 2005.

The use of fuel-wood in the study area is very high. On average, a hotel or lodge consumes at least 30kg of fuel-wood per day during tourist season. The use of energy in commercial sector in 2004 was 6641.5 GJ in cooking, while space heating consumed 330.4 GJ. Similarly, about 31.8 GJ of energy was used for water boiling. (Source: District Energy Situation Report, Solukhumbu, 2004)

While assessing the satisfaction level of the respondents on the use of renewable sources of energy, 90% of them were found to be positive.

So far as the level of education of the respondents is concerned, about 12.5% were found illiterate. However, the number of respondents passing SLC stood at only 2.85%.

While analysing the sources of investment in renewable forms of energy, about 65% of the respondents were found using their savings from the hotel business. About 25% of them utilised credit facilities and 10% used installment. When the sources of credit were examined, about 60% of the respondents were found managing it through personal efforts followed by bank (10%), cooperatives (20%), and others (10%).

In course of observing awareness level of the respondents on the provision of subsidy for the use of RE, 55% were found aware and the remaining 45% were unknown about it. Similarly, while looking at the quantity of energy used in a tourist hotel/ lodge, about 30 kg of fuel-wood was found to be used daily. Similarly, 14.2 kg of LPG and 5kg of kerosene was used by a hotel/lodge per day. When an assessment was made on the reasons behind of RE, an overwhelming 70% used due to better lighting quality, while 20% consumed for economic saving and the remaining 10% opted for environmental preservation.

While analysing the major energy types used in hotels and lodges, fossil fuels and fuel-wood were found being used by cent percent. The number of hotels using solar energy (solar PV and solar water heater) was 97.14% followed by peltric sets (40%).

Regarding the motivation for the installation of RETs, about 35% of the respondents were found self-motivated, 22.5% were motivated by their neighbours, 25% were inspired by tourists, 15% encouraged by institutions like schools, development agencies, etc. and the rest 25% by their family members.

When the major areas of using RE were assessed, about 17.5% of the respondents used it for cooking, about 60% consumed for lighting, 7.5% for water boiling and 15% for space heating. Above all, the impact of RE on the local people was found to be positive.

In the course of analysing the satisfaction level of the respondents about the use of renewable sources of energy, about 77.5% had good satisfaction level and the remaining 22.5% gained average satisfaction level. Similarly, in response to the query about the reduction of non-renewable sources of energy, about 65% of the respondents opted for reduction, while 25% responded in a negative light and the remaining 10% knew nothing about it.

When the respondents' views on use of RE and its contribution in forest conservation was evaluated, about 70% replied in a positive light followed by negative (17.5%) and unaware (12.5%).

As asked whether the use of RE could help in the promotion of tourism, about 80% of the respondents opined positively, 2.5% negatively and the rest 17.5% remained silent about it. Likewise, while analysing the satisfaction level of the respondents on subsidy policy, majority of them found dissatisfied.

Economic barrier, technological hurdle, problems related to operation and maintenance, shortage of human resources and institutional weaknesses were found to be the major challenges for maximising the use of renewable sources of energy and promotion of sustainable tourism.

5.2 CONCLUSION

After accomplishing the research and analysing the findings, the following conclusions have been made:

- The use of RETs in the study area is not sufficient. Despite high level of awareness among the local people about the importance of RE, they are unable to utilise it sufficiently due to lack of affordable and cost-effective technologies. However, most of the respondents seem to be highly satisfied with the use of renewable sources of energy.

- As fuel-wood is available at relatively cheaper prices in the area, its consumption is pervasive. It is being used for various purposes ranging from cooking food and heating rooms to boiling water. So, there is huge pressure of the local people on the delicate forest resources. On average, about 30 kgs of fuel-wood is believed to be used in a hotel/lodge during tourist season per day. If the current trend of using forest resources continues, the area will lose its natural beauty and bio-diversity. Hence, the tourism business, the only major sources of income of the local people, will suffer.

- The dependence on traditional and other non-renewable sources of energy could also be hazardous to the health of the people. Keeping all this in mind, immediate measures should be taken so as to gradually replace the use of such forms of energy along with promoting RETs. Until now, the locals have managed to install some RETs from their savings and credits from cooperatives and other institutions and individuals. They should be encouraged to maximise the use RE for reducing the existing consumption pattern of non-renewable sources of energy.

5.3 RECOMMENDATIONS

- Both short-term and long-term plans and policies should be adopted to promote more affordable and cost-effective RETs in order to reduce the consumption of non-renewable sources of energy in the area.

- The cost of fuel-wood should be increased through consensus between the local people, SNP, district forest office and the FUGs so that the excessive pressure on forest may be decreased
- Effective technological training should be provided to the local people and mass awareness campaign should be launched in the locality to make RETs more reliable and sustainable.
- Due emphasis should be given for increasing the amount of subsidy so that it would become affordable even to the poor people.
- The legal procedures the local people have to come across while installing RETs should be simplified so that the poor would also be benefited.
- Broadly, RE (solar PV) has been used only for lighting due to its less capacity. Thus, there is an immediate need to increase the capacity of RE (solar energy technology) so that it would be used for multi-purpose, mainly for heating rooms, driving electrical appliances and cooking.
- More micro-level studies on renewable energy and sustainable tourism, basically for promoting micro-hydro and bio-gas plants, should be carried out in the region so that necessary feedback would be collected for the planners and policy makers to implement their plans and programs in the days to come.

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ANNEX- 1

QUESTIONNAIRE

Name of respondent:	**VDC:**	**Ward No:**
Marital status:	**Age:**	**Sex:**
Major occupation:		**Level of Education:**
Total family members:		

1) When did you start this (hotel entrepreneurship) occupation?

.....

2) How many members of your family are now engaged in this occupation?

.....

3) Apart from this occupation, have you adopted any other occupation?

.....

4) If yes, which occupation have you adopted?

a) Agriculture b) Business c) Public service d) Handicraft production

5) What made you to adopt hotel entrepreneurship?

.....

6) What type of energy source are you using to run your business (hotel/lodge)?

a) Fuel-wood b) Solar energy c) Hydro-electricity d) Fossil fuel

7) Do you have an idea of RE?

a) Yes c) No

8) If you are using renewable energy, why have you chosen renewable energy?

a) Energy saving b) Reducing GHG c) Cost effectiveness

d) Environmental preservation

9) What is the difference between energy consumption situation before and after the use of RE?

a) Moderate b) High c) Low d) No

10) Is RE alone sufficient to run your business?

a) Yes b) No

11) What are the major factors responsible for motivating you to install RSE?

a) Self-motivated b) Neighbours c) Tourists d) Institution (specify)
e) Family members

12) What are your sources of investment for the installment of RSE?

a) Saving b) Credit c) Installment

13) What are the sources of credit?

a) Personal b) Bank c) Cooperatives d) Others

14) What are the major application areas of RE?

a) Cooking b) Lighting c) Water boiling d) Space heating

15) What is your satisfaction level on using RE?

a) Good b) Average c) Poor

16) Do you think that it is necessary to reduce the consumption rate of non-renewable energy?

a) Yes b) No c) Don't know

17) Are you using non-renewable energy along with RE?

a) Yes b) No

18) If yes, what are those?

I. Fuel-wood

II. Kerosene

III. Bio-briquette

19) What are the reasons behind the use of non-renewable energy?

a) Insufficiency of RE

b) Easy availability of non-RE

c) Cheap cost

20) What is the perception of tourists about the use of RE?

a) Good b) Bad c) Satisfactory

21) Do you think that with the use of RE, tourism can be promoted?

a) Yes b) No c) Don't know

22) What do you say on the existing subsidy policy of the government?

a) Sufficient b) Insufficient c) Don't know

23) What are the major challenges of RE promotion in your region?

a) Economic b) Technological c) Operation and maintenance

d) Shortage of human resource e) Institutional weaknesses

FOCUS GROUP DISCUSSION WITH THE LOCAL PEOPLE

1) What are the prime challenges of RE promotion in this region?
2) What are the major challenges of sustainable tourism promotion in the region?
3) Can renewable energy promote tourism?
4) Can tourism help reduce poverty?

INTERVIEW WITH THE KEY INFORMENTS: [Officials of NTB & TRPAP, Teachers, VDC Secretary, Local elites, Women representatives, National Programme Manager of REDP etc]

1) How can Solukhumbu region be made a popular sustainable tourism destination?
2) How can tourism be made sustainable?
3) Does RE help to promote sustainable tourism?
4) Is RE affordable to all?
5) What are the major challenges of sustainable tourism promotion and renewable energy?

CHECKLIST

1) Renewable energy promotion policy
2) Energy subsidy policy
3) Programmes of environmental pollution control
4) Participation level of the local people
5) Efforts made by various sectors for the promotion of sustainable tourism and RE
6) Detail report of the VDC

ANNEX- II

PHOTOGRAPHS

A solar panel installed on top of the Everest Summit Lodges, a posh lodge at Monjo.

Solar energy is widely used along the Lukla-Monjo trekking route for lighting and heating water.

A scenic view of the Sunkoshi River near Monjo.

With an alarming level of deforestation, landslides seem to have affected Phakdin and the surround areas of Chaurikharka VDC.

Teen-aged girls fetching fuel-wood from the nearby forests at Phakdin.

The people leaving near Monjo have constructed a bridge by using only stones.

A newly opened lodge, which is situated on the lap of beautiful mountains on the banks of the Sunkoshi River near Phakdin.

The researcher receiving information from a local community forest users' committee official at Phakdin.

The researcher observing a peltric set installed in a stream located near Monjo.

A visitor information centre at Ghat.

A pile of fuel-wood at Monjo. This shows the local people's pressure on forest resources.

A breathtaking view of the mountain peak seen from Lukla.

Solar power is commonly used by hotels and lodges along the route.

A Local House Using Solar PV for Lighting Purpose

A tourist standard hotel at Lukla using solar power for both lighting and water heating.

A kerosene water boiler being used by the Mera Lodge at Lukla. As of May, 2006, there were only three such water boilers in Lukla.

The use of back boiler is also commonly used by hotels and lodges along the trail.

A scene of the study area showing biodiversity.